Proceedings

W055 - Special Track
18th CIB World Building Congress
May 2010 Salford, United Kingdom

CIB W055 - Building Economics

CIB Publication 341

CIB WORKING COMMISSION
W055 - BUILDING ECONOMICS

PAPERS AND POSTGRADUATE PAPERS FROM THE SPECIAL TRACK
HELD AT THE CIB WORLD BUILDING CONGRESS 2010, 10-13 MAY 2010
THE LOWRY, SALFORD QUAYS, UNITED KINGDOM

Selected papers from the Proceedings of the 18th CIB World Building Congress.
Proceedings edited by: Professor Peter Barrett, Professor Dilanthi Amaratunga, Dr. Richard Haigh, Dr. Kaushal Keraminiyage and Dr. Chaminda Pathirage

W055 Special Track Papers (excluding Postgraduate Papers) reviewed by: Gerard Devalence and Prof. Jorge Lopes

CIB Publication 341

W055 - BUILDING ECONOMICS

PAPERS AND POSTGRADUATE PAPERS FROM THE SPECIAL TRACK

The objective of the Working Commission is to collect, study, evaluate, disseminate exchange and discuss Economic aspects of resource management and competitiveness, financing, innovation and development of the construction sector at the international, macro and micro levels concerning the design and construction process, the construction activities, renewal and use of buildings, built environment, the international building markets, and comparative conditions regarding financing, subsiding schemes and user cost regulations, Economic evaluation in design and construction planning including quality, productivity and efficiency assessment, design optimisation and methods applied in the construction field such as cost-benefit, risk analysis, life-cycle costing, value engineering, cost and price indexes, comparative studies and forecasting methods and information systems applied in the assessment of buildings, construction and the environment considering knowledge based systems, computer-aided cost modelling systems for monitoring cost, quality and risk factors, and the development of economic data bases.

CONTENTS

Papers

Postgraduate Papers

Managing Workers' Compensation – A Synthesis

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Abstract

Workers' Compensation (WC) is an emotional subject for many American employers. WC premiums constitute a sizeable portion of a construction contractor's overhead and the perception that increasingly high premium rates are accompanied by increasing fraud is intensifying the anxiety. The two concerns seem to be related, though there is no quantified evidence of a rise in fraudulent claims. Traditionally, the only way to manage a firm's WC has been to improve safety, thereby lowering the firm's Experience Modification Rate and premiums. Outside of improving safety and shopping for the best rates, an employer has not had many options for managing this aspect of the business. Relatively recently, however, several states have passed legislation that allows employers to actively manage this aspect of their business by using alternative WC systems, such as self-insurance, Alternative Dispute Resolution, and self-insurance pools. This paper is the result of research into the WC statutes of each state, from which brief analyses are offered on the options available in each state and insight into the success and operation of these options.

Keywords: insurance, dispute resolution, arbitration, mediation, construction site

1. Introduction

Workers' Compensation (WC) is a blend of health insurance and disability insurance but differs significantly from both of these in several ways. In general, WC is a mandatory program (premiums are paid by the employer) that is intended to cover only work-related injuries or illnesses. All of these systems are governed by state law and differ from state to state.

Created out of a necessity to provide needed medical care to injured workers, as well as reimbursement of lost wages, the current individual state systems are each unique in processes, procedures, and benefits provided, as well as performance, cost, and delivery. Some of these systems are performing reasonably well, but many are not (Victor 2004).

This paper first discusses the beginnings of WC insurance followed by an overview of the systems that exist in America today. As suggested above, some of these systems are not performing effectively or efficiently and are in dire need of reform.

1.1 Background

Webster's Ninth New Collegiate Dictionary defines WC not as a form of insurance in the traditional sense but, rather, as a social insurance along the lines of Social Security and unemployment insurance. This social insurance took its modern form when the first Old English laws of the early 18th century saw employers (masters) being held liable for damages to a third person caused by an employee's (servant's) act or omission while the servant was acting within the course or scope of employment.

1.1.1 Early American initiatives

The Civil War propelled the great industrial growth needed to provide the divided country with the means to fight a war. Since the mostly rural South lacked many of the same resources, industrial growth was focused mainly in the North, with industrial demands being primarily in metals and garments for uniforms. People were working in conditions far below what would be tolerated today, with employers having virtually no concern for worker health and safety. As was also the case in Europe, many U.S. workers filed suit against American employers for work-related injury because this was often the only way for them to be financially compensated for an accident. By 1908, the workers were winning nearly 15% of all cases (Harger 2005).

President Theodore Roosevelt urged the United States to do something in order to alleviate the plight of the working man. Under his guidance, the U.S. passed its first law of WC under the title of the Federal Employer's Liability Act, and the movement continued through the states. The first state to adopt a WC law was Wisconsin in 1911. It essentially provided both medical and indemnity benefits to the injured employee, while the injured employee agreed to give up his/her right to sue the employer. By 1948, all 50 states (including Alaska and Hawaii even though they weren't granted statehood until 1959) had at least some form of WC law. Workers' compensation has since become the exclusive remedy for the injured worker.

2. The workers' compensation industry today

Begun with pure and noble motives and offering many advantages even today, the WC industry is currently rife with problems. Many contractors complain of workers faking injury in order to receive WC benefits. Hospitals and emergency care centers, standing to receive more payment for a work-related injury, often encourage people injured away from the jobsite to file a WC claim instead of a health and welfare insurance claim. Attorneys, standing to make large commissions likewise encourage people to file WC claims. Electrical contractors interviewed as part of a research study by the authors ranked WC as the second-biggest problem that they face today, second only to finding workers qualified and skillful enough to prosecute their work.

The research, funded by Electri International, the research arm of the National Electrical Contractors Association (NECA), included an effort to identiify all the different WC programs currently operating in the United States and report on their existence, their operational format, and their level of success. Since each state has different laws for insurance, this meant contacting each state's agency that handles WC and interviewing them. It also called for investigators to travel to states with particularly progressive programs and learn as much as possible about them.

Tables 1 and 2 show that there is quite a bit of variation in compensation systems from state to state. Different states have different industries and demands, which is reflected in how they manage their WC. At no point is the system rigid in most states; most are constantly amending their provisions to best accommodate the demands of their employees and employers.

Tables 1 and 2 give a comprehensive overview of today's WC system in the United States, providing general WC information, such as premium rankings, insurance provisions, and exemptions. These terms and the tables will be discussed further to ensure a complete understanding of the current system.

2.1 Definitions

A basic knowledge of the following terms is necessary in order to understand the ensuing discussion.

2.1.1 Index Rate and Ranking

The Oregon WC index rate is used to create a uniform means with which to measure premiums. The index accounts for the states' base premiums and various administrative and system costs. As seen in Table 1, the index also accounts for differences among states by using a standardized industrial mix and payroll. The rate stands for some dollar amount per 100 dollars of payroll, and the lower the rate, the better.

2.1.2 Insurance Provisions

There are many ways in which a state can provide WC insurance. Some provide a state-funded insurer, which can be either competitive with other insurers or the exclusive provider in that particular state. Private carriers are allowed in most states, and most states also allow for an employer to seek self-insurance.

2.1.3 Full Benefits

Most state compensation systems provide an injured employee with full medical benefits in the event of a work-related injury. There are a few, however (i.e., Florida and Arkansas), that do not make those provisions.

2.1.4 Temporary Total

In the event of an employee becoming temporarily completely disabled, states have established a guideline for the benefits that the person will receive and for how long they will receive them. Compensation is generally a percentage of his current wage rate (unless otherwise stated), and the duration of compensation is usually for the duration of the disability (unless otherwise stated).

2.1.5 Permanent Total

When a worker suffers an injury that leaves him disabled for life, he also receives benefits from his WC insurance. An example would be someone who is paralyzed. Again, monetary compensation is generally some percentage of his or her wage rate over some specified duration.

2.1.6 2.1.6 Permanent Partial

A worker who is permanently injured but not disabled is also entitled to benefits from his compensation system. An example would be an incident such as a loss of a finger. Again, a percentage of wages will be provided while work is missed until the specified maximum period of compensation.

2.2 Traditional Workers' Compensation

The traditional system is what most contractors are working within. Each state's system has its own unique details, but for the most part they are all the same. Basically, a carrier is eligible to write insurance in the state and brokers and salesmen sell their products for them in the state. The contractor decides what product is best for his firm and that is usually the extent of the influence the contractor wields as the carrier "takes it from there."

Table 1. Workers' Compensation State-by-State General Information

	Index Rate/Ranking		Insurance Provisions				Legislation
	Index	2004	State	Private	Self-Insured	Self-Insured	Program
State	Rate	Rank	Fund	Carrier	Employer	Empl.Group	Legislated
Alabama	2.88	19	N	Y	Y	Y	T
Alaska	4.39	2	N	Y	Y	N	T
Arizona	1.49	49	C	Y	Y	Y	T
Arkansas	1.57	48	N	Y	Y	Y	T
California	6.08	1	C	Y	Y	Y	CB
Colorado	2.33	31	C	Y	Y	Y	T
Connecticut	3.23	11	N	Y	Y	Y	S
Delaware	3.44	7	N	Y	Y	N	S
D.C.	3.26	10	N	Y	Y	N	T
Florida	4.20	3	N	Y	Y	Y	CB
Georgia	2.14	37	N	Y	Y	Y	T
Hawaii	3.73	4	C	Y	Y	Y	CB
Idaho	2.25	34	C	Y	Y	N	T
Illinois	2.65	23	N	Y	Y	Y	T
Indiana	1.24	50	N	Y	Y	N	S
Iowa	1.91	43	N	Y	Y	Y	T
Kansas	1.81	44	N	Y	Y	Y	T
Kentucky	3.48	6	C	Y	Y	Y	CB
Louisiana	3.37	9	C	Y	Y	Y	T
Maine	3.08	13	C	Y	Y	Y	CB
Maryland	2.06	40	C	Y	Y	Y	CB
Mass.	1.70	45	N	Y	Y	Y	CB
Michigan	2.34	30	N	Y	Y	Y	T
Minnesota	2.74	21	C	Y	Y	Y	CB
Mississippi	2.19	36	N	Y	Y	Y	T
Missouri	2.67	22	N	Y	Y	Y	S

Table 1 . Continued

	Index Rate/Ranking		*Insurance Provisions*				*Legislation*
State	*Index Rate*	*2004 Rank*	*State Fund*	*Private Carrier*	*Self-Insured Employer*	*Self-Insured Empl.Group*	*Program Legislated*
Montana	*3.41*	*8*	*C*	*Y*	*Y*	*Y*	*T*
Nebraska	*2.10*	*38*	*N*	*Y*	*Y*	*N*	*T*
Nevada	*2.58*	*26*	*N*	*Y*	*Y*	*Y*	*T*
N. Hampshire	*3.19*	*12*	*N*	*Y*	*Y*	*Y*	*T*
New Jersey	*2.38*	*29*	*N*	*Y*	*Y*	*N*	*T*
New Mexico	*2.56*	*27*	*C*	*Y*	*Y*	*Y*	*T*
New York	*2.97*	*18*	*C*	*Y*	*Y*	*Y*	*CB*
N. Carolina	*2.32*	*32*	*N*	*Y*	*Y*	*Y*	*T*
North Dakota	*1.06*	*51*	*E*	*N*	*N*	*N*	*T*
Ohio	*3.59*	*5*	*E*	*N*	*Y*	*N*	*T*
Oklahoma	*3.07*	*15*	*C*	*Y*	*Y*	*Y*	*T*
Oregon	*2.05*	*42*	*C*	*Y*	*Y*	*Y*	*T*
Pennsylvania	*2.82*	*20*	*C*	*Y*	*Y*	*Y*	*CB*
Rhode Island	*3.01*	*16*	*C*	*Y*	*Y*	*Y*	*S*
S. Carolina	*2.08*	*39*	*N*	*Y*	*Y*	*Y*	*T*
S. Dakota	*2.05*	*41*	*N*	*Y*	*Y*	*Y*	*T*
Tennessee	*2.62*	*25*	*N*	*Y*	*Y*	*Y*	*T*
Texas	*3.08*	*14*	*C*	*Y*	*Y*	*Y*	*T*
Utah	*1.63*	*46*	*C*	*Y*	*Y*	*Y*	*T*
Vermont	*2.99*	*17*	*N*	*Y*	*Y*	*N*	*T*
Virginia	*1.57*	*47*	*N*	*Y*	*Y*	*Y*	*T*
Washington	*2.20*	*35*	*E*	*N*	*Y*	*Y*	*T*
West Virginia	*2.64*	*24*	*E*	*N*	*Y*	*N*	*T*
Wisconsin	*2.27*	*33*	*N*	*Y*	*Y*	*N*	*T*
Wyoming	*2.43*	*28*	*E*	*N*	*No*	*N*	*T*

C - Competitive CB – Collectively Bargained Workers' Compensation Allowed

S – Substitute Compensation T – Traditional Only Allowed

The advantages of this system to a contractor are that coverage is relatively easily obtained and no contractor involvement is required or wanted. This lack of involvement is looked upon as an advantage by some, but not to others. The disadvantages of this system are the typically high premiums paid by subscribers, high settlements handed down by juries in court cases, slow delivery of benefits, and high attorney involvement. These traits of the Traditional System tend to contribute to adversarial relationships. Fraud is too frequently reported in this system, and contractors complain that the carriers “cave in” to complainant attorneys.

2.3 Alternatives to Traditional Workers’ Compensation

Employers are constantly looking for ways to slow the spiralling costs of WC insurance premiums, while their employees have expressed their own displeasures for the lengthy process involved with receiving benefits. Other concerns on the forefront of reform are the excessive legal and medical costs incurred, as well as the presence of fraudulent claims. With most states having created investigative units to expose fraudulent cases, efforts have now been focused on the issues of cost and program efficiency. At present, industry is seeing a growing interest in three seemingly reasonable alternatives to managing WC: collectively bargained coverage, self-insurance and associations, and 24-hour health care. Each of these approaches is aimed at cutting costs and streamlining the current WC industry.

Research was conducted to determine which states allow, by statute, alternative forms of WC coverage. Upon accomplishing this, the research team set about locating existing WC programs or systems based upon alternative concepts for coverage and benefit delivery. These programs and systems were then identified, and a cursory analysis of the systems was performed.

2.3.1 Negotiated Workers’ Compensation

Negotiated worker’s compensation (NWC) is a form of WC that is fundamentally separate from the statutory WC system in the state where it exists. NWC is an alternative system for regulating WC in which an employer may either purchase voluntary coverage (market-based) or be self-insured but ultimately retains the ability to resolve disputes with injured employees through the medium of a private system of resolution, as provided for by state law.

The Alternative Disputes resolution (ADR) process internal to all existing NWC systems is conducted through entirely private means; therefore, it is not reliant on any function of the state government or the statutory system of WC for purposes other than:

- the establishment of the legality of the NWC system,
- the administrative regulation of the NWC system, *not* the individual case, and
- the serving of as an appeals mechanism for the NWC system.

Table 2. State-by-State Workers' Compensation Benefits

		Temporary Total		Permanent Total		Permanent Partial	
Jurisdiction	Full Benefits	% of Wages	Max. Period	% of Wages	Max. Period	% of Wages	Max. Period
Alabama	Y	66.7	Duration	66.7	Duration	66.7	300 weeks
Alaska	Y	80.0*	Duration	80.0*	Duration		
Arizona	Y	66.7	Duration	66.7	Life /Duration	55.0	Duration
Arkansas	N	66.7	450 weeks	66.7	Duration	66.7	450 weeks
California	N	66.7	104 weeks	66.7	Life	66.7	619.25 wks.
Colorado	Y	66.7	Duration	66.7	Life		Duration
Connecticut	Y	75.0*	Duration	75.0*	Duration	75.0	520 weeks
Delaware	Y	66.7	Duration	66.7	Duration	66.7	300 weeks
D.C.	Y	66.7	Duration	66.7	Duration	66.7	Duration
Florida	N	66.7	104 weeks	66.7	Duration	75.0***	Varies
Georgia	Y	66.7	400 weeks	66.7	Duration	66.7	300 weeks
Hawaii	N	66.7	Duration	66.7	Duration	66.7	% of loss
Idaho	Y	67.0	52 weeks **	67.0	Duration	n/a	500 weeks
Illinois	Y	66.7	Duration	66.7	Life	60.0	500 weeks
Indiana	Y	66.7	500 weeks	66.7	500 weeks	66.7	n/a
Iowa	Y	80.0*	Duration	80.0*	Duration	80.0*	500 weeks
Kansas	Y	66.7	Duration	66.7	Duration	66.7	415 weeks
Kentucky	Y	66.7	Duration	66.7	Duration	66.7	425 weeks
Louisiana	Y	66.7	Duration	66.7	Duration	66.7	520 weeks
Maine	Y	80.0*	Duration	80.0*	Duration	80.0*	364 weeks
Maryland	Y	66.7	Duration	66.7	Duration	66.7	Duration
Mass.	Y	60.0	156 weeks	60.0	Duration	60.0xAWW	260 weeks
Michigan	Y	80.0*	Duration	80.0*	Duration	80.0*	Duration
Minnesota	Y	66.7	104 weeks	66.7	Until Age 67	66.7	
Mississippi	Y	66.7	450 weeks	66.7	450 weeks	66.7	450 weeks
Missouri	Y	66.7	400 weeks	66.7	Duration	66.7	400 weeks

* - As a percentage of spendable income

** - Thereafter, either 45% state average wage or 67% SAW for duration

***- Some restrictions may apply

Table 2. Continued.

		Temporary Total		Permanent Total		Permanent Partial	
Jurisdiction	Full Benefits	% of Wages	Max. Period	% of Wages	Max. Period	% of Wages	Max. Period
Missouri	Y	66.7	400 weeks	66.7	Duration	66.7	400 weeks
Montana	N	66.7	Duration	66.7	Duration	66.7	375 weeks
Nebraska	Y	66.7	Duration	66.7	Duration	66.7	300 weeks
Nevada	Y	66.7	Duration	66.7	Life		Duration
N. Hampshire	Y	60.0	Duration	60.0	Duration	60.0	262 weeks
New Jersey	Y	70.0	400 weeks	70.0	450 wks/life	70.0	600 weeks
New Mexico	Y	66.7	Duration	66.7	Life	66.7	Varies
New York	Y	66.7	Duration	66.7	Duration	66.7	Duration
N. Carolina	Y	66.7	Duration	66.7	Duration	66.7	300 weeks
North Dakota	Y	66.7	Duration	66.7	Duration		1500 weeks
Ohio	N	66.7/72.0	Duration	66.7	Life		
Oklahoma	Y	70.0	156 weeks	70.0	Duration	70.0	500 weeks
Oregon	Y	66.7	Duration	66.7	Duration	66.7	n/a
Pennsylvania	Y	66.7	Duration	66.7	Duration	66.7	500 weeks
Rhode Island	Y	75.0*	Duration	75.0*	Duration	75.0*	312 weeks
S. Carolina	Y	66.7	500 weeks	66.7	500 weeks	66.7	340 weeks
S. Dakota	Y	66.7	Duration	66.7	Duration	66.7	Duration
Tennessee	N	66.7	400 weeks	66.7	Until age 67	66.7	400 weeks
Texas	Y	70.0*	104 weeks	75.0*	400 wks/life	70.0*	300 weeks
Utah	Y	66.7	312 weeks	66.7	312 weeks	66.7	312 weeks
Vermont	Y	66.7	MMI	66.7	330 weeks	66.7	n/a
Virginia	Y	66.7	500 weeks	66.7	Duration	66.7	500 weeks
Washington	Y	60.0/75.0	Duration	60.0/75.0	Life		
West Virginia	Y	66.7	104 weeks	66.7	Duration	66.7	
Wisconsin	Y	66.7	Duration	66.7	Life	66.7	1000 weeks
Wyoming	Y	66.7	Duration		80 months	n/a	n/a

For the purposes of this paper, NWC is composed of two subsets: collectively bargained worker's compensation (CB/WC) and substitute compensation systems (SCS).

2.3.1.1 Collectively Bargained Workers Compensation (CB/WC)

Collectively bargained WC may be seen as a system of NWC, as established through a collective bargaining agreement, where permitted under state law. Ten states are known to possess CB/WC provisions within their statutes, as shown in Figure 1. A CB/WC provision is characterized by the inclusion of language that alludes to union involvement through the use of an authorized bargaining agent or representative, as well as a level of specificity regarding what general types of programs are permitted for inclusion in the NWC system.

2.3.1.2 Substitute Compensation System (SCS)

SCS is a system of NWC, established where permitted under state law. Figure 1 shows the five states known to possess SCS provisions within their statutes. An SCS provision is characterized by the absence of language in direct reference to union involvement and an ambiguous, and thus permissive, nature regarding what general types of programs are permitted for inclusion in the NWC system.

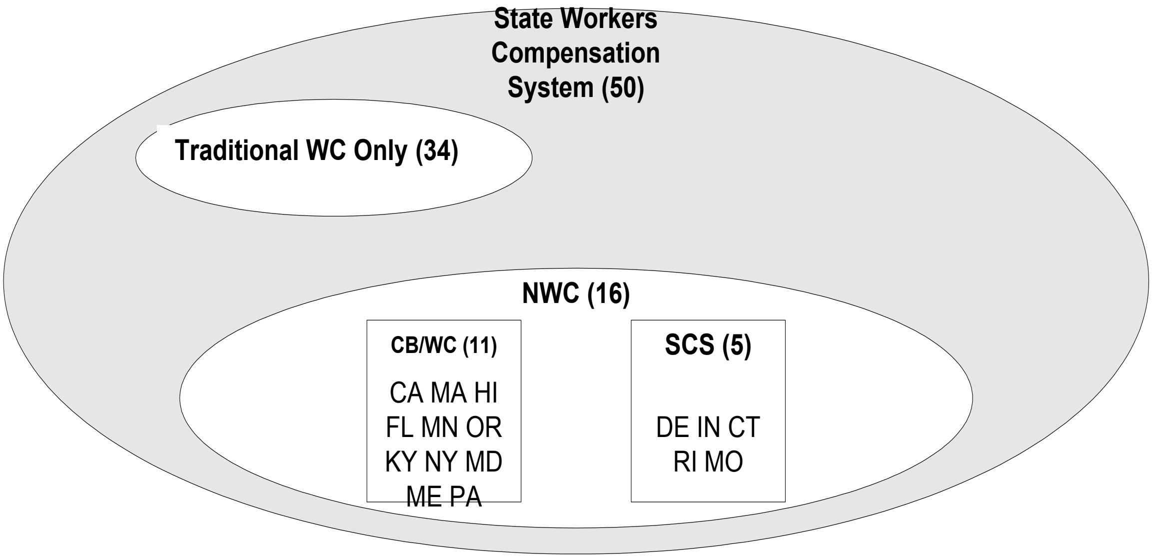

Figure 1. Division of States by WC Statutory Status 24-Hour Health Care Depicted

2.3.1.3 Alternative Dispute Resolution

Alternative dispute resolution systems are generally distinguished from traditional litigation by the nature of the process and the presence of third-party neutral stakeholders, such as Ombudsmen, Mediators, and Arbitrators. Simply, ADR is a mechanism for the resolution of disputes, which operates external to the traditional dispute resolution function. Generally, there are three possible levels of ADR found in a NWC system: ombudsman, mediation, and arbitration.

Ombudsman: The term *ombudsman* is likely to have diverse meaning dependent upon the context in which it is being used. Generally, it is the first level of dispute resolution in an NWC setting. An ombudsman will perform one or both of the following functions related to NWC:

- Act as a contact and information provider for the injured worker. Many WC entities have successfully used the services of an ombudsman in an anticipatory manner in order to, in a sense, solve problems before they occur.
- Act as an informal arbiter, primarily through the facilitation of communication between parties, in a manner simpler than that of mediation.

Mediation: A consensual process in which the parties agree on the resolution of the dispute themselves with the help of a mediator. This is usually accomplished by guiding the parties through a series of stages: agreeing on ground rules, identifying facts and positions, promoting mutual understanding, developing mutually acceptable options, and, finally, agreeing on the option that best resolves the dispute (Levine et al., 2002).

Arbitration: An adversarial process in which a neutral third party decides disputes in an informal proceeding. Generally, the arbitration process is not bound by traditional rules of evidence or procedure. The arbitrator's decision is usually binding and final and cannot be appealed on substantive grounds (Levine et al., 2002).

2.3.2 Self-Insurance

There are several programs that fall under the broad heading of self-insurance. These range from the very simple (a large employer simply insuring itself, with a catastrophic re-insurance policy from a carrier) to more complicated programs.

2.3.2.1 Small, Exclusive Self-insured Pools

According to a top WC attorney working mostly with these pools, associations were formed, mostly in the construction industry, where contractors involved in these systems are active participants (they, in a sense, own the insurance "company"). The association then buys catastrophic insurance from a traditional carrier, with a typical deductible of $2-300,000. The association contracts with a third-party administrator (TPA) to run the program. Premiums for members are set using established state mandates, and the TPA has claims specialists who decide how to handle a claim (Richard Plagens, personal communication, May 23, 2005). The process for the self-insured pool, or association, is as shown in Figure 2.

TPAs are firms in business for the purpose of operating an insurance plan for private entities. They have a contractual relationship with the association and employ claims specialists. The contractor knows the specialist assigned to his case.

This arrangement causes positive peer pressure in that if one firm has an inordinate number of claims, the other members will pressure the one to improve safety, improve moral, etc., in order to reduce claims, which may hurt all members. An important function of the TPA is to decide how much money to put in "reserve" for each case.

The contractor has significant input into this and in how the process is executed.

Contractors have input into who represents them. Contractors are therefore much more cooperative with their attorneys and much more involved than those not in associations.

Three-five percent of claims end up in litigation. Claims are settled more quickly because the contractors are involved, and they realize that a dollar spent is a dollar spent, whether it is paid to a claimant or to fight a claimant . (Richard Plagens, personal communication, May 23, 2005).

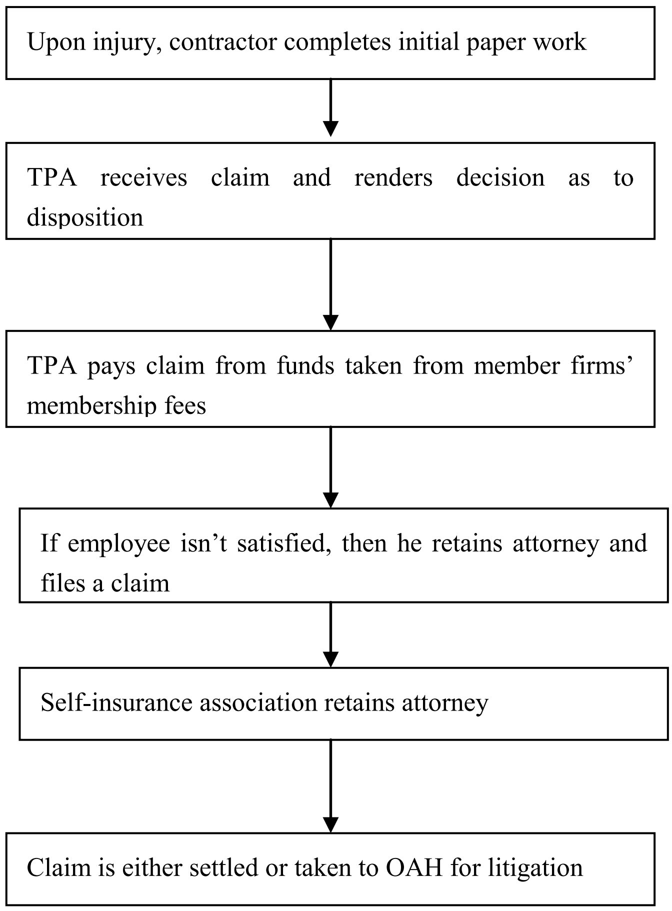

Figure 2. Procedure for a Typical Small Self-insured WC Pool

One contractor that is a member of a small (five contractors) self-insured group in Minnesota described the group in an interview. The group has been in existence since 1991 and consists of five sub-contractors. The interviewed contractor is the only electrical sub-contractor in the group. The group is always looking for new members but is selective. To be considered for membership, any applicant must have:

- a documented, anticipatory - not reactive - safety program
- financial strength (Ken Rademacher, personal communication, May 24, 2005)

The group has two meetings per year in which members set premiums in the fall and review the year and address any unresolved concerns in the spring. At the spring meeting, most members get refunds in the form of retro-premiums. It is rare when any group member does not receive a refund. In fact, since the group has started, there has been only one year in which each member did not receive a refund. That year, two contractors' retro-premiums meant they had to remit additional funds. One of the great advantages that this system has over the large, impersonal self-insurance pools and traditional carriers is that only the company that "has a bad year" pays extra.

The pool has a $200,000 deductible with catastrophic coverage from a major insurance carrier, and the member-contractor states that "We have maximum input and control of our own claims and premiums." The State Department of Commerce (DOC) regulates the group and assigns modification factors, calculated using DOC formulae, but the self-insurance pool is only good for the work performed in Minnesota. The insurance carrier that holds catastrophic coverage covers out-of-state work for the members.

2.3.2.2 Large Independent Self-insured Pools

Currently, the WC community in Kentucky is reeling from the collapse of a large self-insured pool, Associated Industries of Kentucky (AIK). The ramifications of this collapse are at least two-fold: 1) all members and former members of the group now have to reimburse the state because the state had to assume the payments to injured workers covered by AIK, and 2) the unfavorable position in which these employers find themselves is causing them and many of their fellow employers to be somewhat reluctant to use anything but the most traditional programs.

There are other large self-insured pools in Kentucky. One that is particularly popular with contractors is the Associated General Contractors (AGC) program, which has hundreds of companies enrolled, not all of whom are contractors. The program uses a TPA, but the TPA does not get involved unless there is a dispute. The large pool has one advantage - lower premiums, but contractors often fight with the TPA, so dealing with this pool is much like dealing directly with any carrier; that is, the contractor has little-or-no control (Dan Walsh, personal communication, September 19, 2005).

2.3.3 Safety Groups

Safety Groups are employer associations for those involved in a common trade or business and may be used as a means of negotiating rates for its members (Victor 2004). The use of safety groups has become attractive to smaller businesses in all industries, but safety groups differ from small, exclusive, self-insured pools and large, independent, self-insured pools in that, unlike these systems, safety groups are insurance carrier-initiated. "Traditionally, only large organizations have been able to use self-insurance to control their WC rates. Safety groups allow organizations of similar business type to pool their resources to purchase compensation through a self-insurer who has initially formed the group. Establishing a separate non-profit entity managed by an elected board from association members does this and the results can have participants seeing cost savings of more than 50%" (Tweed 1994).

At this time, thirty-two states allow for the existence of safety groups. One small example of the potential savings associated with these groups can be seen in John Palmer Moving and Age, Inc., of Acton, Massachusetts. Company premiums dropped from $110,000 to $95,000 annually when Mr. Palmer obtained coverage with the safety group Commonwealth Transportation Corporation. The Massachusetts Movers Association started this corporation back in 1992 for small companies involved in the moving business. Savings are expected to be even more significant in the future (Tweed, 1994).

On the surface, it appears that a small business owner would be irresponsible in not joining a safety group if the opportunity were to present itself; however, in reality, it's not that simple. Safety groups have strict eligibility requirements that all interested businesses must meet in order to be considered for membership. For example, the Commonwealth Transportation Corporation requires that employers have a good safety record, a net worth four times the annual WC premium, a minimum of three years in the business, and an annual premium of at least $50,000. Initially, "some 59 companies applied for coverage, but only 18 were accepted" (Tweed 1994).

2.3.4 Hybrid Programs

A good example of a hybrid program is the Electrical Employers Self Insured Safety Plan (EESISP), the arm of the Joint Industry Board (JIB) of the Electrical Industry that is responsible for WC for electrical workers in New York City. EESISP was founded in January, 1967, after Gov. Nelson Rockefeller backed and signed legislation to allow contractors to be self-insured.

The infrastructure was in place to easily transition to EESISP because a Safety Trade Group had been in place since 1954. In 1996, following the passage of enabling legislation, EESISP adopted ADR, thus becoming, in essence, a hybrid consisting of elements of a self-insurance pool and an ADR program (Herbert Flaum, personal communication, December 1, 2005).

In October, 2005, the NECA/IBEW (International Brotherhood of Electrical Workers) WC program in California, an ADR program in existence since 1994, adopted elements of the self-insured pool concept, becoming a "100% Captive" system, which will result in a self-insured pool for ADR. The key to the new initiative is quota sharing. Under the plan, the pool pays 50% of the first $250,000 of a claim, and the carrier pays the rest. After $250,000, the carrier pays 100%. This process is called "stop loss." Until recently, the carrier paid the full amount of all claims, resulting in much higher premiums for program members (Don Campbell, personal communication, July 7, 2005).

2.3.5 24-Hour Care

Twenty-four-hour coverage describes various efforts to reduce or eliminate the distinctions between benefits and services provided to disabled workers for work-related injuries and diseases and benefits and services provided for non-work-related injuries (California Commission 2003). The idea fuses the general health care and occupational health care programs that are common today. This, in theory, would reduce total health care costs and create a more efficient health care system.

3. Summary

The original philosophy of WC stated that:

1. Workers should be taken care of.
2. The industry responsible for the injuries, not society as a whole, should pay for the care of the injured individual.

Workers' Compensation is not welfare, unlike Health and Welfare insurance. In its original, purest form, WC was developed to answer the rhetorical question, "Should the general public subsidize an inefficient or dangerous industry?"

Workers' Compensation presents managers of construction businesses with one of their greatest challenges. The states with systems established and executed by people of vision and character have effective options and relatively efficient systems. However, many states do not enjoy this circumstance. When a firm has options as to how to handle WC (i.e. options outside the statutes), it is wise to consider all of the options.

Within the United States, all 50 states have WC systems and statutes to govern their execution. Most states offer only that system, which requires that an employer (contractor) procure WC insurance either directly from a carrier or through a registered insurance broker. In the event of a worker getting injured, the contractor contacts the broker or carrier, and if the worker is not satisfied with the settlement offered by the carrier, the contractor then removes himself from the process while the attorneys for the injured worker and the carrier work toward and then achieve a resolution. Sadly, the contractor pays for the whole proceeding that often results in a disgruntled employee that is likely to infect the rest of the contractor's workforce with his negativity.

Both NWC and the small, exclusive self-insured pool have proven to satisfy participating contractors while enjoying the support of labor, or at least avoiding complaints from labor. In fact, NWC in particular has become a favorite of some labor unions. Insurance carriers, at first opposed to NWC, have now begun giving contractors discounts on their premiums for joining a NWC program in some states.

Individuals interviewed as part of the research were, on average, much happier in the states in which employers have a choice regarding whether they want to use either the state system or some alternative system. This is admittedly an unquantified observation; however, the difference in many cases was stark.

As for 24-hour coverage, no such program has ever worked successfully, but nobody that was interviewed believes that it cannot work. The concept has never had a "champion," someone who makes it his life's work to develop and implement such a system. The authors, as well as those interviewed as part of the research, agree that with the right situation and the right proponents, the system could work and could change the landscape of WC coverage in the United States.

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The Effects of User Costs at Highway Work Zones on the Incentive and Disincentive Values of Highway Construction Projects

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Abstract

The excess user costs of traffic delays caused by the presence of work zones are essential for assessment of the impact of the work zones on public. The excess user costs include the traffic delay costs and the additional vehicle operating costs resulted from the speed changes at work zones. User costs at highway work zones are increasingly used by highway agencies in determining the contract times of highway construction projects. User costs at work zones are often used as the basis of determination of the monetary values for incentive or disincentive clauses in highway contracts for early or late completions of highway construction projects. This paper presents a method for estimating user costs at highway work zones based on the traffic data recorded by weigh-in-motion (WIM) devices in Indiana, USA. The estimated user costs provide highway engineers and construction managers with useful information for effective highway construction planning. The user cost information is especially useful for highway agencies to determine contract times and incentive and disincentive monetary values for highway construction projects. For any highway construction project, there exists a construction time that would minimize the construction cost with given manpower and equipment. If the construction is shortened or prolonged from this construction time, the construction cost will increase. It is demonstrated that reasonable incentive and disincentive values can be determined by including a portion of the work zone user costs in the relationship between construction time and construction costs.

Key words: work zone; user cost; traffic delay; incentive/disincentive; contract time

1. Introduction

The excess user costs of traffic delays caused by the presence of work zones are essential for assessment of the impact of the work zones on public. The excess user costs include the traffic delay costs and the additional vehicle operating costs resulted from the speed changes at work zones. User costs at highway work zones are increasingly used by highway agencies in determining the contract times of highway construction projects. User costs at work zones are often used as the basis of determination of the monetary values for incentive or disincentive clauses in highway contracts for early or late completions of highway construction projects. The estimated user costs provide highway engineers and construction managers with useful information for effective highway construction planning. The user cost information is especially useful for highway agencies to determine contract times and incentive and disincentive (I/D) monetary values for highway construction projects.

2. Excess user costs at work zones

There are many types of traffic data collection methods. The weigh-in-motion (WIM) traffic data were used in this study because they were readily available and required no additional effort or cost. The WIM devices are designed to capture and record vehicle axle weights, axle spacing, and gross vehicle weights as they drive over a sensor. Based on the axle weights, axle spacing, and time intervals between the tires passing the WIM plate, the WIM device also provides the data of traffic volumes, vehicle speeds, and vehicle types. The Indiana WIM system consists of 47 WIM sites installed on interstate and other state owned primary highways. Of the 47 WIM sites, 23 are on interstate highways, 17 on state roads, and 7 on US routes. The vertical loading applied to the pavement by a moving vehicle consist of two components: the static load and the dynamic load. The static load depends on the weight and the layout of the axles and tires of the vehicle. The dynamic load is generated by vibration of the vehicle.

WIM data recorded in 2008 on Indiana freeways were used in this study for user cost computation. At each of the 47 WIM stations, the average daily traffic (ADT) in vehicles per day was calculated with the WIM data. The hourly traffic distributions were calculated as a percent of the ADT. Since user costs were different for passenger cars and trucks, the percentages of trucks for each hour of a day were also obtained. As an example, Table 1 shows the calculated ADT, hourly traffic distribution, and percentages of trucks in July and August of 2008 at the WIM station on I-65 near Lafayette, Indiana. At this WIM station, I-65 is a four-lane divided freeway (two lanes in each direction). The ADT values are the total traffic volumes on the four lanes of the roadway. For example, the ADT value of 47,024 (the first value in the last row in Table 1) means that in July the average ADT was 47,024 vehicles per day on the four lanes in the two traveling directions. The table contains the proportions of the hourly traffic volumes as the percentages of the total ADT. As shown in Table 1, from 0:00 to 1:00 in July the traffic volume was 1.7% of the total ADT of 47,024. Thus, the hourly traffic volume from 0:00 to 1:00 in June at the I-65 WIM station can be calculated as (1.7%)*(47024) = 799 vehicles.

To estimate the user costs caused by work zones, it is necessary to obtain the proportions of passenger cars and trucks in the traffic flows. These proportions are readily available in the WIM recorded traffic data because of WIM's vehicle classification functions. For the purpose of user cost estimation, the "passenger cars" also include mini vans and pick-up trucks and the "trucks" include single unit trucks (such as delivery trucks), buses, and semi-trucks. The values in Table 1 are the average percentages of trucks in each hour of a day in the month. As shown in Table 1, from 0:00 to 1:00 in June, the percentage of trucks was 48.1 at the I-65 WIM station. As calculated above, the hourly traffic volume for the period was 799 vehicles, the number of trucks in the hour can be obtained as (799)*48.1% = 384. Thus, the number of passenger cars was 799-384=415. That is, among the hourly traffic volume of 799 vehicles, there were 415 passenger cars and 384 trucks.

Table 1: Traffic flow data and estimated user costs at the I-65 WIM station

	July	*August*	*July*	*August*	*July*	*August*
Time	*% ADT*	*% ADT*	*% Trucks*	*% Trucks*	*User Cost ($)*	*User Cost ($)*
0:00-1:00	*1.7*	*1.8*	*48.1*	*45.3*	*262*	*304*
1:00-2:00	*1.3*	*1.5*	*54.7*	*47.3*	*209*	*254*
2:00-3:00	*1.2*	*1.4*	*59.8*	*50.0*	*187*	*241*
3:00-4:00	*1.2*	*1.4*	*61.1*	*51.4*	*192*	*242*
4:00-5:00	*1.4*	*1.6*	*54.8*	*48.2*	*216*	*263*
5:00-6:00	*2.1*	*2.3*	*39.6*	*37.5*	*343*	*394*
6:00-7:00	*3.1*	*3.4*	*33.4*	*31.3*	*472*	*554*
7:00-8:00	*4.0*	*4.3*	*26.9*	*28.3*	*619*	*717*
8:00-9:00	*4.5*	*4.5*	*25.6*	*28.8*	*683*	*748*
9:00-10:00	*5.1*	*4.9*	*25.1*	*28.7*	*775*	*817*
10:00-11:00	*5.7*	*5.4*	*23.8*	*28.2*	*875*	*894*
11:00-12:00	*6.1*	*5.7*	*23.3*	*27.6*	*960*	*984*
12:00-13:00	*6.2*	*5.8*	*23.0*	*27.2*	*1003*	*1027*
13:00-14:00	*6.2*	*6.0*	*22.4*	*27.1*	*1032*	*1119*
14:00-15:00	*6.5*	*6.4*	*22.3*	*26.4*	*1130*	*1269*
15:00-16:00	*6.6*	*6.5*	*21.9*	*25.8*	*1203*	*1386*
16:00-17:00	*6.5*	*6.4*	*21.1*	*25.2*	*1227*	*1455*
17:00-18:00	*6.4*	*6.4*	*20.7*	*24.5*	*1249*	*1535*
18:00-19:00	*5.8*	*5.7*	*22.6*	*25.6*	*1151*	*1458*
19:00-20:00	*5.1*	*5.0*	*24.7*	*27.1*	*1000*	*1315*
20:00-21:00	*4.4*	*4.3*	*27.0*	*28.7*	*790*	*1134*
21:00-22:00	*3.6*	*3.8*	*29.6*	*30.6*	*549*	*929*
22:00-23:00	*2.8*	*3.0*	*34.4*	*34.8*	*437*	*612*
23:00-0:00	*2.3*	*2.4*	*39.6*	*38.1*	*349*	*391*
	ADT =47024	*ADT =50681*			*Daily User Cost =$16,913*	*Daily User Cost = $20,044*

The excess user costs at work zones include traffic delay costs and additional vehicle operating costs resulting from the speed changes at work zones. The traffic delay costs are estimated on the basis of the equations for traffic delay estimation that were developed in the previous study on work zones (Jiang, 1999). The traffic delay equations are not discussed in detail in this paper because of length limitations. The excess user costs at a work zone are resulted from the following traffic delays caused by the presence of the work zone:

- *Deceleration Delay:* When approaching a work zone on a freeway, a vehicle gradually reduces its speed from the freeway speed to the work zone speed over a deceleration distance.
- *Reduced Speed Delay:* The vehicle transverses the work zone at reduced speed.
- *Acceleration Delay:* Time needed for the vehicle accelerates from the work zone speed to the freeway speed after exiting the work zone.
- *Vehicle Queue Delay:* Traffic congestion occurs with the formation of vehicle queues at the work zone due to changes of traffic capacity and patterns.

In addition, speed changes at work zones result in additional operating costs of vehicles as a result of excess consumption of fuel, engine oil, tires, and vehicle parts. Additional accident costs were not included in this study due to inadequate information on accident costs at work zones.

Two types of work zones on four-lane divided highways are commonly utilized in Indiana as shown in Figures 1 and 2. They are defined as follows (FHWA, 1989a):

1. Partial Closure (or single lane closure) - when one lane in one direction is closed, resulting in little or no disruption to traffic in the opposite direction.
2. Crossover (or two-lane two-way traffic operations) - when one roadway is closed and the traffic which normally uses that roadway is crossed over the median, and two-way traffic is maintained on the other roadway.

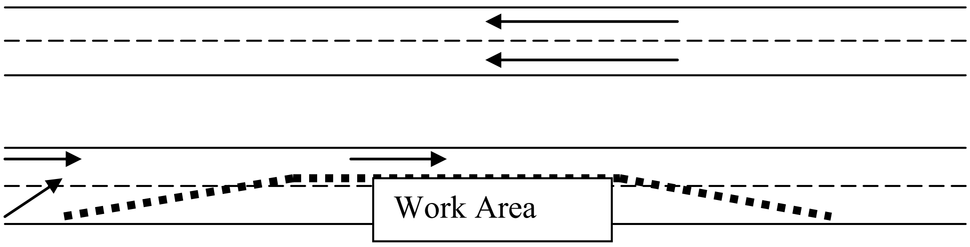

Figure 1: Partial closure work zone

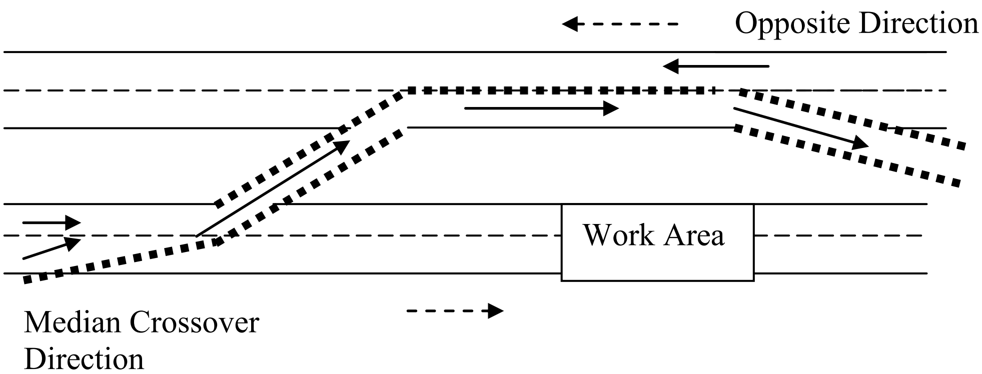

Figure 2: Crossover work zone

As can be seen, the partial closure work zone disrupts traffic in only one direction and the crossover work zone affects traffic in both directions (the median crossover direction and the opposite direction). However, the crossover work zone allows the construction crew to work on two lanes and also provides a safer work area because the work area in a crossover work zone is separated from traffic while the work area in a partial closure work zone is adjacent to traffic. To demonstrate and analyze the work zone user costs at a freeway work zone, the traffic data recorded at the I-65 WIM station shown in Table 1 were utilized. A computer program based on Microsoft Excel was developed so that the user costs at a work zone can be instantly computed once the work zone type and traffic data were provided. With the traffic data in Table 1, the user costs were calculated for a partial closure work zone. It was assumed that the right side lane in one direction was closed for the partial closure work zone with a length of one mile. The user costs for the partial closure work zone for July and August are also presented in Table 1.

User costs at work zones are directly related to traffic volumes as expressed in the user cost equations. To examine the relationship between the user cost and traffic volume at the I-65 site, the hourly traffic volume and user cost at the partial closure work zone in August are plotted in Figure 3. The curves in Figure 3 clearly demonstrate that as the traffic volume goes up the user cost increases. However, the traffic volume reached the peak point earlier than the user cost. As shown in the figure, the traffic volume was in its maximum at 15:00 and the user cost reached its peak point at 18:00. This can be attributed to the fact that as the traffic volume increased to the highest level at 15:00 the traffic started to become congested and a vehicle queue started to form. As the vehicle queue grew longer, the user cost increased until at 18:00 when the traffic volume had decreased to a certain level and the vehicle queue had cleared from the work zone.

The work zone user costs discussed above were obtained with a specified work zone length of one mile. To examine the effect of work zone lengths, the user costs were also computed for work zone lengths of five miles and ten miles with the same WIM traffic data. Shown in Figure 4 are the average daily user costs for a partial closure work zone with different lengths. The figure demonstrates that the patterns of the three curves are similar but not identical. This indicates that the work zone lengths affect the user costs differently for different traffic volumes. This is because the reduced speed delay is significantly affected by the work zone length, while other types of traffic delays, such as vehicle queue delay, acceleration delay and deceleration delay are not significantly affected by the work zone length.

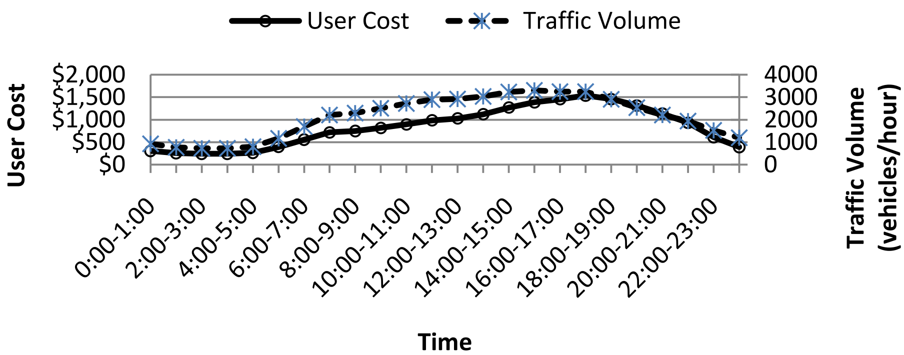

Figure 3: Hourly user costs and traffic volumes at the partial closure work zone in August

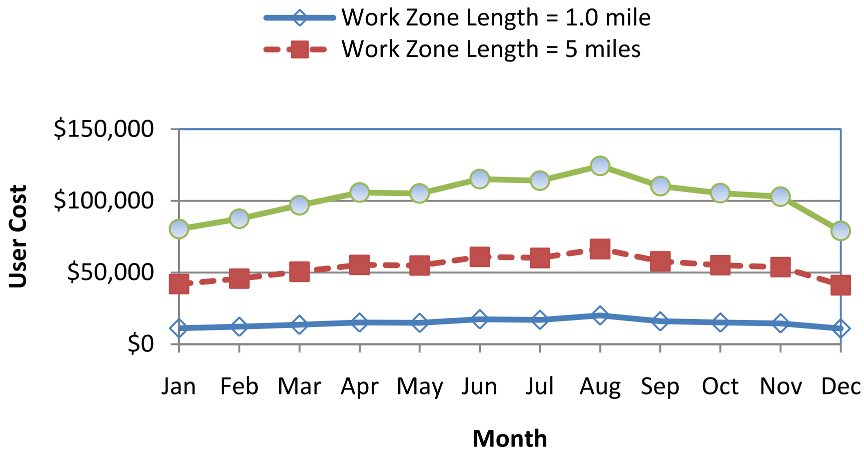

Figure 4: User costs at the partial closure work zones with different lengths

3. Incentive/disincentive values

3.1 Cost-time relationship and maximum incentive

The main purpose of using incentive/disincentive (I/D) contracts is to motivate contractors to complete highway construction early so that the interruption to the normal traffic can be mitigated and the user costs caused by construction can be reduced. The incentive part of an I/D contract is used to reward the contractor for early completion of a project, while the disincentive is used to discourage contractor for late completion of the project. To ensure such a contract to work as intended, appropriate amount of incentive and disincentive should be determined. The incentive amount should be sufficient to motivate the contractor to make effort for early completion of the project. On the other hand, the incentive amount must be limited to avoid unreasonable increase of construction cost. Similarly, the contract time should be reasonably set so that the early completion of the project is achievable, but not without additional effort. FHWA (1989b) recommended that the maximum incentive value do not exceed 5% of the total construction cost of the project.

For a highway project, the construction cost and the duration of construction are the two major parameters for highway agencies to consider. To appropriately determine incentive and disincentive values, the cost-time relationship should be incorporated into the process. In addition, user cost should also be included as a factor in determining incentive and disincentive values. Shr and Chen (2004) developed a quantified model based on the Florida Department of Transportation's data. To develop such a model, the cost-time relationship must be established. For a highway construction project, the relationship between construction cost and construction time can be illustrated through Figure 5. As can be seen in Figure 5, there exists a construction time (T0) that corresponds to a minimum construction cost (C0) for a given highway project with a given construction crew. If the construction duration (T) is delayed beyond T0, or (T>T0), the effectiveness will be reduced and the cost will be increased. On the other hand, if an early completion is needed (T<T0), the construction crew must make additional effort, such as increasing work hours, manpower, or equipment, which will result in an additional cost. The construction cost in Figure 5 does not include the excess costs to

the roadway users and highway agency. In order to optimize the amount of incentive, the daily I/D values must be obtained based on the user costs and other costs associated with the construction activities. The I/D values can then be included as a type of costs to determine the maximum amount of incentive money and time. The concept of this incentive optimization is illustrated in Figure 6 (Shr & Chen, 2004). In the figure, the solid curve is the construction costs; the straight line represents the incentive and disincentive rates; and the dashed curve is the combined values of construction costs and I/D costs. The maximum days for incentive and maximum incentive are determined as shown in Figure 6 through the relative positions of the three curves, i.e., the construction cost curve, the I/D rate curve, and the construction cost plus I/D curve.

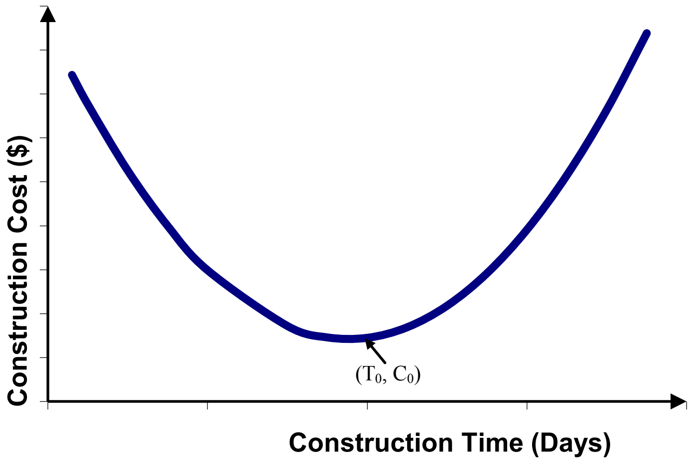

Figure 5: Cost-time relationship of highway construction project

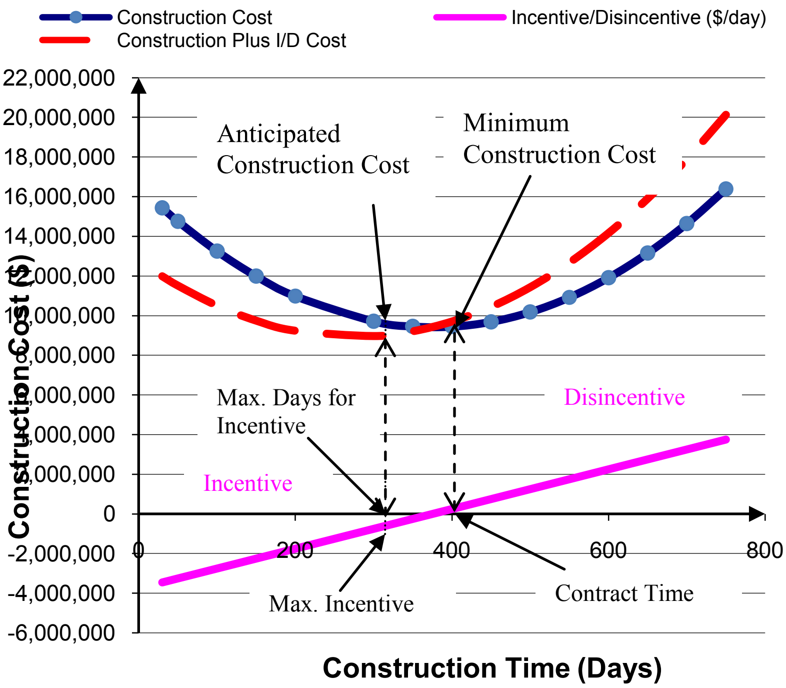

Figure 6: Determination of maximum days for incentive and maximum incentive

3.2 Cost-Time Equations of Highway Construction Projects

The cost-time equations were then derived based on the INDOT construction data through statistical analysis and regressions. The cost-time equations were developed with polynomial regressions. The cost-time relationship equations of 11 types of highway construction projects are listed Table 2.

For each type of construction projects in Table 2, the corresponding polynomial function represents the general relationship between construction cost and time. This general relationship can be considered the average pattern of many highway projects in the specified construction type. To apply this general relationship to a given construction project, the cost-time curve can be shifted according to the estimated construction cost and contract time of the particular project. The curve shifting process is illustrated in Figure 7. The polynomial equation of the general curve is expressed as y=ax2+bx+c. The lowest point of the curve is at (T0, C0). The values of T0 and C0 can be obtained by the derivative of the polynomial equation of the construction type:

$dy/dx = 2ax+b$ (1)

Setting dy/dx=2ax+b=0 and solving for the minimum point of the curve:

$C_0 = x_{min}=-b/(2a)$ (2)

$T_0 = y_{min}=-b^2/(4a)+c$ (3)

Table 2: Cost-time equations of highway construction projects

Construction Types	*Time-Cost Relationship Equations* *[x is construction time (days), y is construction cost ($)]*
Asphalt Resurface	*y = 318.55x2 - 41,652.97x + 2,784,769.51*
Pavement/Road Rehabilitation	*y = 358.14x2 - 143,281.93x + 20,377,661.15*
New Road Construction	*y = 289.50x2 - 87,839.33x + 11,896,755.64*
Bridge Replacement (Interstate)	*y = 146.51x2 - 57,139.08x + 7,173,044.13*
Bridge Replacement (US Routes)	*y = 255.56x2 - 51,425.02x + 4,130,888.40*
Bridge Replacement (State Roads)	*y = 64.14x2 - 14,780.32x + 1,863,168.68*
Bridge Rehabilitation (Interstate)	*y = 100.17x2 - 39,911.97x + 5,579,225.97*
Bridge Rehabilitation (US Routes)	*y = 75.89x2 - 27,354.68x + 3,861,342.10*
Bridge Rehabilitation (State Roads)	*y = 77.62x2 - 18,320.74x + 1,971,154.59*
Bridge Painting	*y = 33.46x2 - 6,423.46x + 608,462.48*
Intersection Improvement	*y = 123.22x2 - 16,025.90x + 860,631.96*

For a given construction project, under normal contract condition (without I/D clauses), the point at the contract time T1 and the estimated construction cost C1, or (T1, C1), can be considered the lowest point of the cost-time curve of the project. To determine the I/D values, the general curve of the construction type should be shifted from (T0, C0) as the lowest point to (T1, C1) as the lowest point of the curve. The distance to be shifted is g=T0-T1 in the horizontal direction and is h=C0-C1 in the vertical direction. The equation of the shifted curve is then expressed as y+h=a(x+g)2+b(x+g)+c.

With the curve shifting technique, the cost-time curve of a highway project can be obtained through an appropriate polynomial equation in terms of construction type in Table 2. Once the cost-time curve is obtained, the maximum days for incentive and maximum incentive can be determined with user cost information as illustrated in Figure 6. For each application, the curve shifting and the maximum incentive determination processes were incorporated into an Excel based computer program. With this program, a user only needs to input estimated contract time, construction cost, and user cost. The output is instantly calculated, including maximum incentive days and maximum incentive money amount.

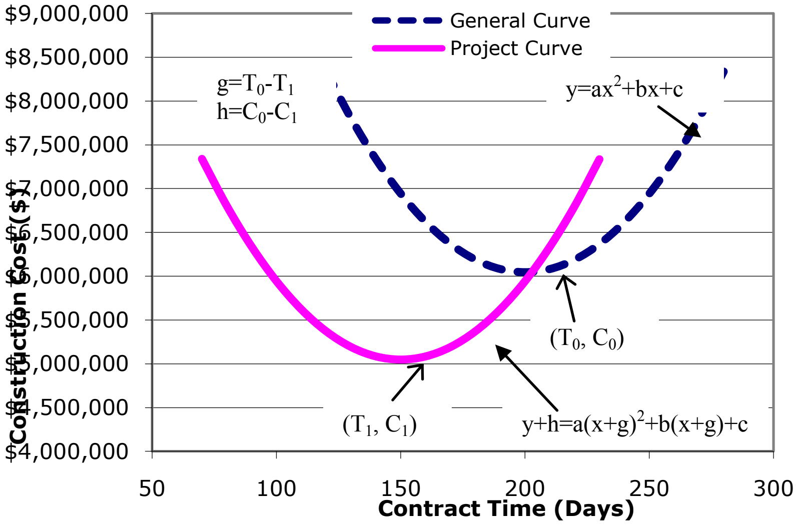

Figure 7: Shifting from general curve to project curve

3.3 Effects of User Costs on Incentive/Disincentive

As discussed above, user costs caused by work zones can be estimated based on traffic flows passing through the work zones. To examine the effects of work zone user costs on the maximum incentive/disincentive values, it was assumed that an asphalt resurface project was planned on I-65 with a total construction cost of $500,000 and an estimated contract time of 25 days. The resurface project was to be constructed in August. As shown in Table 1, the estimated daily user cost was $20,044. If the whole user cost is used as the daily I/D amount, the incentive or disincentive may be too large for the contractor to pay for the disincentive or for the highway agency to pay for the incentive. The daily I/D amount can be determined by considering savings in user costs as well as benefit to the contractor.

To demonstrate the effects of user costs on incentive/disincentive values, the maximum incentive values are computed with the Excel based program with different daily I/D values. The maximum incentive days and maximum amount of incentive money were computed with 20%, 25%, 30%, 35%, and 40% of the daily user cost ($20,044) as the daily I/D amounts. The computed maximum incentive days and incentive money are presented in Table 3 and in Figure 8. Although only the incentive values are presented in Table 3 and Figure 8, it should be pointed out that the disincentive values were assumed to be the same as the incentive values in case the project was completed behind schedule. As shown in Figure 8, the maximum incentive values were directly affected by the percent of the daily user cost as the I/D amount. As the daily I/D amount increased, the maximum incentive days also increased. This is intuitively correct as a greater I/D value will motivate a contractor to speed up construction so that they can obtain a larger reward or avoid a larger penalty. From a highway agency's point of review, the highway agency has to pay more in order to encourage a contractor to complete the construction project as early as possible.

For any given highway construction project, the highway agency can use the method shown in this example to determine the I/D value as an appropriate portion of daily user cost. The maximum incentive values can serve as a basis for a highway agency to decide a reasonable amount of money to be used to motivate the contractor to reduce the construction duration for a certain number of days.

Table 3: Maximum incentive values with different I/D amounts

Portion of Daily User Cost	*20%*	*25%*	*30%*	*35%*	*40%*
I/D Amount	*$4,009*	*$5,011*	*$6,013*	*$7,015*	*$8,018*
Max Incentive Days	*6.29*	*7.87*	*9.44*	*11.01*	*12.59*
Max Incentive	*$25,227*	*$39,413*	*$56,752*	*$77,242*	*$100,909*

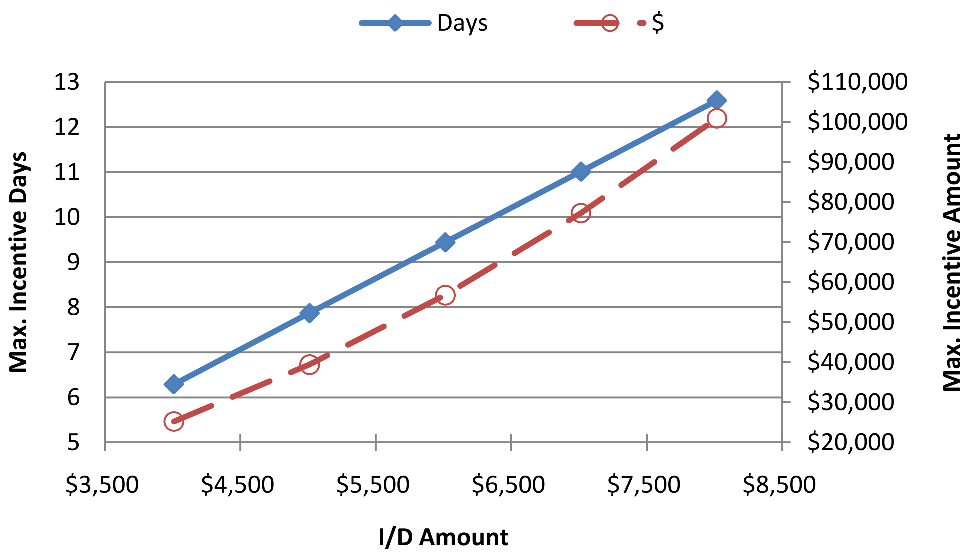

Figure 8: Maximum incentive values for different I/D amounts

4. Conclusions

The excess user costs of traffic delays caused by the presence of work zones are essential for assessment of the impact of the work zones on public. WIM data provides detailed information on traffic flows for calculating user costs at work zones. User costs at work zones are often used as the basis of determination of the monetary values for incentive or disincentive clauses in highway contracts for early or late completions of highway construction projects. This paper presents a method for estimating user costs at highway work zones based on the traffic data recorded by weigh-in-motion (WIM) devices in Indiana, USA. The estimated user costs provide highway engineers and construction managers with useful information for effective highway construction planning. The user cost information is especially useful for highway agencies to determine contract times and incentive and disincentive monetary values for highway construction projects. For any highway construction project, there exists a construction time that would minimize the construction cost with given manpower and equipment. If the construction is shortened or prolonged from this construction time, the construction cost will increase. It is demonstrated that reasonable incentive and disincentive values can be determined by including a portion of the work zone user costs in the relationship between construction time and construction costs.

The main purpose of using incentive/disincentive (I/D) contracts is to motivate contractors to complete highway construction early so that the interruption to the normal traffic can be mitigated and the user costs caused by construction can be reduced. The incentive part of an I/D contract is used to reward the contractor for early completion of a project, while the disincentive is used to discourage contractor for late completion of the project. To ensure such a contract to work as intended, appropriate amount of incentive and disincentive should be determined. The incentive amount should be sufficient to motivate the contractor to make effort for early completion of the project. On the other hand, the incentive amount must be limited to avoid unreasonable increase of construction cost. Similarly, the contract time should be reasonably set so that the early completion of the project is achievable, but not without additional effort. In this paper, the maximum incentive days and maximum amount of incentive money are computed with different portions of the daily user cost as the daily I/D amounts. The maximum incentive values are directly affected by the percent of the daily user cost as the I/D amount. As the daily I/D amount increases, the maximum incentive days also increases.

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Means for Enhancing Housing for Low-Income People

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Abstract

Housing provision for low-income people has been an important issue for the most susceptible economies worldwide. There is a mismatch between families' purchasing power and the prices charged for houses in an open market. Besides, counting on private companies involvement on developing housing markets for these sorts of clients, many features must be addressed to their economic and operational purposes in order to provide price-to-cost and return-to-investment ratios alike those reached in residence markets. When the activity is not attractive to private companies, the production of houses for low-income people becomes a government concern, eventually producing many failures due to the lack of government knowledge to working in a competitive market. Nevertheless, market solutions would come across if government interference were focused strictly on providing subsidies to enhance housing production.

Government action must turn into an appropriate set of instruments to enhance housing production. Taking into account that the projects must be conceived considering a large number of units in order to perform economic results alike those addressed to other markets, such as low-cost production or enhancing of purchasing power must be considered, among many others, including the closeness to jobs. In addition, it will be always necessary not only to increase market purchasing power but also providing a funding system protected against default effects.

Using the framework of the last plan proposed by the Brazilian government, conceived for boosting up 1 million out of more than 7 million houses demanded for low-income people, we will discuss the efficiency of different tools created to entice developers into taking up ventures aiming at this market. We analyze their guidance in order to evaluate the quality of the proposed rules to seek out the initial purpose, suggesting the amendments needed for ensuring good results in short and medium terms. Besides, as the current program is yet being implemented along with this evaluation, many corrections are still taking place. Despite the analysis being located in a Brazilian environment, it can be extended to any other country suffering from the same need.

Keywords: housing finance, low-income families

1. Introduction

The Brazilian housing deficit has grown significantly in the last decade as the real estate market offers neither the number of units matching the vegetative growth demand, nor the supply is focused on products for low-income families. As a result, the land in metropolitan areas and their surroundings are prone to receiving sub-housing in slums. Examples of some of the major Brazilian cities such as Sao Paulo, Rio de Janeiro and Recife are noticeable.

Although Fundação João Pinheiro (FJP) pointed out a deficit of 6.4 million units in 2007, the Brazilian Federal Government considered 7.2 million units as the current deficit to plan a new housing program[1].

The evolution of households in Brazil, in both number and increase rate, is shown in Figure 1.

The real estate credit system used in Brazil for residential housing (known as the Housing Financing System-SFH) was created in 1964 and has changed since then (1964-2009)[2], in what relates to formal guarantees, limits and definition of the adjustment of payments. The system provides funding for either construction or financing housing units, mainly those addressed to medium-income families, also using resources captured via instruments to raise conservative savings funds.

As housing products are not viable from a business point of view, subsidized resources are required to meet the needs of the lowest income families, Government Programs (Federal, State and Municipal) have addressed to these niches using resources from FGTS[3].

Although increased at a low interest rate, the amount of resources in FGTS tends to continuously grow, mainly during economic growth times, due to low unemployment. On the other hand, the capability of providing funds is not as leveraged as it might be, mainly because the default rates are irrelevant, which contributes to the system to stand still.

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[1] Fundação João Pinheiro is a Brazilian Foundation that holds the most respected studies on housing deficit in Brazil. The 0.8 million-gap between FJP data and those used by the Federal Government is due to a change in the used methodology while FJP was updating its 2007 study according to the Brazilian census data. With this new approach, the estimated deficit for 2007 was composed by 1.5 million families living in inadequate households, 2.5 million families sharing the same house unit, 2.0 million houses coping with unaffordable rent conditions, and 0.4 million families living under overcrowded conditions.

[2] See Vasconcelos; Cândido (1996)

[3] FGTS stands for Fundo de Garantia por Tempo de Serviço. It is a Retirement Institutional Fund, composed by a compulsory contribution from the employees' salary. As its capitalization rate is low, the use of this resource can be considered a subsidy.

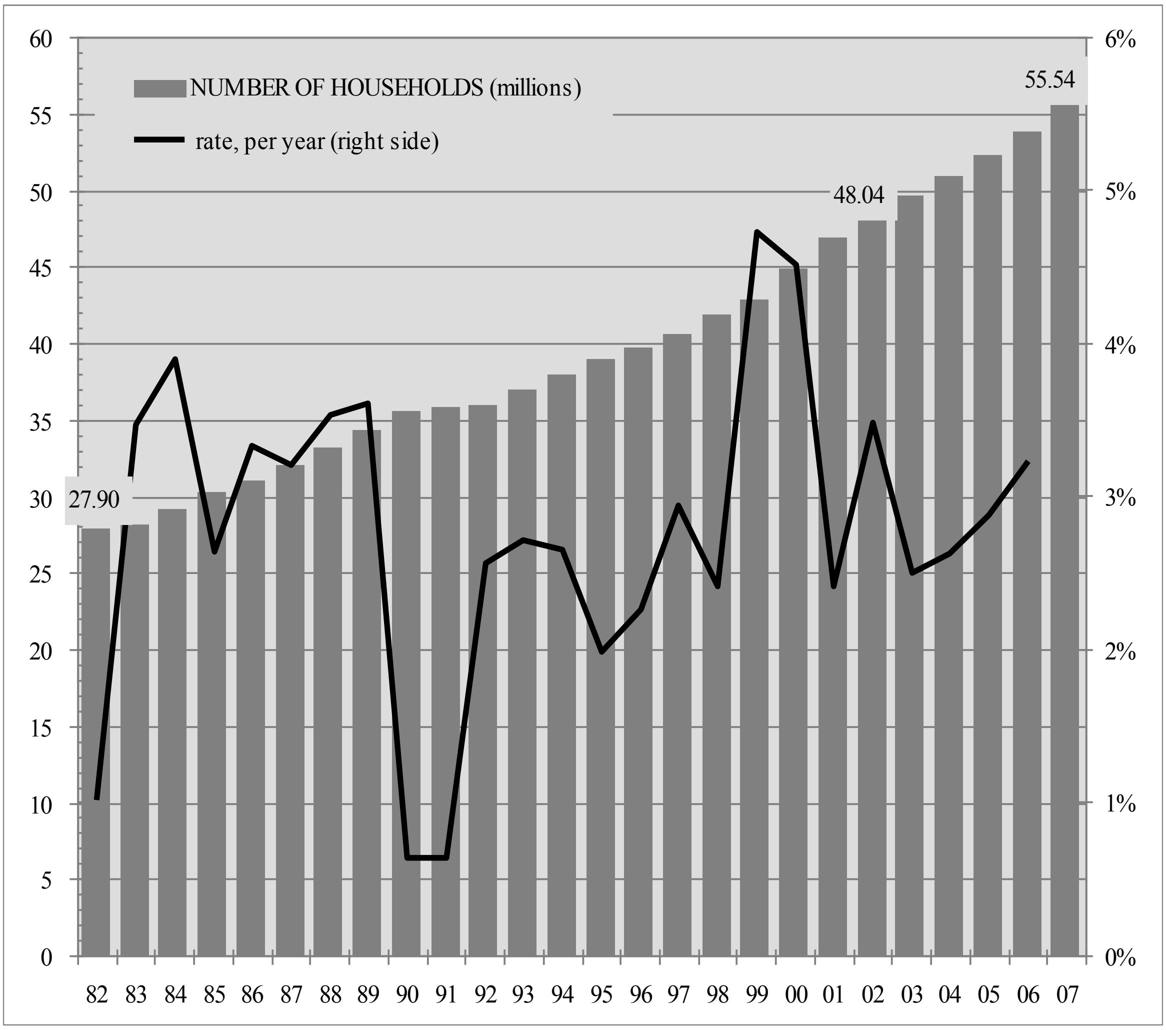

Figure 1: Households in Brazil – total and increase rate, Source: IBGE*4* (2008)

In order to better organize the housing programs, federal government stratifies the low-income families according to their monthly income in 3 different ranges:

- [range i - up to 3 MW],
- [range ii - from 3 MW to 6 MW],
- [range iii - from 6 MW to 10 MW].

MW stands for minimum wage, adjusted by means of specific legislation, usually near the inflation index, always yearly in May. From May 2009 until April 2010 1 MW equals 465.00 BRL[5]

[4] IBGE- Instituto Brasileiro de Geografia e Estatística - Brazilian Institute of Geography and Statistics (equivalent to the US Census Bureau)

(USD 258.00), so the intervals are equivalent to: [i. up to 775 USD], [ii. from 775 to 1,550 USD], [iii. from 1,550 to USD 2,583].

Studies developed by the Real Estate Research Group at the Polytechnic School of USP[6] show that it is not possible to validate new developments in the low-income [range i] using the current market parameters, costs, interest, taxes, even considering compressed return margins. The Brazilian government has been busy building houses for this market segment, which has appeared ineffective, in view of the bureaucracy that dominates the procedures needed to develop real estate projects through entities operating into the locks of the state.

There is a number of entrepreneurs in Brazil that produce housing for the [range iii] segment, with some modest inserts in the [range ii]. It is clear that the housing deficit is concentrated more "bottom up" and in view of the action in business ventures for low-income focus "top down" and do not penetrate the full [range i], we see no means to meet the deficit, or even stop their growth, giving coverage to the organic growth of demand.

In this sense, this is a theme of urban policy, housing and income distribution, traditionally treated lightly in Brazil, and with no guidelines for medium and long term. The actions have been topical and uneven; between what is needed in the three hierarchies of pubic power (Federal, State and Municipal) and what each government included in its action plans.

In April, 2009, the Federal Government enacted a legislation, already approved by Congress and signed into law (Law 11.977/09), setting up a housing plan, with no target date, but with commitment of resources advertised as able to meet the production of 1 million houses, being 400,000 for [range i], 400,000 for [range ii] and 200,000 for [range iii].

2. The federal government support program

PFH will not be able to cover the vegetative growth within the lowest-income segment, neither even considering a time spare of a year. In fact, IBGE data shows that the annual demand for new housing in Brazil has been increasing around 580,000 within the family income [range I] (of up to 3 MW), and 83,000 within the [ranges ii and iii] (from 3 MW to 10 MW). As a result, PFH will produce no practical effect in reducing the recorded deficit, which will actually grow in the absence of complementary actions toward housing provision. Although the incentive on purchasing houses in the [3 MW to 10 MW] range is much more modest in the PFH, the contribution to reducing the deficit is a little more evident within the lowest income segment.

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[5] BRL stands for Brazilian Reais – R$

[6] Such as Real Estate Research Group (2009, 1 and 2)

Several Brazilian States and some municipalities provide housing for low-income families through Urban Development companies or Residential Construction companies, mainly using funding resources driven from FGTS. The PFH is complementary to this action, seeking to encourage entrepreneurs to operate in this market segment, which they had never gone down.

In order to prevent from the effects of the critical juncture that still damages the global economy, the Brazilian Federal Government has practiced tax waiver policy on the automotive and appliances. This procedure has shown to be inefficient, as the reduced tax has only served to increase industries' results, not fully reflecting the fall in price. It also happened in many different circumstances in the past when tax benefits had been granted to construction raw materials aiming to encourage housing construction for low-income families. Eventually, no significant effects had been produced to the sector at all but slightly to self-construction and housing improvements.

Differently from the promotion through targeted subsidies for housing purchase, made available directly to purchasers of houses, the PFH program eventually will seem more effective, although shy in its scale.

The PFH not only relieves the costs on some construction materials and marginal costs to buyers, such as insurance and real estate registry, but also cuts taxes for entrepreneurs. Two main perceptions come from it. The first one is that the PFH focuses comprehensively on the issue of production costs for low-income housing. Second, the option to enhance housing acquisition by providing grants to pay the price is more efficient as referring to public resources Nevertheless, the land and infrastructure costs, seen here provided with utilities (electricity, water, sewer, communication), but also the integration of urban developments to be built on the basis of PFH are still vague in PFH.

Development projects, whose unit price is small, are validated for entrepreneurs when presents large-scale, able to carry the solutions to the periphery of the large metropolitan centers, where the low-income housing shortage is most aggressive. The cost of the adequacy of land to receive new developments (physical infrastructure), the existence of adequate transportation to work and the insertion of urban equipments (education, health, services and leisure) are factors that will indicate the feasibility of each development. There is no doubt that there is no land, at adequate cost for low-income housing, in the periphery of the large metropolitan areas in Brazil, such as São Paulo, Rio de Janeiro, Belo Horizonte and Recife. Therefore, it is possible that the program will spread mainly into medium and small cities in Brazil, maintaining the present unsolved situation in the large metropolitan areas.

Considering both the price limits for houses and the level of subsidies offered in the PFH, it stands out that the costs of land features cannot be considered in entrepreneur's budget. As a result, the supply of land should be a State contribution for each project, as an additional indirect subsidy and also as important as the financial subsidies provided for in PFH. This would be the only way to turn PFH resources into neither sub-housing (or slums) in major metropolitan cities, nor the proliferation of small-scale enterprises in small cities in Brazil.

The land issue, however, is not directly tackled in the PFH. Instead, it considers just incentives for those municipalities that contribute with the land for projects driven to the lowest income range [range i] (up to 3 MW).

3. Subsidies for Housing Acquisition

PFH considers different concepts on granting subsidies for housing acquisition according to the monthly income group the family belongs to, as indicated in tables 1 and 2.

Although PFH completion is not tied to any target schedule, the correspondent amount of subsidies has already been assigned, considering the aim of reaching 1.0 million new houses.

According to studies developed by the Real Estate Research Group (2009), the assigned resources will not be enough to the completion of the PFH goals, taking into account the costs derived from construction technologies now applied in Brazil and also land costs in metropolitan areas. Considering that a high construction cost can be made up for low land costs, it would drive to two different possibilities: settlements in the countryside or new technologies to bring down construction cost. The first option does not match the PFH main goals, as the metropolitan areas are exactly those where the housing deficit for low-income families are crucial, pushing them to living in slums. The second option demands the perception of the plan to be permanent, so that the need of developing new construction technologies could be triggered in constructors and developers. As no signs were yet given, it seems that the plan may fall through, as resources will be fully depleted before reaching the goal of 1.0 million units produced. Clearly, the PFH does not anchor a system, but rather function as a stand-alone plan, with a defined end, portrayed by the consumption of resources allocated.

The relevant subsidies provided by PFH are summarized in tables 1 and 2, on which we make the following comments:

Table 1: Classes of income and subventions of PFH

Monthly family income		*Subvention on price*		*Market price limit*	
MW	*USD*	*BRL*	*USD*	*BRL*	*USD*
Up to 3	*775*	*-*	*-*	*52,000*	*28,889*
3	*775*	*23,000*	*12,778*	*75,636*	*42,020*
4	*1,033*	*16,000*	*8,889*	*86,181*	*47,878*
5	*1,292*	*9,000*	*5,000*	*96,726*	*53,737*
6	*1,550*	*2,000*	*1,111*	*96,677*	*53,709*
6 to 10	*Top=2,583*	*-*	*-*	*128,327*	*71,293*

Sources: CEF and 11.977/09 Law

Table 2: Classes of income and subventions of PFH

Monthly family income		*Major subvention*	*Interest rate*
MW	*USD*		
Up to 3	*775*	*i. residential price = 120 monthly instalments each one equivalent to 10% of monthly family income* *ii. with a minimum value of R$ 50 = USD 23.9*	-
3	*775*	*i. mortgage finance in 360 months* *ii. price limit considers monthly instalment equal to 20% of RFM* *III. subvention on price*	*5.00% + TR*[7]
4	*1,033*		*5.00% + TR*
5	*1,292*		*5.00% + TR*
6	*1,550*		*6.00% + TR*
6 to 10	*Top=2,583*		*8.16% + TR*

Sources: CEF and 11.977/09 Law

i. PFH provides the largest subsidy for housing acquisition exactly to those families matching the income [range i], that shelters the largest housing deficit and to whom developers find more difficult to propose products able to produce economic results. For this lowest income range (up to 3 MW per month) a housing unit is worth in 120 monthly payments, each installment not exceeding 10% of the family monthly income (equivalent to 50 BRL, when considering the current value assigned to 1 MW). The subsidy for the buyer will be the remainder of the unit price, treated as Federal Government sinking funds, managed by CEF[8].

ii. For the same income [range i], the operational procedure is that houses are bought by CEF and sold to the families, letting the entrepreneur free from interest and marketing expenses. Since PFH Law (11.977/09 Law) has been approved, CEF has been registering families as candidates for housing purchase, and constructors have been studying and proposing projects. The evidence is that projects will only be validated at a very low land cost, combining the maximum price accepted by the CEF (table 2) with the minimum specifications required. Such combination leads to a single-family residence area of around 35 sqm and apartments around 42 sqm.

iii. 52,000 BRL (USD 28,889) is the limit price accepted by the CEF for a unit in the metropolitan areas, such as São Paulo where the largest deficit in the country is observed. Considering both the highest income in [range i], the limit of 10 percent of the income for the monthly payment, 5 percent per year as the interest rate, but the cost of insurance and others usually added to the monthly

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[7] TR – Taxa referencial – is the basic interest rate used on the Brazilian real estate financing system.

[8] CEF – Caixa Econômica Federal – is a commercial bank, controlled by the state, with different functions within the Brazilian real estate financing system.

payment, the maximum loan a family can get is 13,219 BRL (USD 7,344). It implies a 38,781 BRL (USD 21,545) subsidy.

From the 400,000 households targeted in PFH for the families within [range i], São Paulo Metropolitan region is supposed to receive, produce and finance 165,600 new households. In this case, BRL 6.4 billion (USD 3.56 billion) is the amount required by the area in subsidies, corresponding to around 46% of the BRL 14.0 billion (USD 7.78 billion) assigned to the country as a whole. Even considering the land at no cost, no financial cost, and low taxes, the expected income for the entrepreneur will be set between 7 and 8 percent of the price, at high risk.

iv. Depending on the region in Brazil, the price for a house unit driven to the [range i] may vary between BRL 37,000 (USD 25,555) and BRL 52,000 (USD 28,889), the last one being the limit to the São Paulo Metropolitan area.

v. For those families whose incomes match [range ii] (3 to 6 MW), the house price can be fully financed considering those interest rates indicated in the table 1. When compared to those currently practiced by CEF, the subsidy comes from around 1 percentage point per year in interest rate.

vi. For families within income [range ii], the price is paid in 360 monthly installments equivalent to 20 percent of the family income. PFH pays an allowance in price, as indicated therein, given that CEF only funds projects to the price limit indicated.

4. Final remarks

A program designed to provide housing for lower-income families, considering Brazilian housing deficit depends on some main and simultaneous aspects.

The most important is to keep construction at compatible costs to maintain developers and constructors´ attractiveness. Intense government participation may happen in order to achieve the proposed goals, manly providing land, utilities and service infrastructure for big projects. Tax reduction for construction materials will be also needed. In addition, it´s necessary to point out that the program was conceived to be a permanent one, so that investments in developing new technologies can be triggered.

The concentration at CEF may end up overloading this agent, causing delays that can be reflected on entrepreneurs´ results. Maybe allowing other agents can relieve CEF, but it will depend on the willingness of private banks to have transactions within this segment.

Finally, from the buyers´ point of view, the debt-to-income ratio has shown to be feasible. But as the program was set to provide 1 million new houses, the housing deficit will still keep at high levels unless new resources are conveyed to provide more units, transforming the program into a permanent one.

In its first anniversary, some complementary comments about PFH performance deserve to be brought up.

a) In fact, for attending people within the lowest income [range i] in metropolitan areas, mainly in São Paulo, the initial proposal has not been sufficient, demanding help from the housing companies in both municipal and state levels. The supply of infrastructure, the high land cost and also the raising in construction material costs have been demanding the concession of complementary subsidies to complete the gap between the price considered in PFH (BRL 52,000 - USD 28,889) and the amount a housing unit is worth in such markets (BRL 75,000 -USD 41,667);

b) The suspicious of damages to the implementation of PFH caused by the concentration in CEF as the unique agent has really contributed with some delay, but it has been overcome with internal measures;

c) Finally, Federal Government has been signing the intention to turn PFH into an even program. As elections will take place in 2010, it has been announced that PFH-2 is about to be launched, and it has been used as a banner for the current president party to running for presidency.

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An Institutional Perspective on Managing Migrant Workers in the North of England

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Abstract

Despite advances made in our understanding of migrant worker issues, analysis of the literature reveals disconnections between the policy and practice of „managed migration" across three fundamental levels of the state (e.g. public institutions at the EU, national and regional levels), corporate (e.g. employers and unions) and community (e.g. migrant social networks) levels. Consequently, this has implications on corporate and community aspects that often escape deeper analytical scrutiny. Concomitantly, the literature often assumes that policy decisions at the state level are necessarily homogeneous, and fails to account for the local specificities that could exist in this area. This research therefore sought to investigate the interplay between state, corporate and community levels in managing migrant workers across three regions in the North of England, and explore its implications on managing migrant worker employment in construction. The key research questions examined include the critical issues confronted by state, corporate and community actors in terms of framing migrant worker issues, and the nature of existing interactions between these stakeholders in terms of managing migrant workers in each of the three regions. Cross-regional comparisons were also considered in this research. Through interviewing key participants, it was found that subtle differences exist in regional government actors" response to the impacts of migration through their policy formation. It was also noted that interactions between the three levels vary substantially cross the three regions, and the tendency for stronger relationships to be forged between government and corporate actors where economic imperatives are concerned, with weaker and more ad hoc connections made between stakeholders across the three levels where social policy is concerned. It was concluded that any migration policy cannot be viewed as stand-alone, since empirical analysis across the three regions demonstrate the intertwining dimensions of linking migration policy with social and employment concerns.

Keywords: migrant workers, regional analysis, social policy

1. Introduction

In a time when governments, economists and banking professionals across the world are trying to make sense of the causes and scale of the current financial crisis, the global construction industry continue to suffer from rising unemployment. In the UK, the unprecedented decade of growth since the mid 1990s have been replaced by a period of stagnation in construction work, resulting in the sector being the third hardest hit in terms of decline in employment (ONS, 2009). What is specifically notable in the UK is that whilst the number of native-born workers becoming unemployed has risen since the onset of the recession, the number of non-UK born workers gaining employment in the same period has also grown (ONS, 2009). It is no wonder therefore that disputes over the employment of migrant workers, such as the one seen at the Lindsey Oil Refinery building work (ACAS, 2009), are on the increase. Arguably, the global economic crisis has resulted in the fuelling of nationalistic, protectionist sentiments, encoded in slogans like "British jobs for British workers". For instance, mounting anti-immigrant attitudes have been reported in an authoritative report on *The global economic crisis and migrant workers* (Awad, 2009), whether these are manifested in tougher immigration policies across the world or growing xenophobia and violence on migrants in the community.

The issue of migration is, without a doubt, politically sensitive and contemporary. Unsurprisingly, this has attracted a lot of research interest, ranging from studies that examine the factors of international migration (Massey *et al.*, 1998) to research into the impacts of migrants on the native community (Stenning *et al.*, 2006), migration policy (Ruhs, 2006a), and integration of migrants into the community (Spencer *et al.*, 2007). Effects on employment relations have also been examined (Andall, 2007); with some arguing that migrant worker employment reinforces flexible labour markets (Ruhs, 2006b) and potentially erodes the welfare state (Schierup *et al.*, 2006). Others highlight benefits of learning from migrant workers (Williams, 2007). Such benefits can only be reaped if strong institutional frameworks exist to regulate and govern labour markets (Bartram, 2004). Researchers have also investigated opportunities and challenges for trade unions in organising migrant workers (Hardy and Clark, 2005). Furthermore, how migrant workers participate in social networks (Vasta, 2004) and juggle between work and family lives (Datta *et al.*, 2007) have also been considered.

Whilst these studies advance our understanding on migrant worker issues, there is surprisingly little scrutiny of institutional perspectives of managing migrant workers and the dynamic interplay of policy and practice found between three levels of analysis: the state (e.g. public institutions at the EU, national and regional level), the firm (e.g. employers and trade unions) and the community (e.g. migrant worker social networks). Often, the institutional perspective of migration is framed through immigration policy and re-presented as if this is consistent, coherent and unproblematic; the British case of managed migration reflected through the Points-based System (see http://www.ukba.homeoffice.gov.uk) as a case in point. Yet, government policy on immigration is increasingly known to be less than coherent. For example, knowledge about the levels of migration continues to be patchy and disjointed. In the UK, there is uncertainty over the number of migrant workers in the country especially where self-employment figures are concerned (Balch *et al.*, 2004), yet the UK government was seen to be zealously promoting the benefits of migrant worker employment (see Dench *et al.*, 2006) prior to the economic crisis. Similarly, limitations of tougher immigration policies introduced at the onset of the crisis to secure employment prospects for native workers and quell the tide of migration have been observed (Awad, 2009). What remains opaque is the enactment of government policies at the grassroots, and how these are interwoven with impacts on corporations and the community. This therefore forms the thrust of research reported in this paper that sought to investigate the interplay between state, firm and community levels of stakeholders in managing migrant workers in the North of England.

The study focuses on the construction industry specifically because of the disproportionate reliance on self-employed workers. The choice of location is because it offers a nuanced analysis as to how migrant worker issues manifests in the three Northern regions. Johnson *et al.* (2007) noted, in the *Northern economic agenda*, that reporting the three Northern regions collectively as a lagging cluster in terms of economic performance can be misleading since it can mask the true performance of each individual region. Furthermore, the experience of migrant worker issues can potentially differ across the three chosen regions (see e.g. Pillai, 2006), thereby reinforcing the need to focus on the three geographic regions in the North of England. The article is organised as follows: first a review of the salient points in the policy literature on migration (especially within the British context) is presented, followed by a brief explanation of the methods adopted and a discussion of the preliminary findings. The study confirmed the heterogeneity of approaches in managed migration in each of the three Northern regions, and the findings suggest a need for a more nuanced understanding of how migration policy is both influenced by, and impacts upon, corporate and social policies.

2. Review of the policy literature

In reviewing the policy literature, three emerging themes have been identified, including impacts assessments of immigration, government responses, and policy formation. These will be considered in turn.

Impacts assessments have mostly been based on geographical labour market mapping of migrant workers, and included the identification of skill levels, labour participation patterns and employment conditions. Intelligence have also been derived from local area reports (see e.g. Fitzgerald, 2005 and 2006; Slim, 2005), regional/national publications (see e.g. McKay and Winklemann-Gleed, 2005; IPPR, 2006; TUC, 2007) and those that are European wide (see e.g. Carby-Hall, 2007). In general, assessments of the dynamics of migration have concentrated essentially on numbers and ethnicity of migrant groups, sectors where people are employed and their employment experiences. However, the dominance of quantitative perspectives of the migration situation can be problematic primarily because of sampling difficulties and the lagging nature of data collection (Briscoe, 2006). This is most prominent with respect to data on migrant worker employment in the construction sector, since the sector‟s disproportionate reliance on self-employed workers means that its workforce can often be largely „invisible‟ to official statistics (Balch *et al.*, 2004; Cremers and Janssen, 2006; Briscoe, 2006).

This probably explains why the Worker Registration Scheme (WRS) data of A8 workers[1] have reported such a low participation rate of migrant workers – four per cent (6,100) of northern A8 registrations – in the construction sector, yet it is also the sector known for its relative ease of access to migrants for initial employment[2] (see Border and Immigration Agency 2008; Fitzgerald, 2007). Furthermore, official statistics tell only a partial story of the dynamics of migrant worker employment, and fail to acknowledge the plurality of how migrant workers are being employed in practice. Routes to entry therefore constitute quite a significant area of research elucidating migrant employment dynamics at the corporate and community levels. For example, Fitzgerald (2007) recently highlighted that in both the North East and North West regions, construction foreign owned subcontractors and agencies now dominate the supply of migrant workers to the sector; Hence recruitment of lower skilled foreign labour has become formalised through these suppliers who have initially recruited A8 migrants from their country of origin, before beginning to engage with developing regional migrant networks. This method of recruitment has led to not only non-registration of A8 workers on the WRS but also numerous instances of the poor treatment of A8 and other migrant workers in the North (Fitzgerald 2006). This exploitation and disregard for migrant worker employment rights has begun to be widely identified elsewhere in the sector and support is growing to extend the newly formed Gangmasters‟ Licensing Authority into construction (Donaghy, 2009). Thus, an examination of impacts assessments has revealed disconnections between policy intent and practices at the grassroots.

Government response to migration has been characterised by commissioning of numerous fact-finding reports (see e.g. Dench *et al.*, 2006; Gilpin *et al.*, 2006; Home Office, 2007). Of particular concern in these government reports is the employers‟ demand for migrant workers (Dench *et al.*, 2006) and impacts on wage levels and indigenous displacement (Gilpin *et al.*, 2006). Up to the onset of the recession in 2008, these reports – in espousing the benefits of immigration and the negligible effects on displacement – suggest that the UK government is zealously in favour of migrant employment. Yet, research has also noted negative implications of immigration (see e.g. Fitzgerald 2006; 2007), especially in terms of the perpetuation of the flexible labour market system that typifies neo-liberal Anglo-American economics (Ruhs, 2006b), which are partly to blame for the collapse of the financial markets. Others, especially the local authorities have identified pressure points that immigration creates in terms of increased demands on local services (see I&DEA, 2007; CRC, 2007). The House of Lords (2008) critically stated that the economic impact of migration has been negative, rather than positive; interestingly it also contained a number of priorities for government including better enforcement of employment regulations. Where the construction sector is concerned, the policy arena in relation to migrant worker employment appears to be patchy. It has been acknowledged that employment practices in the sector are typically informal (Lockyer and Scholarios, 2007). Furthermore, and owing to its project-based nature that seems to counter any efforts to sustain some form of predictability, any (long-term) policy-making in this area is hampered by the reliance of a

[1] A8 refers to the eight countries of Central and Eastern Europe which joined the EU in May 2004 (Poland, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Slovakia and Slovenia).
[2] Although difficult to ascertain in terms of quantitative impact, there is evidence that migrant workers who tend to be highly qualified within other professions get shoe-horned into the construction sector because of a lack of institutional acceptance of their qualifications (Lucio *et al.*, 2007; Pollard *et al.*, 2008).

casualised, largely self-employed workforce (Harvey, 2001). This again demonstrates the discrepancies between policy intent at the state level and the demands exerted on local community actors and the practices in corporations, thereby bringing into question the efficacy of solely relying on policy formation at the government level.

In terms of ***policy formation***, this again is more pluralistic than coherent and consistent. Whilst government policy on immigration has mainly been employer-led, the trade unions have also been actively formulating policy on immigration matters. For example, the Trade Union Congress (TUC) published a report on vulnerable workers, which forms the basis for the TUC migrant worker strategy. This is significant since it contributes to calls for extending the Gangmasters" Licensing regulations to include construction work. Other areas of trade union involvement entail issues of integration of migrants into the community (see e.g. CRC, 2007; I&DEA, 2007; 2008). Yet, there are disconnections between these strategic options and the dominant focus of quantitative assessments of immigration to align demand and supply of skilled labour through the Points-based System (see MAC, 2008). Yet, the ability to quantify skills have been called into question, and doubts have been cast as to whether it is fruitful to only focus on skills shortages since this ignores the dynamics of skills deployment and development (see Chan *et al.*, 2008).

3. Emerging questions and supporting methodology

The policy review presented in the preceding section has confirmed disconnections between policy at the state level and the implications on practices at the corporate and community levels. Given this backdrop, the study reported in this article focuses on scrutinising the interplay between the three levels of analysis to explain reasons for such discrepancies, and to suggest possible areas for better alignment and consistency. Three fundamental research questions were framed for this purpose, including:

- What are the critical issues surrounding migrant workers across the state, firm and community levels? And are there similarities and differences across the three Northern regions under investigation?
- How are decisions made in relation to migrant worker issues at the state, private and community levels? Who makes these, who is consulted, and on what basis are decisions made?
- What were, and how have these early interactions developed, between state, private and community actors in relation to managing migrant workers in the three regions? Who communicates, how, when, how often, in what fora, and what is the role of the migrant worker in this?

To help answer these research questions, the research team undertook a series of in-depth interviews with a range of stakeholders in each of the three levels identified, including:

- *State respondents*: one representative each from the three northern Regional Development Agencies (RDAs); one representative from a local authority in each region, which was supplemented with an interview in each region with a representative of a local government service that had directly been involved with migrant workers;

- *Private respondents*: one representative each from three major construction companies that have operations across the three regions; and one representative from trade union branches in each of the three regions.
- *Community respondents*: one representative from the Citizens Advice Bureau (CAB) in each of the three regions and a national officer who has dealt with migrant policy in the bureau; „representatives‟ of newly arrived migrant groups in each region; and representatives from „locations‟ which migrants have used and often approached for help (e.g. the local church; see also Fitzgerald, 2008 for a wider discussion of this).

Each interview lasted between 1 to 2 hours and was transcribed to facilitate the analysis, which will now be elaborated.

4. Preliminary findings

The preliminary findings presented here are based on an analysis of interview responses along the three fundamental research questions alluded to above.

Critical issues: It is perhaps not surprising to report that the critical migrant issues for actors in each of our analytical levels depended on the context in which they operated within, and there were differences in the experiences across the regions. Most notably, our community level respondents spoke of dealing with migrants directly on a “needs” basis and that there was a lack of real support to continue “doing what they did”; in fact community level respondents talked of a lack of engagement with government actors and often felt left out in the decision-making process critical to policy formulation and implementation. This was also echoed by our local authority (LA) respondents, who on the one hand acknowledged the importance of aligning themselves with central government policy in order to secure central funding for local council services, yet reported the pressure immigration has caused in terms of service provision on the other hand. Often, provision of services to cope with especially new migrants is dependant on will and commitment of resources at the local level, and there is a lot of divergence here. For example, at the Yorkshire and Humberside region, whilst an officer had been appointed to engage with the new communities, the real issues had been about overcrowding in housing previously owned by older established migrant communities. The one most worrying issue for a council in the Yorkshire and Humberside region was that long established Muslim streets were now populated by young A8 workers who often “stayed up late drinking and making a noise”. What was critical for this particular council, therefore, was less to do with migrant employment, but integration issues and the problems of social integration and cohesion. In the North West, however, it was observed that their collaborative approach had meant that Las have been proactive in involving local communities to create greater awareness of new migrants. Nonetheless, the North West (and the other two regions) have recognised that they face immense pressure in providing such basic public services as waste management. Accordingly, our LA respondents identified the A8s as having a very different approach to waste disposal and that resources were needed to ensure education of new arrivals, e.g. through the employment of a council outreach worker who was Polish in the North West. Finally, the LA respondent in the North East seemed to be driven not only by funding for services but also by the lower density of new communities and the space this offered for a more measured approach. Notwithstanding the divergence in tackling migrant issues in the community, it was interesting to note that the RDAs in each of the region, charged with economic development of the regions, had all carried out evaluations along the lines of attracting talent and were involved in Strategic Migration Partnerships. This mirrors developments of labour market intelligence at central government level explained in the policy review presented above. Whilst this was recognised as an important thing to do at the regional level so as to attract inward investment into the regions through aligning with government policy, one LA respondent dismissed such developments simply “as talking shops, wasting my time”. That said, it was also observed that in the North West, a more innovative approach seemed to be developed where the been supported. MWNW not only provided direct assistance to migrant workers but also identified poor employer practice, with the aim of securing an employer commitment to a migrant worker charter of good employment practice.

Decision making: At the level of the RDA it was initially difficult to identify who dealt specifically with the migrant worker agenda, as senior staff turnover is common. However, this was ameliorated by the fact that a multi agency talent attraction strategy group had been instigated to develop and sustain a strategy for the regions. This was especially evident in the North East. In the other two RDAs, however, it was a little easier to identify individuals who had connections with immigration strategies, although there was no specific named individual charged with looking at immigration issues. Much of the discussions on immigration at RDA level are closely interlinked with economic issues, and it was observed that committee and networks were the principal vehicles for making decisions on policy formulation regarding migrant involvement in the regional economy. It was also noted that RDA representatives not only liaised within their regional actors, but also regularly interfaced at the national level to share practices. Whilst the RDA representatives were largely concerned about immigration and economic development, our LA respondents focussed mainly on the sustainability of public services. Here again, the practices remain divergent. So, in the North West, emphasis is placed on coordinating a communication strategy across the LAs, supported by an internal LA information network. In the North East, because of the RDA‟s explicit talent attraction strategy, the LA group in the North East have deployed an international officer to engage, both internally and externally, with migrant worker groups in the region. In Yorkshire and Humberside, given the problems of social cohesion, the emphasis of LAs in the region is on ethnic minority issues, and it was observed that the appointment of BME officers – funded through national government budget – directly responsible for establishing links with the new communities was top in priority. However, whereas there seemed to be greater alignment between RDAs and LAs with the national government, the picture of community level engagement is less than rosy. For instance, in the North East the new Polish community group spoken to commented that they had tried on a number of occasions to open up a dialogue with the LA through various means. However, the LA appeared lacklustre in getting involved, opting instead to engage with a more (Higher Education) student based group. This perhaps corresponds again with the explicit talent attraction strategy formulated by the RDA in the North East. On the contrary, LA representatives in Yorkshire and Humberside were very much at the core of new migrant activity, although there was little engagement through the formal links with the BME officer mentioned above. In the North West, a more holistic approach was observed, but it seemed that engagement between LAs and the migrant community groups was based on passionate individuals who had originally worked with migrants earlier on; the role of these individuals is increasingly under threat due to questions raised on the sustainability of public funding. At the community levels, again all our respondents were involved in some form of committee, but there was some cynicism here particularly from a Federation of Poles in Great Britain project worker who noted that these are often official bodies that are seeking to support organisational service issues rather than dealing with the often very difficult range of issues that face new migrants. In terms of what guided decision-making in relation to the migrant worker agenda (whether explicitly or implicitly, covertly or overtly), this seemed to be directly or indirectly connected with the agenda formulated by central government, which largely promulgates the narrow economic imperative whilst ignoring the social implications that immigration bears on the community levels. So, whereas respondents did not articulate clearly how they decided upon the validity and reliability of quantitative data (both of the economic and labour markets), strategies were predominately aligned to central government‟s vision and steerage of where the national economy should be positioning, as well as funding regimes linked to the comprehensive spending review. Within the confines of this project, however, a deeper scrutiny of how funding streams are targeted was not possible, although this represents an extremely fertile area for future investigation, especially in terms of alignment of policy and practice.

Developing interactions: Whilst migration is a global issue, the role LAs play in managing the dynamics of migration is arguably very central in terms of engaging with actors at the corporation and community levels. Overall LA interviewees noted that their engagement with migrant employers was limited in part due to the difficulties in securing employer involvement across the diverse range of industry sectors. Therefore, in our investigation, the representation of construction companies in LA and even RDA discussions about migrant workers is often absent. At times, it seemed that policy formulation seemed to focus principally on high-level issues and fail to recognise the implementation challenges in practice. For example, the talent attraction strategy in the North East was initially driven by an OECD review of the region and not by the demographic information of new migrant arrivals. It seemed that the issue of immigration was addressed more tactically than strategically, and that LA interventions only emerged as a result of the growing problems of dealing with migrant communities. It was also observed that the availability and securing of financial resources drove the „strategy‟ (or tactics) employed by the RDAs and LAs. So even though there was an acknowledgement that the LA did have community outreach officers to engage with the new A8 communities this was not seen as a significant part of their strategy if funding was not available. Where funding is available, as it was seen in Yorkshire and Humberside, the deployment of BME officers was then made possible to enable fuller engagement with existing and new migrant communities; interestingly, this was driven by social considerations (i.e. anti-social disturbances in the community) rather than economic reasons. In the North West, interactions between stakeholder representatives across the three levels have been overtly encouraged through a holistic, collaborative model. Even this is not unproblematic. Funding was raised as an issue of concern since engagement activities were perceived to be one of those things that would be sacrificed in the event of funding cuts by the Treasury.

In general, respondents across the three regions argued for a need to have a holistic migrant worker strategy based on a number of elements. First, a strategic vision of migration which is not solely based on economic need but also social consideration needs to be derived from central government and cascaded down to the regions and localities; often migration policy is driven by economic need and fails to link up adequately with wider social policy. Secondly, a LA-based communication strategy needs to be developed to facilitate engagement with companies and community actors.

5. Conclusions

To conclude, joined-up governance has often been raised over the last decade. Yet, this research has identified that national government policy on immigration is often divorced from the realities of service provision at the local authority levels and community engagement activities. Alignment of objectives is inextricably connected with the availability of central government funding, driven mainly by short-term economic imperative. Paradoxically, the disconnections between economic policy and social policy around immigration also meant that employers are often ill-represented in local government and community fora on migration. The perpetuation of flexible labour markets imply that companies base their recruitment and deployment of human resources on a tactical „numbers" game with little strategic consideration and thought for social implications. It was also observed that community-level actors (especially migrant representation groups) can seem peripheral to policy development on immigration matters, even though they bear the brunt of engagement and in fact have good links into the local authorities. The lack of regulation of labour markets in the UK is well-documented. As a consequence, addressing the social implications of migration, whether it is the needs of migrants or natives – continue to run on a tight rope of balancing the lack of funding with the need for service provision. Because of the lack of engagement with employers, the true cost of migrant worker employment becomes opaque. Notwithstanding the shortcomings of engagement of stakeholders across the three levels of analysis, the study has also revealed the heterogeneity of practices in the implementation of immigration policy at the regional levels. More work needs to be done to study how policy and practice across the levels of stakeholders can be better joined-up to improve the alignment of economic and social objectives.

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Firms' Overhead Costs in Real Estate Construction Industry

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Abstract

Firms in Real estate construction industry typically use cost-based pricing schemes. Cost-based pricing schemes include direct costs plus remuneration for overhead costs, profits and risk. The literature on empirical estimates of the size and composition of overhead cost is thin. Firms though might have incentives to better understand overhead cost drivers to benchmark performance, reduce costs, and improve productivity. This paper aims to shed more light on firms' overhead cost considering the cost drivers for a sample of Dutch firms in real estate construction industry over 2006-2007.

Keywords: cost-plus pricing, overhead costs, cost drivers, main contractors

1. Introduction

Construction firms typically use cost-plus based pricing schemes that involve the allocation of both direct and indirect costs to a project. Direct costs include materials and labour costs and can be attributed to the project on a one-to-one basis. Indirect costs typically cannot be attributed straightforward to a specific project. Indirect costs include cost items like management, supervision and overhead. Deciding how to assign overhead costs to projects is a troublesome issue. Yet, cost-plus pricing is still the dominant strategy (Noble and Gruca, 1999). Firms' pricing practice typically is to calculate direct cost plus remuneration for overhead costs like for profit and risk. Tah et al. (1994) suggest that cost calculation software have been making direct cost estimates becoming increasingly similar across bidding firms, arguing that bids vary particularly in overhead costs. Banker and Johnston (1993) argue that these costs might be substantial. Managing overhead costs is a mean towards the firm objective of profit maximization. Firms may therefore aim to better understand the overhead cost drivers to reconfigure production processes to reduce costs, improve productivity and increase market share (see also Assaf et al. 2001).

The literature indicates significant variation in overhead costs across bidders for various reasons. Tah et al. (1994) and Assaf et al. (2001) observe that contractors have different perceptions as to what were overhead costs. Alles and Datar (1998) suggest that a firm's pricing strategy is a function of their market power rather than of the size of its direct costs and overhead costs only. The literature that provides empirical estimates of firms' overhead costs is rather thin. Foster and Gupta (1990) and Banker et al. (1995) are a few exceptions be it on a very limited number of manufacturing firms1. Estimates for overhead costs for other industries like construction are scarce. Assaf et al. (2001) provide overhead costs for construction companies, however, not formally addressing the interrelation between overhead costs and associated cost drivers. Assaf et al. (2001) who consider firms' overhead costs in construction industry do not distinguish between these various drivers formally, pointing towards volume-based and complexity-based drivers also. Furthermore, a systematic analysis on the interplay between overhead cost and inefficiency is missing to the best of our knowledge.

The research reported here serves to elaborate on firms' cost structure. It is the interplay between firms' cost structure, associated overhead cost drivers and productive performance which is at the centre of this paper. Do firms vary in overhead cost rates ? How can we understand differences in overhead costs between firms?

The organization of this paper is as follows. Section 2 discusses the literature on cost-plus pricing. Section 3 describes the survey and descriptive statistics of the sample. In section 4 we discuss the empirical model and estimation results. Conclusions and directions for future research follow in Section 5.

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[1] Foster and Gupta (1990) consider one manufacturing firm with 37 plants, Banker et al. (1995) 32 manufacturing firms, and Assaf et al. (2001) 61 construction firms.

2. Cost-plus pricing

A firm's cost structure can be modelled following Rogerson (1992), augmenting the model with overhead costs being now proportional to total direct costs. A firm's cost structure which is the sum of direct and indirect costs can be written as

(1) $C_i = L_i + M_i + IC_i$,

whereby L_i is cost of direct labour input, and M_i cost of direct materials and outsourcing and ICi total indirect costs. The total indirect costs consist of ICAi indirect costs allocated to particular projects2, and overhead costs OH, defined as:

(2) $IC_i = ICA_i + OH_i$

The overhead cost rate R^M is defined as:

(3) $R_i^M \equiv \frac{OH_i}{(L_i + M_i + ICA_i)}$

The associated cost-plus pricing scheme for firms that is typically observed in bidding for contracts reads as:

(4) $C_i = (1 + R_i^M)(L_i + M_i + ICA_i)$.

In this paper we are particularly interested in the overhead cost rate R^M, specified as:

(5) $R_i^M = g(OH_i, L_i, M_i, ICA_i)$.

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Interpretation of equation (5) is straightforward. The overhead cost rate is a function of overhead costs (OH), volume-based drivers (L and M) and to those indirect costs that could be allocated to specific projects (ICA), conditional on a firm's production technology (cf. Banker et al. 1995).

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[2] Activity costing will allocate all indirect costs to activities and likewise to specific projects.

3. Survey and descriptive statistics

3.1 Survey design

The data comes from a questionnaire held in the second half of 2007 and of 2008 among all Dutch main contractors with employees, registered at the Cordares Pensions. In this paper we concentrate on real estate construction firms. The 2006 population of real estate construction firms3 comprise 5.562 firms with 100.020 employees measured in terms of full time equivalent (fte). Table 1 gives population and sample information on the distribution of number of firms and number of employees by firm size.

Table 1 Share of firms and employees by size in the population

		Sample		*Population*	
Size	*Size in fte*	*Number of firms*	*Number of Employees*	*Number of firms*	*Number of employees*
Small	*< 20*	*55*	*14*	*81*	*28*
Medium	*21 – 50*	*24*	*21*	*12*	*22*
Large	*> 50*	*21*	*65*	*7*	*50*
Total		*100*	*100*	*100*	*100*
Number of firms		*304*	*11710*	*5792*	*100591*

The sample obtained does not fully represent the population in each and every aspect. From Table 1 one observes that the sample under-represents small firms, yet over-represents large firms measured in the number of employees.

The survey is based on a written questionnaire either being filled out on paper or via the Internet. The questionnaire is designed to elicit more detailed information on the size and composition of firms' indirect cost structure. Cost-items were identified on the basis of construction firms' profit and loss statements.

A second questionnaire provides information on output and direct costs including materials, outsourcing, and direct labour costs. Information on these cost items together with the survey on indirect costs allows one to determine the size and composition of overhead costs. In addition, the questionnaire provides us with information on type of work (residential or non-residential construction), client type (government, housing associations, or firms and households), type of output

[3] We confine ourselves to real estate construction firms discarding the civil engineering firms.

(new construction or maintenance) and tendering (open, selective, single). These data are merged with the questionnaire on indirect costs by firm-id.

3.2 Sample description

The descriptive statistics of the sample is given in Table 2 presenting summary statistics on the various cost drivers over 2006-2007. In total we have 225 observations for 206 firms for which we have full information. Following the literature we distinguish between volume-based drivers and complexity or operations-based cost drivers. Volume-based overhead cost drivers include Labour (L), Materials (M), OUTPUT, the number of white collar workers (INDIRECT) and blue-collar workers (DIRECT). Complexity-based overhead cost drivers include a variety of measures including: type of work (residential- or non-residential construction), market (government, housing associations, firms, and households), and type of output (maintenance or new construction). Output, labour costs and materials have been deflated to 2006 values.

Table 2 Summary statistics of the sample

Variable	*Description*	*Mean*	*Std. deviation*
Volume-based cost drivers			
FTE	*Labour (in fte)*		
INDIRECT	*Indirect Labour (in fte)*	*12*	*21*
DIRECT	*Direct Labour (in fte)*	*30*	*41*
OUTPUT	*Sales (in 1,000,000 euro's)*	*13*	*23*
L	*Direct labour costs (in 1,000,000 euro's)*	*2.3*	*3.7*
M	*Direct costs for materials and subcontracting (in 1,000,000 euro's)*	*9.7*	*9.7*
Complexity or Operations-based cost drivers			
PRES	*Residential construction (share in sales)*	*.64*	*.29*
PMAINT	*Maintenance, repair and reconstruction (share in sales)*	*.48*	*.37*
PGOV	*Government (share in sales)*	*.07*	*.12*
PWOCO	*Housing associations (share in sales)*	*.15*	*.23*
PPART	*Households (share in sales)*	*.39*	*.35*

Considering the descriptive statistics in Table 2 one observes substantial variation or heterogeneity in size of the firm in terms of numbers of both direct and indirect workers. Most of the construction work for firms in our sample consists of residential construction. On average, maintenance output accounted for almost two thirds (64.1 percent) of total output. The standard deviations for the general characteristics of the contractors indicate substantial variation in the mean values. Regarding the type of client, the sample indicates that on average about forty percent come from households.

Construction work for the government or housing associations is much smaller measured in percentage output.

4. Size and composition of overhead costs

We decomposed the firm's i cost structure into components of direct costs and indirect costs by rearranging equation (1) and (3), such that

(6) $C_i = L_i + M_i + ICA_i + OH_i$

Table 4 gives a decomposition of total costs for our sample of firms in median percentage of total costs C.

Table 4 Cost structure by direct, indirect and overhead costs

Costs	*Definition*	*Median percentage*
Direct costs in total direct costs	*(L + M) / (L+M+ ICA)*	*88.1*
Total indirect costs in total direct costs	*IC / (L+M+ ICA)*	*11.9*
Overhead cost rate RM	*OH / (L+M+ ICA)*	*8.8*

Following firms' bidding practice we express overhead costs in percentage total direct costs viz. $(L + M + ICA)$. The sector-weighted median overhead cost rate equal to 8.8, and total indirect cost rate equal to 11.9. This percentage is in line yet somewhat lower than the 15 percent reported by Assaf et al. (2001). This is not unreasonable. We expect the estimate of Assaf et al. to be higher as civil engineering firms (which are excluded in our sample) do have higher overhead costs relative to construction firms.

5. Conclusions

Construction firms' pricing practice typically is to calculate direct cost plus remuneration for overhead costs like for profit and risk. This paper considered firms' overhead costs structure. The research reported here serves to elaborate on the interplay between firms' cost structure and associated drivers. Do firms vary in overhead costs rates? How can we understand differences in overhead costs between firms? Do productivity differences relate to variation in overhead cost rates?

Insight into firms' overhead cost structure is of great importance for society at large. Managing overhead costs is a mean towards the firm objective of profit maximization. Firms might aim to better understand indirect cost drivers to reconfigure production processes to reduce costs, and improve productivity. Note that in practice a firm's overhead cost rates vary for various reasons:

- Firms might differ in to what belongs to overhead costs;
- Firms might differ into cost accounting method;
- Strategic pricing depending on bargaining power;
- Firms differ in overhead costs.

Our research aims to get more detailed information on the latter considering the size and composition of firms' overhead cost structure. To prevent overhead costs to be depending on firms' definition, cost accounting approach and/or pricing strategies here, we take a rather normative approach by identifying pre-defined overhead cost items.

The results indicate that volume-based measures do play a significant role in explaining variation in overhead cost rates. The data give evidence of scale effects with overhead cost rates reducing with firm size as measured by output. Furthermore, we find evidence that operation-based cost drivers like specialisation, type of clients and type of output do play a significant role. The share of residential construction in output do increase overhead cost rates relative to non-residential construction. Residential construction includes a wide variety of activities including new construction, and maintenance for households. These activities are most likely of limited size as measured in terms of output and associated with higher overhead costs rates. Maintenance is also associated with higher overhead cost rates. The interaction term indicates that while correcting for firm size, residential construction activities that relate to maintenance do not have significantly higher overhead cost rates. This is reasonable. Whether maintenance is in residential or non-residential buildings ceteris paribus do not lead to lower or higher overhead cost rates. Furthermore, the results indicate that type of client does make a significant difference in overhead cost rates, with lower overhead cost rates for maintenance for housing associations. Summarizing, the results suggest that for construction, overhead rates do vary with firm size and nature of the project.

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Productivity Comparisons, Are They Possible or Even Desirable?

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Abstract

Increased productivity is of societal good and efforts to achieve this should be a relevant task for all businesses. However, the concept of productivity is not clear as to what is to be measured. This becomes a problem especially when statements are made that the development of productivity in the construction industry is not as good as other sectors of industry. It is not clear if this comparison is relevant or even possible to make. This study aims to address and discuss the problem surrounding productivity measurements and comparison of them and is based on literature reviews that address the problem of evaluating productivity, with special focus on construction productivity. The results show that there is no uniform measure for construction productivity that can be used. Different situation calls for different measures. There unique circumstances for various construction activities, such as housing, commercial, industrial, infrastructure etc, that makes comparison of productivity between them virtually impossible. If statements of productivity are made without the knowledge of what the measures really show or is based on, there is a risk that these lead to misleading conclusions. Every study of productivity needs to be critically scrutinised with a high degree of scepticism. Instead of trying to achieve one uniform measure of productivity a set of key performance indicators can be used instead in order to obtain more qualitative facts about the state of the construction industry.

Keywords: productivity, efficiency, incommensurability, construction

1. Introduction

Increased efficiency in various sectors of society is a prerequisite for growth; the construction sector is no exception. Buildings and infrastructures needs to be improved in order to achieve the ambitions of a more sustainable use of limited resources. Often this increased efficiency is described in terms of increased productivity. Statements concerning the development of productivity in the construction sector are often made in relation to other industrial sectors, where the conclusion often is that the construction sector is not as productive as other industrial sectors (e.g. Koskela and Vrijhoef 2001). However, most of the available data and statistics are of *macro economical type*, which means that the pictures given are rough and not very suitable for control and decision-making at company operational level.

Nevertheless, the information is useful for the industry as general background. But when it comes to measuring productivity and efficiency, the need of project level data is essential (Ingvaldsen et al. 2004). Different initiatives to improve the construction industries competitiveness have been introduced in a number of European countries, for example Constructing Excellence, the UK, PSI Bouw, Holland and BQR Best Practise, Sweden where all more or less base their existence on a notion that the productivity in construction has increased less than in other industrial sectors. Three Swedish governmental official reports (SOU 2000, 2002 and Statskontoret 2009) during the last ten years all base their evaluation based on this assumption. This debate is not new and not limited to the perception of Swedish governmental agencies. Already in the 1960s, Dacy (1965) questioned the statement that the productivity in the US construction sector was worse than other sectors. Davy based his arguments mainly by questioning the reliability and suitability of available statistics.

This study aims to address and discuss the problem surrounding productivity measurements and comparison of them and is based on literature reviews that address the problem of evaluating productivity, with special focus on construction productivity. The results show that there is no uniform measure for construction productivity that can be used. Different situation calls for different measures.

2. Is it possible to measure productivity in construction

In a perfect world, perfect productivity (Whiteside 2006) would be achieved during a 40 hour working week where all employees take their vacations as planned. All drawings are 100% correct and no delays occur in the project process. All work safely, everything fits and functions perfectly the first time, and the temperature is always 20 degrees Celsius. However, Whiteside (2006) points out that we are not living in a perfect world. In order to evaluate the level of productivity for the construction sector and compare this with other sectors there is a need for a common framework. For example, a simple way of measuring productivity of a building process is to measure the working time productivity (labour productivity). Based on the working time of the working force at the site and the produced floor area, one can calculate the gross area produced per. hour, which in some situations can be used to compare different project organizations" ability to compete (Ingvaldsen et al.

2004), but, in this case, a consistent definition of direct labour needs to exist (Whiteside 2006), otherwise the misinterpretation can be made that a contactor that uses more direct labour hours is less productive. In reality the opposite may be true if indirect labour hours have been accounted for as direct. Whiteside (2006) argues that the only time productivity as a measure can be constant and thus act as a comparative measure is in highly automated and robotised assembly lines. Thus, there are good grounds to doubt statements concerning productivity in different sectors and the comparisons between them. Such "short-cut interpretations" can be explained by the lack of satisfactory statistics for the construction sector. The result is a sector with very limited true information for studying and understanding own performance and prepare for the future (Ingvaldsen et al. 2004). Calculations and measurements of productivity are always uncertain. To measure both added value and labour input is hard and when changes in productivity is calculated by dividing these with each other there is bound to exist an interval of uncertainty.

Incommensurability is the scientific term of describing the problem of „no common measure", i.e. the impossibility of comparing two factors expressed in different units and scales (Stanford Encyclopedia of Philisophy 2009).

"It has been said that successive and competing theories within the same domain 'speaks different languages'. They cannot strictly be compared to each other nor translated into each other. The languages of different theories are the linguistic counterparts of different worlds we may inhabit. We can pass from one world or one language to another by a gestalt-switch, but not by any process of understanding." (Hacking, 2007)

Kuhn stated that the scientific history has proven the failure of competing paradigms to acknowledge the views of each other and, thus never be able to develop serious inter-disciplinary studies. The different paradigm does not evolve cumulatively towards a common goal, with firm rules, methods and standards, but rather away from anomalies within the reigning paradigm. Incommensurability between two theories means that the same term is used as reference, but with different meaning and content. This is evident when discussing productivity measurement and comparisons. The term productivity is often used differently in different contexts and, thus, creates incommensurable viewpoints for describing the phenomenon. How academics and practitioners interpret something (e.g. productivity) is depended by the theories that are used, and when theories are changed so is the explanation of a certain phenomenon. Duhem (1954) stated that it is necessary to both understand the theories as well as how they are implemented. It is important to define the context of a studied phenomenon in order to understand the specifics and relate to the whole. When it comes to comparisons concerning productivity and innovation it is common to compare the motor vehicle sector with the construction sector, where the result often falls to the advantage of the motor vehicle sector. However, is this a fair comparison? The value created is often the base when comparing different sectors, a key factor is then how values for different sectors are defined. Winch (2003) argue that because international standards define sectors differently the comparison between them basically has no value. For example when defining the value created in the construction sector the whole value chain (design, manufacturing, distributing and maintenance) are included, but for the motor vehicle sector only design and manufacturing are included. By excluding the maintenance, which by its very nature have a low productivity and innovation rate since its purpose is to reinstate the existing. Winch (2003) states that this sheds construction in an unfavourable light while it flatters other industries. Thus, the way something is measured affects how the results can be interpreted, with apparent risk of misinterpretation in the best case and in a worst case scenario constitutes the base for potentially harmful developments.

Productivity is generally defined as the relation between the value of produced goods and services (output) and the cost of used resources (input). For example, in a road project the output could be described by the amount of produced road in meters divided by used resources. However, a problem arise, Talvitie and Sikow (1992) states that one meter of constructed road in difficult terrain cannot be compared to one meter of road constructed under more favourable conditions. There is no way of determining which of the two road projects that is most productive because they cannot be compared on equal terms. Talvitie and Sikow (1992) suggest a solution to the problem by introducing an advanced logarithm function where different parameters are weighed together. Despite of the fact that the calculations becomes intricate and difficult to grasp the value of the results are limited when trying to compare productivity with other kinds of projects, and even more so when trying to compare companies and industrial sectors with each other i.e. productivity is hard to measure. However, there is still a need for indicators of how efficiency and productivity are developing. As Lord Kelvin stated "if you cannot measure it, you cannot change it".

3. Measuring the value creating effects of change and innovation

Change is a complex issue, especially in fragmented and project-based industries, such as construction, where success often is depending on the actions of more than one organisation. Change can on one hand be easy to understand, but often involve issues that are not obvious (Bergh and Fairbank 2002). Different types of change need different units of measure; most types are covered by human resource measures, process measures and operational measures, i.e. the notion of one uniform productivity measure is perhaps a utopian concept. For evaluating operational excellence Taskinen and Smeds (1999) proposed some different variables that can be used for measures:

1. Human resources measures:
    a. Effectiveness: competencies and skills, education, operational expertise, customer awareness, and process awareness.
    b. Efficiency: input/output measurements on human productivity, quality, and flexibility.
2. Process measures:
    a. Effectiveness: strategy alignment (links between operational performance and strategic competitive factors), and profitability.

   b. Efficiency: operational input/output measurements such as productivity, volume, lead-time, flexibility, amount of work-in process, quality.

3. Technology measures:

   a. Effectiveness: selection of strategically right technologies and tools (process technology and IT).

   b. Efficiency: productivity of technology, cost/benefit measurements.

Project-based industries have a different setting than traditional manufacturing industries and change need to be measured at three different levels, industry, company and project levels (Brusoni et al. 1998). There have been different efforts to measure change in construction, these have had different scope and subsequently different approaches. In the UK, Key Performance Indicators (KPIs) is used both to compare single construction business performance with the construction industry as a whole (Constructing Excellence 2006). Other initiatives for, example Considerate Constructors Scheme, UK and BQR Best Practise, Sweden measures the performance on a project level so that projects can be compared with each other. It is also possible to see overall changes in industry performance over time when comparing project scores between different over a period of time. However, at the end of the of the day initiatives of change and innovation is undertaken with the purpose of increasing the value creating capacity of that organisation.

All organisations create value from leveraging their intangible assets (e.g. human capital, information systems, processes, customer relationships, innovation capabilities and culture). An organisations (in the case of construction this is often a project organisation) intangible assets may represent more than 75% of its value (Kaplan and Norton 2004). So, the performance of these assets needs to be monitored and evaluated. It is important to consider how an organisations performance is measured and how it can be communicated to a wider market, i.e. how it can be understood and interpreted by the potential stakeholders (Kagioglou et al. 2001). Measuring the impact of performance from a solely financial perspective may not be sufficient (Landin and Nilsson 2001), and can encourage companies to achieve short term financial results at the expense of long-term objectives. Torbett et al. (2001) showed that design performance measurement (DPM) in construction most focus on cost issues, overlooking design quality, flair, project management and client satisfaction. Financial measures are lagging indicators that fail to capture much of the value created or destroyed by managers (Kaplan and Norton 1996). However, it is incorrect to believe that financial measures are unnecessary (Kaplan and Norton 1992). A well designed financial control system can enhance rather than inhibit an organisation‟s total quality management program.

In traditional manufacturing organisations most intangible assets lie within the border of the company while in construction they lie within the borders of the project. This means that many different organisations will have an effect on whether value is created or not. The construction project is an interdependent organisation that ought to work towards the same goal but tends to create conflicts concerning responsibility and power instead (Loosemore, 1999), thus limiting the possibility of creating value. To add to the complexity many stakeholders define and understand value differently. It is important to ensure that none of these values, created or asked for, are lost in the process. A number of different methods and tools have been identified that aim to aid in various ways. None though, aim to take a holistic perspective of the project process and none are used to any larger extent (Pemsel et al. 2009).

The balanced scorecard (Kaplan and Norton 1996) aims to provide a comprehensive framework to translate an organisations vision into strategy. Kaplan and Norton (1996) argue that it is essential to identify the key performance indicators and the key performance drivers to adequately assess an organisations fulfilment of its vision and strategy. Benchmarking procedures are a technique that companies can use to compare their performance against competitors „best practice" (Kaplan and Norton 1992). Benchmarking and performance assessment attempts in construction are bound to face certain difficulties such as incomplete or non-existent data (Mohamed 1996). Mohamed distinguish between three types of benchmarking:

- Project benchmarking, where the construction organisation assesses the performance of projects in which it is involved.
- Internal benchmarking, where the construction organisation aims towards identifying improvement areas within its structure through comparison with others.
- External benchmarking, where the construction sector as a whole attempts to increase its efficiency by making tools and techniques developed and successfully used by other industries, applicable to construction.

Benchmarking the delivery and performance of construction services can extend from the analysis of a specific process to cover a general social vision that looks to use metrics as milestones for general quality of life issues (Holt and Graves 2001). Josephson et al. (2006) identified nine factors relevant to performance assessment for a construction project, which all can be structured using the four perspectives of the balanced scorecard; however, special attention needs to be addressed to the factor of learning and development. Landin and Nilsson (2001) emphasise the point that when evaluating construction companies and projects the perspective of innovation and learning is not used to its full potential. A company"s ability to innovate, improve and learn ties directly to the company"s value (Kaplan and Norton 1992).

Value is a concept that has many definitions. Value can be regarded as subjective in nature and the context of the individual´s experiences and current situation (Thomson et al., 2003). Value can also be regarded as the relation between subjective and economic parameters (Andersson et al., 2006). In other words the concept of value may be interpreted differently in different contexts. From an evaluation perspective value is one part and therefore it is important to clarify the values and underlying assumptions behind the goals in the evaluation of a process (Preiser and Vischer, 2005).

A process can be seen as a set of inter-related resources and activities which transform inputs to outputs. It can also be explained as something ongoing that leads to a change or development, or the process refers to how the collaboration should be managed to create value (Sebastian, 2007). Bergman and Klefsjö (2003) who looked at manufacturing industry define a process as a "network of activities that are repeated in time, whose objective is to create value to external or internal customers". Within the definition of process is a notion of value, but it includes the dimension of collaboration and customer, i.e. the core business of an organisation.

The construction sector‟s core business is undertaking projects generating new or refurbished facilities (Kagioglou et al. 2001). When a project is finished the project organisation is dissolved and new constellations are formed. The construction sector struggles to see how benchmarking of performance can be used effectively in a project based setting where products, processes and teams change regularly (Garnett and Pickrell 2000). Thus, there is a relevant need for effective assessment and benchmarking tools during the construction project life cycle and for knowledge transfer between projects. Cost, time and quality are the traditional indicators of success or failure of a construction project. However they do not, in isolation, provide a balanced view of project performance (Kagioglou et al. 2001) and there is a lack of consensus as to what performance criteria should be measured beyond traditional time, cost and quality measures (Dainty et al. 2003).

4. Conclusions

There are unique circumstances for various construction activities, such as housing, commercial, industrial, infrastructure that makes comparison of productivity between them virtually impossible. If statements of productivity are made without the knowledge of what the measures really show or is based on, there is a risk that these lead to misleading conclusions. Every study of productivity needs to be critically scrutinised with a high degree of scepticism. Instead of trying to achieve one uniform measure of productivity a set of key performance indicators may be used instead in order to obtain more qualitative facts about the state of the construction industry. Uncertain measurements of productivity need to be replaced with the measurement of well defined indicators that, when analysed together, can give insights about value creating factors as well as increased efficiency and productivity. Within the construction sector various actors, practitioners and academics alike, implement their views of how well, or bad, the sector is functioning. In order to avoid incommensurability when discussing the development of the construction sector methods needs to be developed that can handle conflict concerning different expectations as a result of insufficient communication and inconsistent definitions of the context. There is, according to Duhem (1954), a difference between practical facts (the observed and real) and theoretical facts (the symbolic and ideal). A common view within the construction sector that combines theory with practise is needed in order to create meaning and stability when developing indicators for efficiency and productivity.

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Optimization of Building Defects

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Abstract

Defects are seen as lack of product quality. Defects represent a loss in economy which increases with the amount of defects. On the other hand, costs to avoid defects increase if the accepted amount of defects is reduced. Consequently, an optimal amount of defects may be stipulated. In building projects, the optimal amount of defects is considered as a balance that every player seeks to achieve.

This paper includes the development of a qualitative model for dealing with optimization of the amount of defects and the associated quality cost. The parameters that influences the dynamic optimization processes in real building projects are explored.

It is concluded that the model is useful to form heuristics concerning quality cost and that such heuristics shall aim at minimizing the quality cost rather than the amount of defects.

The paper is based on a part of a larger research project 'Defects in construction: strategies, actions and learning'.

Keywords: defects, quality, optimisation, construction, economy

1. Introduction

The study of defects in buildings is important in Danish building research, partly based on interests from the building sector and the authorities. One reason is that defects are often exposed in public media harming the reputation of the building sector. Another reason is that the costs caused by defects are believed to represent a considerable loss in the economy, about 10 pct of the turnover in the building sector (Nielsen et al, 2004). This has resulted e.g. in action plans for reducing the amount of defects in the Danish building sector (Danish Enterprise and Construction Authority, 2005)

We do not want defects in buildings, structures and all other products that surround us. Defects represent lack of fulfilment of expectations. In modern society many people seem to be impatient on defects. The world is expected to be perfect, and defects supposed to be avoidable. On the other hand, complex one-off products like buildings are by nature born with defects being the result of an incomplete and not fully developed process involving human decisions.

As the building sector in many countries is becoming industrialized and buildings regarded more and more as 'just another product', the builder or end-user is thought of as a consumer that may expect a certain prescribed quality and level of function.

The authors discussed the buildability concept as a tool for optimization of building defects (Nielsen et al., 2009). Part of that study was to develop a theoretical framework for such optimizations and that part is further developed and discussed in this paper.

The term *defect* is used as a common term for a *physical defect* and for a *process defect*. It is considered *a physical defect* when *project documentation, a building material, a structure or a part of a structure lacks abilities which can be expected according to the construction contract, public requirements or good building practice*. It is considered *a process defect* when *the building process takes place in a way that represents a significant loss in resources or time in comparison to an optimal process*. This means that a defect is seen as a technical problem independently of the cause for the defect and independently of when the defect is observed, which may be before, during or after the construction period.

In accordance with (ISO, 2008), we distinguish between *quality* and *standard*, using the term *quality* to describe the delivery of a given agreed *standard*. Fulfilment of all expectations means high quality no matter the standard. You may have high quality at a low level of standard, e.g. low-cost low-tech housing, or low quality at a high level of standard, e.g. poorly constructed housing using expensive materials. Consequently, high quality means low amount of defects and visa versa – quality is reciprocal to amount of defects.

In this paper the term *quality cost* corresponds to a certain amount of defects and expresses the sum of costs caused by defects and costs to avoid defects.

2. Theoretical Framework

The framework for optimization of defects is seen as composed of three perspectives:

- the building process considered as a path of *Decision Points* leading to acceptable situations or defects
- the building process and the resulting building product considered as being of a *Probabilistic Nature*, where nothing is for sure
- decisions made in decision points are led by *Heuristics* in an attempt to do the best in any given situation.

2.1 Decision points

The building process is perceived as a process with many possible paths leading to a finished work, see Figure 1. The full lines represent successful processes which end up in an acceptable solution. The doted lines represent processes which either end up being corrected or continue until finished work as a solution with defects. It may or may not be known to the building contractors that a defect is present in the solution. The solid dots indicate decision points, which are points where the further process may follow different paths, including going back. Decisions are taken by people involved in the building process at all levels. People may or may not be aware of the presence of a decision point.

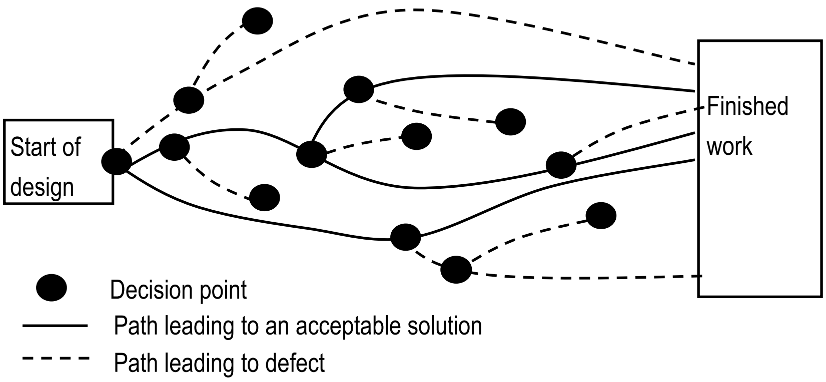

Figure 1: Perceived building process. Possible paths between start of design and finished work.

2.2 Probabilistic nature of construction

A building can be seen as a collection of a number of solutions (roof, walls, floors, bathroom, etc.). The number of decision points and of potential possible processes is huge. A deterministic view implies that, in considering all those potential processes, an optimal design may be developed, described and communicated to people involved in the building project so that no mistake is done. If not impossible in practice, such a deterministic approach will obviously be extremely expensive.

A probabilistic approach offers a more realistic view. It considers that design and planning must stop at a certain stage and that some decisions concerning details are to be taken in the construction phase.

In this approach the expertise at the construction site is used. Seen up front it is then accidental exactly which process and which solution will be realised. This perception fits well with a probabilistic view on the building process as illustrated in Figure 2.

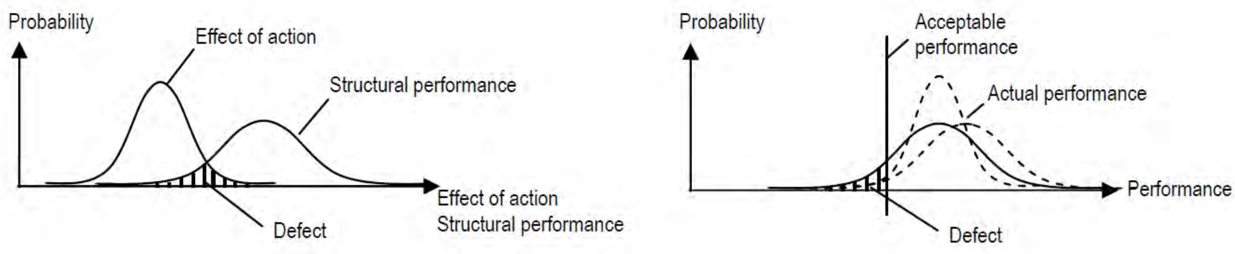

Figure 2. The probability of a defect is illustrated as the area below two curves showing probability distributions (left), one showing the effect of action (e.g. from an earthquake) and the other showing the performance of the realised structure (e.g. the strength of a wall). A defect materialises when a relatively weak structure is subject to a relatively large effect of action. The figure to the right shows the situation when an acceptable performance is just a matter of a simple measure (e.g. the minimum inclination of a drainage pipe). The probability of no defect may be improved by prescribing a better performance or by more emphasis on quality management leading to a smaller statistical variation in the outcome.

2.3 Heuristics in engineering

The probabilistic approach fits with the *engineering method* defined by Koen (2003) as *the use of heuristics* (common sense rules) *to cause the best change in a poorly understood situation within the available resources*. These kinds of experience based rules are also known as *engineering judgment* or *rules of thumb*. Any building project is so complex that nobody can oversee everything.

The engineer's word *best*, usually called the optimum, refers to the most desirable trade-off of the design variables in a multi-variant space in which each criterion has been given its relative importance.

The effort shall be seen together with the likelihood for a successful process in a way that the total costs for design, planning, construction and correcting defects are minimized.

While the costs for design, planning and construction may be estimated fairly accurate, the risk of defects and hence the costs related to defects are in many cases not known. Rigorous risk analyses are made when it concerns safety of structures and also for other risks, if the economical consequences of a defect are big. However, concerning buildings the economic consequences of defects are by far dominated by many small defects each of which only has a small economical consequence (Nielsen et al., 2004). Efforts for minimising the quality cost are based on legislation concerning quality assurance, requirements in project material and heuristics used by people involved in the building process.

2.4 Qualitative model for optimization of quality

Defects represent a loss in economy. It seems realistic to assume that *costs caused by defects* always will increase with the amount of defects. Associated with a certain amount of defects are certain costs to keep the number of defects at this level. These *costs to avoid defects* are assumed to decrease with an increase in the accepted amount of defects. Consequently, an *optimal amount of defects* may be stipulated, as illustrated by the qualitative model in Figure 3.

This model brings together the three perspectives from the theoretical framework: By trying to optimize cost vs. quality in any *decision point* and accepting the *probabilistic* nature of construction and the need for using *heuristics*, any participant in the building project contributes to the optimization of the amount of defects.

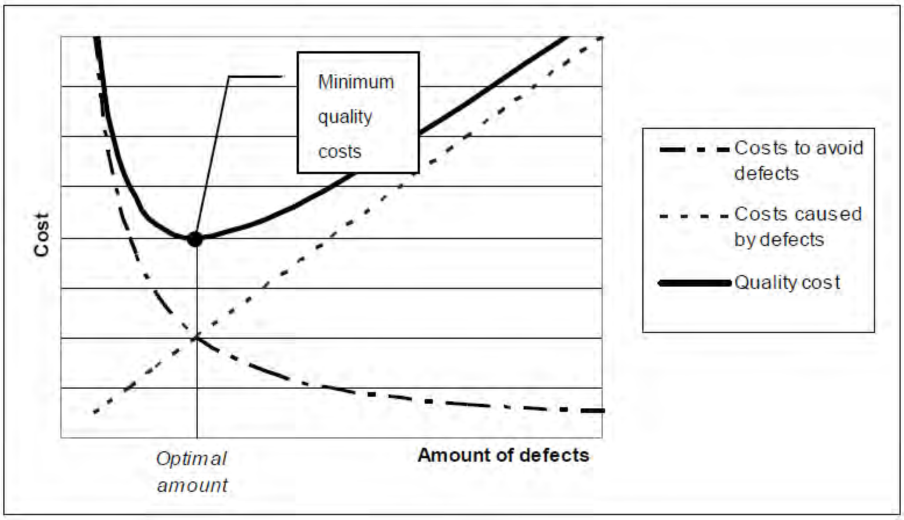

Figure 3. Optimal amount of defects (reference case). The optimum is dependent on the costs to avoid defects and the costs caused by defects.

Costs caused by defects are represented in Figure 3 by a straight line through the origin. Since different types of defects might have very different economic consequences, a linear relation is valid only for a specific type of defects (amount of defects can then be e.g. number of defects or m^2 with defects). However, in this qualitative model a straight line is chosen as a simplification to illustrate that the more defects the higher costs caused by defects.

Associated with a certain amount of defects are certain *costs to avoid defects*, i.e. to keep the amount of defects at this level. If there are only a few requirements regarding quality, these costs can be kept low. The lower the accepted amount of defects the higher the costs to keep the amount that low, but a building without defects cannot, in practice, be achieved even at a very high cost. Therefore, these costs are represented in Figure 3 by a power function.

The third curve in Figure 3, *Quality cost,* is simply the sum of the other two. The best choice of quality is here assumed to be the one leading to the minimum quality cost, which defines *the optimal amount of defects*.

The set of curves in Figure 3 are considered valid for a reference set of parameters concerning technology, organisation and market for building materials as well as conditions, requirements and people involved in the building project. Any change in these parameters results in a new set of curves and a another optimal amount of defects.

This approach assumes that the actions chosen to avoid defects are efficient.

Costs to avoid defects sum up the economical consequences of efforts during design and construction processes, for example

- contracts and descriptions of who is doing what to ensure that everything is done properly
- quality assurance activities, like preparation of project plans and quality plans as well as control and supervision activities
- calculations, descriptions and tests as basis and recipe for the execution
- use of prescribed solutions and explicit information structures like Best Practices or Building Information Models
- use of skilled designers and workmen
- construction management effort, e.g. regular meetings during construction to synchronize information and knowledge about the project as well as economical budgeting account and follow-up activities.

Costs caused by defects might for example be

- costs to repair defects and consequences hereof
- costs for doing the work in a less efficient way because of defects
- costs caused by delay in the construction process
- reduced service life of the building
- reduced functionality of the building or the building components.

3. Reduction of quality cost

In the following the model is applied to different situations aiming at reducing the quality cost.

3.1 Changes in specific projects

In a specific building project you may 'slide along the curves' as illustrated in Figure 4. If it is decided to reduce the amount of defects, the decision is associated to increased costs to avoid defects. What you do not know is whether the starting point for that decision is to the right or to the left of the optimal amount of defects. It may or may not result in a lower quality cost. Therefore such decisions shall not be made without some justification concerning the position of the optimal amount of defects in the actual case. A few observations, based on a mix of tradition in the industry and experience by the single individual decision maker, e.g. the project manager, may be used to develop some heuristics (Koen, 2003).

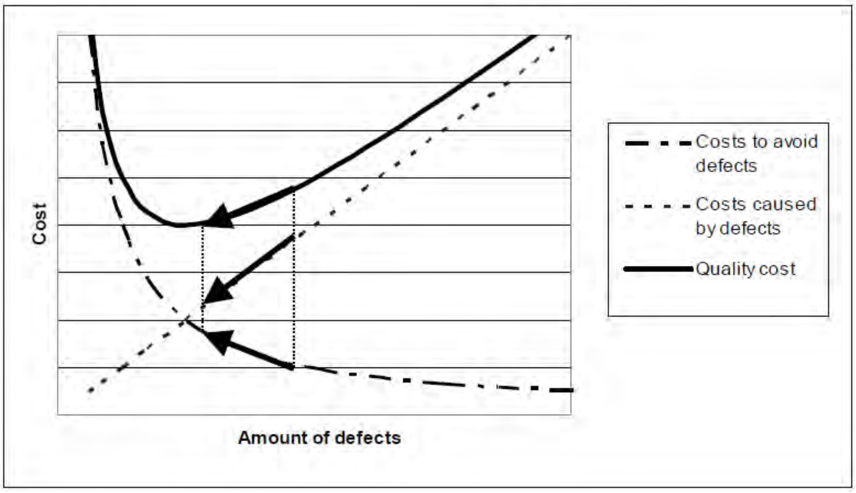

Figure 4. A decision to increase the quality assurance and the associated costs to avoid defects is followed by a decrease in costs caused by defects. It may or may not result in a lower quality cost.

3.2 Reduction of costs to avoid defects

Imagine a situation where innovation results in reduced costs to avoid defects compared to the reference case (Figure 3). Then both the quality cost and the optimal amount of defects decrease, as shown in Figure 5. Note that the consequence of deviating from the optimal amount is somewhat higher than in the reference case, expressed by a less flat *quality cost* curve, i.e. it is more important to reach at the exact optimum in this case.

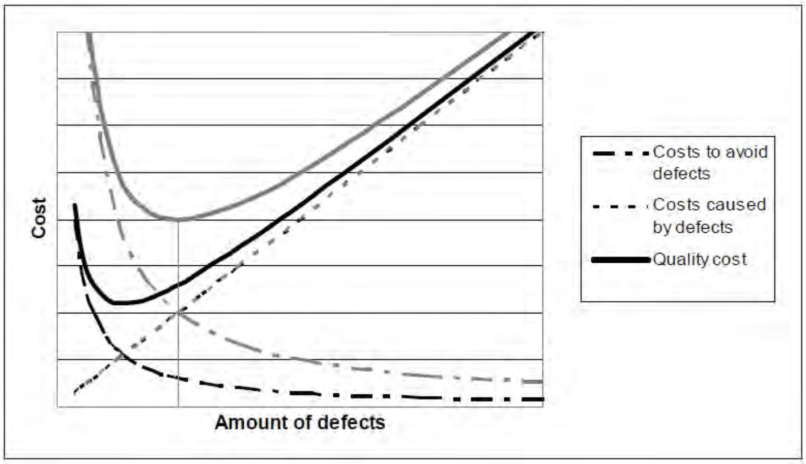

Figure 5. Optimal amount of defects when costs to avoid defects are decreased (black curves), reference case (grey curves).

Reduction of costs to avoid defects might be obtained by a variety of actions or combinations hereof, e.g.

- more efficient information and communication technology to foster collaboration in the project, e.g. internet, BIM-models and mobile communication tools
- more effcicient tools in the design and execution process, e.g. better tools for calculating performance of building components or automated handling of building materials
- widespread use of prescribed solutions; e.g. Best Practices
- introduction of new and more effectice tools for quality assurance, e.g. efficient control schemes or reporting systems
- use of more skilled designers or workmen

A reduction of costs to avoid defects by one or several of the above actions may be harvested as a direct saving on the project or converted to fewer defects by keeping up the costs and thereby seeking a minimum quality cost at a lower level.

Other things being equal, reduction of costs to avoid defects are preferable since it reduces both the amount of defects and the quality cost although it might be seen as an investment for the single building project.

3.3 Reduction of costs caused by defects

Another situation, where innovation in repair methods leads to reduced costs caused by defects, is illustrated in Figure 6. Also in this case the quality cost is reduced, but now the optimal amount of defects is higher than in the reference case, and the consequence of not being at the optimum is smaller.

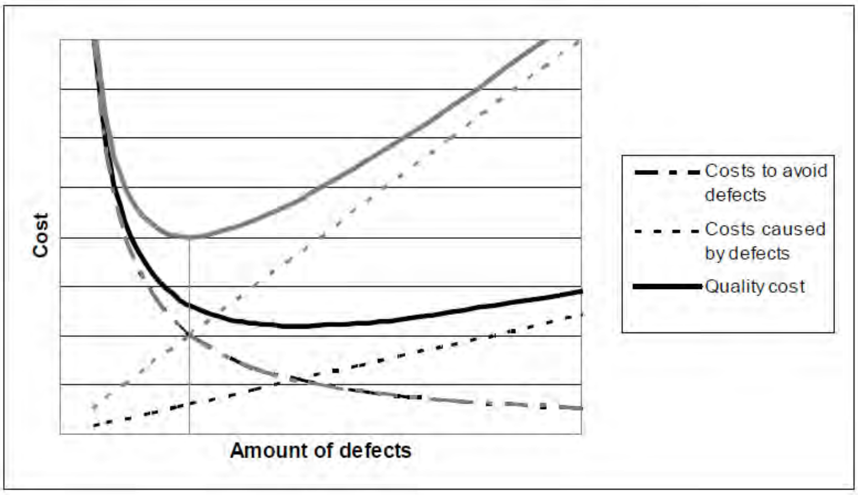

Figure 6. Optimal amount of defects when costs caused by defects are reduced (black curves), reference case (grey curves).

Reduction of costs caused by defects may be obtained by use of technical solutions that makes repair cheaper, reduces maintenance costs or makes it possible to keep up the functionalities of the building even in despite of defects. It is important to reduce costs caused by defects as much as possible since it reduces total quality costs. On the other hand it may lead to a higher optimal amount of defects and less sensitivity for variations. Consequently, you will get more robust building solutions.

4. Impacts of radical changes

The theoretic framework may be used as guidance for considerations concerning the optimal amount of defects for many different cases and situations in the building process. As an illustration two cases are selected and discussed in the following. One is *industrialised building* the other is a *one-off building* being two extremes with each their characteristics which calls for radical changes in the approach to minimisation of the quality cost. Both examples demonstrate that although the model gives a qualitative understanding of the relations between different changes in the building process and the associated cost for defects specific date is needed if heuristics shall be developed in practical cases.

4.1 Case: industrialised building

We now discuss a situation where the considered part of the building is produced as a prefabricated element at a factory. By moving the production into a controlled factory environment using digital tools for design and production and utilising repetition effects in a mass production the costs to avoid defects are reduced. As seen in Figure 4 this leads to a decrease in the amount of defects and a decrease in the quality cost.

However, the consequence of a defect may also change. While the costs caused by defects in some mass produced items as kitchen elements may not be serious some complex prefabricated units may cause a big loss in economy, if a serious defect is not detected until the element arrives at the construction site and the whole building process has to be stopped. In that case the costs caused by defects may raise so much that although the optimum is still at a lower amount of defects, but the quality cost may increase, see Figure 7.

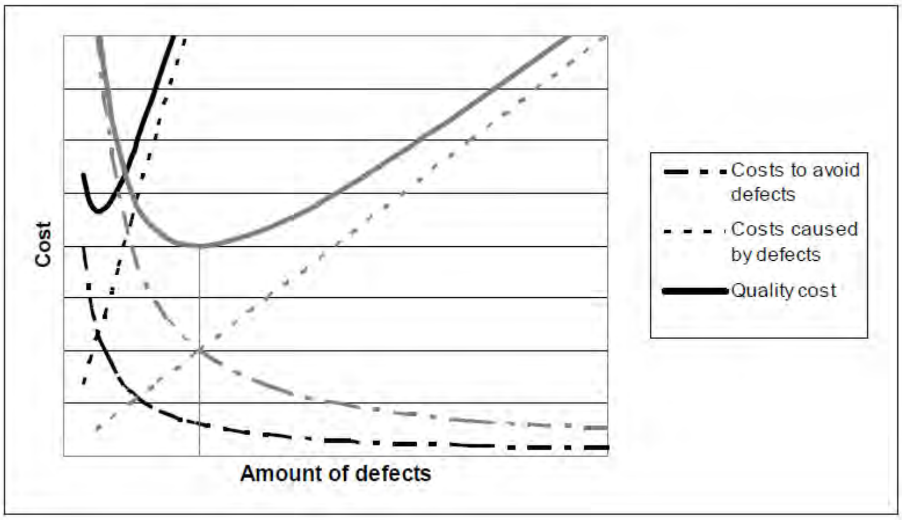

Figure 7. Industrialised building project characterized by low costs to avoid defects and high costs caused by defects (black curves), compared with the reference case (grey curves).

The example indicates that the optimal amount of defects is smaller in industrialised buildings, but it does not say whether the quality cost decrease. That depends on the type of defects associated with the new building process. It shall also be noted that the product itself may become so much cheaper to produce that a higher quality cost may be acceptable.

4.2 Case: complex one-off buildings

In the case of a complicated one-off building one strategy might be to increase the effort to avoid defects because it is difficult to use experience from other building projects. Furthermore it might be decided to reduce the costs caused by defects by choosing other technologies or solutions where the probability for high costs caused by defects is low, see Figure 8.

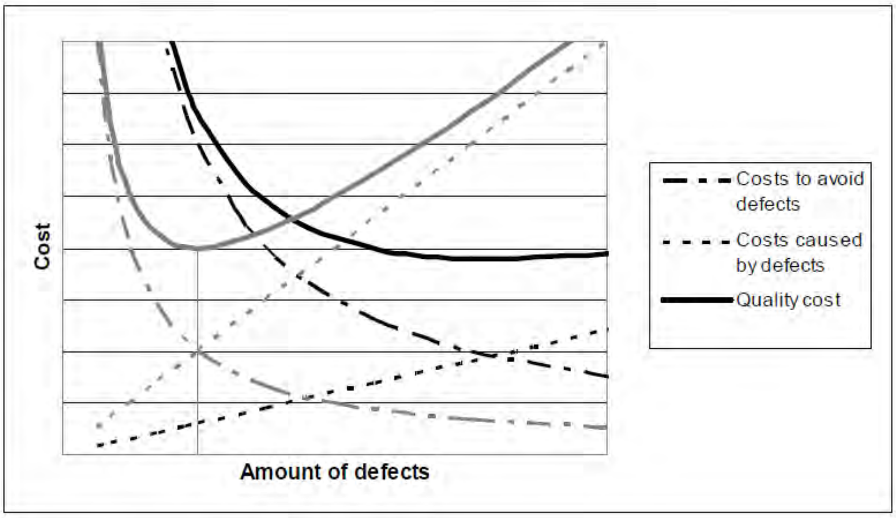

Figure 8. Complex one-off buildings characterized by high costs to avoid defects and low costs caused by defects (black curves), compared with the reference case (grey curves).

As seen in Figure 8 this might lead to a situation where the optimum is found at a higher amount of defects while the quality cost may not have changed much. However, other factors than the optimization of costs may play a role as well.

4.3 Discussion

The presented cases show that if we want to achieve the lowest possible economical consequences of the fact that real world projects are not perfect and may lead to defects, we should not strive for a zero-defect culture in the building sector. In stead we should establish a more balanced view on costs and defects taking into account that avoiding defects has a price.

On the other hand defects may cause totally unacceptable effects; e.g. industrial accidents, death or, as more often is the case, unsatisfied end-users or building owners. Such considerations may lead to a preferable amount of defects which is lower than the optimal amount.

As shown by the cases it is not simple to answer the question: Is a loss of 10 percent of the annual turnover in the Danish building sector because of defects high or low? As previously stated the optimal amount of defects is dependent on the type of building project.

This calls for a number of different types of heuristics as also stated in (Nielsen et al., 2009). To form a basis for those heuristics we need case studies where a number of building projects are studied. Some of these should be comparable in relation to e.g. the building technology used, but where e.g. the effort to reduce defects was handled differently, resulting in different amounts of defects and different costs related to defects.

The model may be used as well for global optimization as for sub-optimizations of larger or smaller parts of a building process. However, heuristics developed for the two kinds of optimization may conflict, which is a fundamental challenge in the building sector.

5. Conclusions

The main findings in this study are:

- Quality assurance shall not be seen as a question of minimising the *amount* of defects but as a question of minimising the *quality cost*, consisting of costs to avoid defects and costs caused by defects.
- Authorities, companies and individuals can benefit from this understanding in forming rational rules and heuristics in relation to quality management
- Data from practice are needed for the presented qualitative model to be used as guidance concerning the development of heuristics aiming at improving quality.

Acknowledgements

This paper is developed in continuation of a collaborative project (2006-09) *Defects in construction – strategies, actions and learning* conducted by researchers from the Danish Building Research Institute/Aalborg University, the Technical University of Denmark and Copenhagen Business School. The project has received financial support from the Danish Enterprise and Construction Authority.

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The Development of Techniques to Support the Control Activities during the Carrying Out Of a Building Work: Instruments to Minimize the Financial Risk

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Abstract

Promoting a building work involves several actors that share a latent financial risk linked to the value of the work which is connected to the characteristics of the work itself and its requirements – in terms of equipments, structures, and trimmings. Some new legislative national regulations introduce the obligation to control the building works that are being built if there are some subcontractors involved in the process, and if they can undergo the effects of a failing quality of the building object.

A performing approach of the planning stage extended to the building sector is more and more spreading on the international level: based on a fixed set of rules they apply to the product certification through inspecting third-party bodies and they show, as a virtuous model for the guarantee of the technical and technological quality, the control activities carried out by bodies performing inspection following the standard EN 45000 e EN ISO/IEC 17020. The definition of such control activities need some instruments both to provoke a growth of the sector in terms of builded quality and to stimulate the dialogue among the actors involved in the building process. The technical control in building represents an instrument of guarantee with a third-party characteristic for the different actors and reinforces its action through the monitoring system in the building site plus the control of correspondence between the builded object and the project. The control activity requires a database to be always updated and implemented: in the daily practice they use, in the most advanced cases, check lists to verify what has been built also attaching some photos to the non-compliance evaluations.

This article is presenting some proposals in order to make builders directly responsible and involved in the executive planning thus minimizing not only financial risks coming from technical aspects in the building process but also the need to make a technical control in the building site. We are reporting some real experiences and analysis to define a common platform which will be able to encourage the dialogue among the actors of the process who are involved in the technical control of

the building. In particular we are analysing some planning techniques to highlight the critical aspects of the project and support the technical control.

Keywords: control activities in building, financial risk, bodies which perform inspections, building process

1. Organizational models of the building process and appeal to the technical control bodies which perform inspections

The Italian building sector largely involves buildings aimed at civil residences. National statistics bodies (ISTAT) state that the percentage of home owners where they live is around 80%. The inclination to own the house where to live has always been increasing and a large part of the population who buys a house applies to banks to be granted a loan in order to pay this real estate (ISTAT , 2007). The position of the building contractor has been more and more developing. He is the one who presents on the market buildings to live in not just as built object but mainly like a planning proposal to be carried out: the transaction occurs on the base of a project and the quality of the building is entrusted to the dialogue and to the subsequent agreement between the buyer and the promoter. The agreement concerns:

- the exigencies of the buyer and the requisites the whole building-structure is supposed to have;
- the ways the other actors in the building process are going to be involved: builders and planners;
- the quality of the work, its time requirements and costs of implementation.

The quality of the agreement between the parties is directly proportional to the technical-building analysis represented by the project and the time planning of the works . The financial risk of the feeble actors / clients and consumers involved in the building process depends both by the quality of the buiding object (therefore the value that the goods will reach) and by the definition of the building timing in order to really and fully enjoy the completed work. In this sense the correspondence between the built object with the planning becomes a leading exigency shown by the feeble actors involved in the building process particularly in a context in which the banks (strong actors involved in building process) demand some guarantees on the quality of the buildings when they grant loans to buy the properties. The banks influence the perspective owners of the building up to the redemption of the loan needed to buy it also through mortgages. Therefore the direct consequences are:

- the request of guarantees, from the feeble actors towards the promoters, about the standards to be reached while building the property
- the need to protect themselves, from the strong actors, through a technical third-party control on the execution of the building object;
- the certainty of an impartial control on the building, carried out by bodies performing inspections, permits the builder to avoid misunderstandings and solve technical mistakes during the production.

The requests of guarantees for all the different actors involved in the building process have been increasing mainly thanks to a model of development of the project based on the new service approach (European Commission, 1999); such guarantees set up a system of crossed controls by some actors towards others in a scenery where the bodies performing inspections partly cover the role of judges of the same process. The appeal to bodies performing inspections by the banks or insurance agencies really protects these last ones, through a correspondence evaluation on the completed work when they offer the promoters or builders an economic help for the carrying out of the building. In that case the control focuses on the quality of the work to be executed and its successive correspondence with the prescriptive rules and the project, especially for the complicated parts. In the same time the building enterprises or real estate promoters (in case they are two different parties) involved in the process address themselves to bodies performing inspections with the particular aim of using third-party opinions which can certify the quality of their buildings.

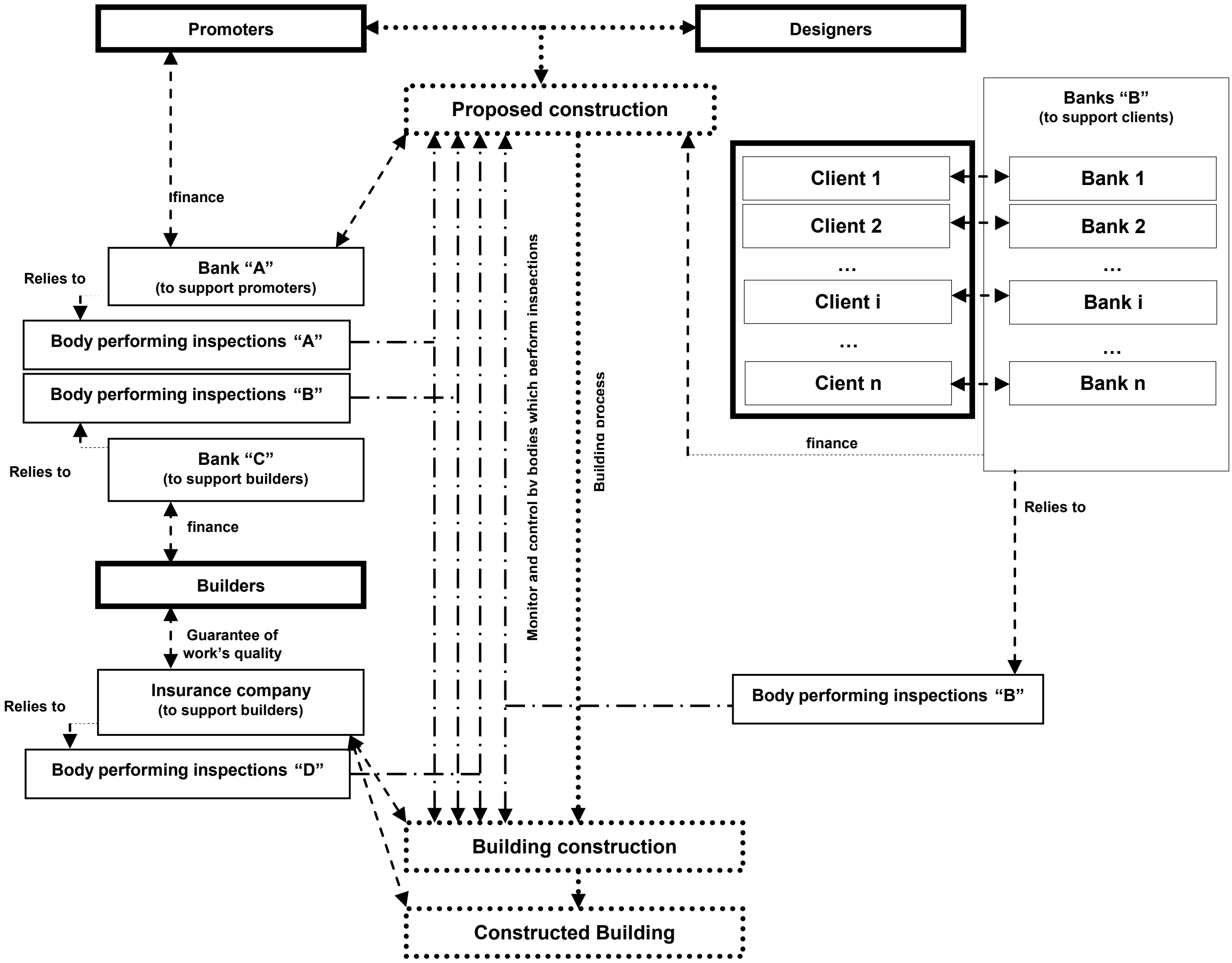

Figure 1: Role of financial institutions and bodies performing inspections in the building process

In case of a promoter who coincides with the builder, they try to tranfer the risk of a technical failure towards figures who are not owners of the buildings, mainly making use of an insurance coverage. The intervention of bodies performing inspections is quite common especially in similar cases in order to offer guarantees to the insurance companies covering the risks of the builders.

2. The international set of rules: Basel Accords, the "New Approach" and standards of bodies performing inspections

On the international level in the past few years several rules rising from different sectors or approaches have been issued and elaborated by heterogeneous bodies: a quick analysis reveals that the prescribed purposes, essentially disconnected, form a preliminary prescriptive corpus to face the problem of a technical control of the builded object in the building sector. In particular:

- the Basel Accords make up the guidelines for the patrimonial requisites of the banks soon after their adoption some models have been developed which are able to define a system for the evaluation both of the riskness of small or medium companies (or real estate promoters) with the aim of granting credit, and of the building processes at the base of the contract. They are the starting point for the credit granted by the banks (De Grassi, Naticchia,… 2008);
- the progressive fulfilment of the unitarian provisions in Europe and the standardization of the products (to make their marketing free) has introduced a new service approach in the planning, not linked to detailed rules which are able to regulate every requisite of detail; the new approach for the standardization is organized with a very in-depth level of general set of rules and introduces the free appeal by the planners to shared and validated models for the development of a product (European Commission, 1999);
- among the requisites expressed by the international standards EN 45004 e EN ISO/IEC 17020 which define the characteristics of the bodies performing inspections and of the certification of products and services, we can see the provisions related to the impartiality of the same bodies with the aim of assuring the guarantees of correspondence of the products.

If the legislative approval of the Basilea Accords helps to understand the exigencies of the banks to protect themselves from effective risks of financial exposition, also appealing with some difficulty to the support of technical controls carried out by bodies performing inspections, not less application difficulties are reserved to the new service approach in the building planning by the actors involved in the building sector. The new service approach, though, has shown an impressive development in the field of the industrial production especially for the application advantages linked to the chain production but the introduction of the directive 89/106 of the European Council on the building products has given a hard impulse in this respect also to the production in the building field. Nowadays the national provisions belonging to the building sector heavily introduce a new service approach for the structures for the fire safety engineering and for the thermal performance of buildings. The application difficulties of these rules are to be searched in the common practice in the building sector where the innovations generate a strong applicative inertia caused by the poor attitude to innovation and low education of the operators (E. Van Egmond E., Oostra M., 2008).

The technical characteristics of the building objects planned starting from a precise definition of the exigencies really find, in the planned complexity of the combination of the building elements, an effective answer in terms of quality for the buildings. The strong actor of the model introduced by the new service approach is the final consumer who, in the market of the building objects, discriminates on the basis of the best qualitative characteristics and on costs/convenience ratio; the novelty is relevant especially for the market of the residences which is involved particularly for the thermal performance of buildings and the lower energetic consumption of the building-equipment system. The energetic quality certification is more and more assuming the character of “added value” of the residence especially in relation to the costs of energetic resources and also for the international environmental education campaigns. At the moment the rate of attention of the clients is very high, somehow even higher than the quality of the internal trimmings of the same buildings. The goodness of the completed building though is not very easily understood by the client because it also involves complex technical aspects: it is necessary to get guarantees and/or certifications and it is not sufficient for the builder or the promoter to produce the same certifications because they are directly involved in the production process and beneficiaries of the economic earnings following the sale of the buildings. The involvement of the bodies performing inspections guarantees the division of responsibilities of the inspection personnel from the people busy with other functions: in this sense the standard EN ISO/IEC 17020 represents a reference for the bodies performing inspection who carry out correspondence evaluations with regulations, rules or technical specifications.

3. The instruments for the inspection of the project and for the technical control of the building used by inspecting bodies

Considering the project as the first guarantee of quality of the building work and counting on the checking techniques of the project, it is possible to coordinate a preventive checking action extended to the formal aspects (equipments and structures) on the attached printout in order to correct possible easily traceable mistakes. The control of the project is a procedure commonly used in case of public building activities (very clearly detailed in the set of rules on public works issued by European directives) whose control is compulsory; the economical sensibility of private building initiatives has caused the development of checking methods which are punctual and precise also applied to such actions. The recording of the exigencies (and the need to exploit the implicit expectations) of the final clients of the buildings is the first step of an approach to the control of the project. The second step refers to the assessment of the planning solutions, their efficacy, the correspondence to prescriptive criteria, feasibility and optimization.

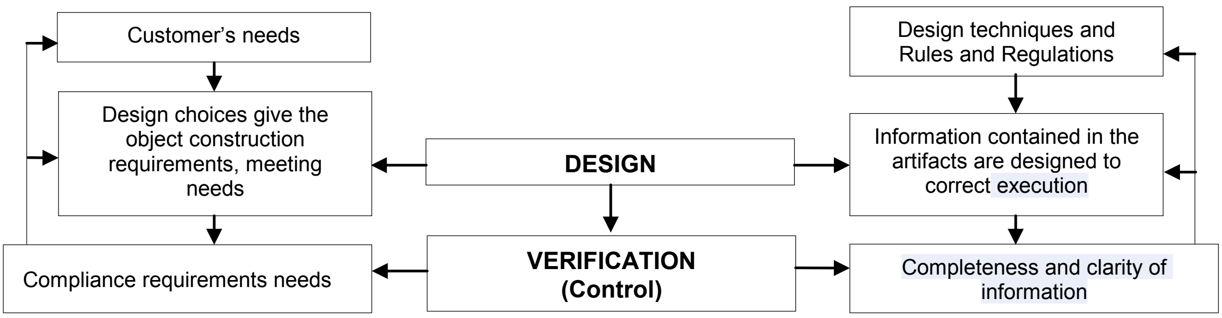

Figure 2: Step and role of the assessment of the project

The most relevant aspects in the assessment of the project refer to the rate of maintenance and flexibility of the planning solutions, environmental pollution, the safety of the building and the workers during the construction. Considering it is an intervention with economical implications each planning choice is measured with a comparison with other possibilities evaluating costs, time, and resources to be used. Experiences in the public sector highlight the use of check lists within algorithms for the assessment of the project but we know they are not too much advanced instruments because the standards are defined as minimum requisites of a legally binding nature and therefore not tailored on a fluid context such as the private building initiative. Public enterprises facing risks of economical and financial nature clearly appear less exposed compared to the private sector but the evaluation of the project carried out by third-party bodies is more and more expanding to private initiatives. The reasons are mainly linked to the guarantees requested by the banks for a financial support following the model of risk sharing. The evaluation of the project, though, represents a pre-building phase of control whereas the checking activity of the building spreads over the period of the execution and the end-of-work tests thus characterizing itself :

- for the continuity of the action;
- for the punctual control of correspondence with the planned work;
- for the presence of an informative report which involves all the stakeholders who can attend the process development and address and correct its progress;
- for the support to the planning to be effected for the changes in progress when the prospective solution appears somehow lacking compared to further solutions proposed by the builder;
- in order to manage secondary works entrusted exclusively to the goodness of the action of the enterprises when we have parts which cannot be planned in detail.

CHECK LIST – STRUTTURE IN ELEVAZIONE

Cod.: SC-PT/P1-cls

Scala: tratto PT/P1
(Tavola di Riferimento: ___)

Località:
Stazione Appaltante:
Opera:
Appaltatore:
Responsabile del cantiere:
Direttore dei Lavori:
Responsabile Sicurezza E.:

Voce di capitolato

Calcestruzzo a prestazione garantita (UNI EN 206-1) per strutture in elevazione (esposizione XC2 della UNI 11104). Rck 30 N/mm2, classe di consistenza S4/S5

Ingredienti utilizzati per il confezionamento del calcestruzzo

	Ingrediente	Requisito	Esito Prova	Verifica del
1	*Acqua di impasto*	Conforme alla norma UNI-EN 1008		
2	*Additivo superfluidificante*	Conforme ai prospetti 3.1 e 3.2 UNI-EN 934-2		
3	*Additivo superfluidificante ritardante*	Conforme ai prospetti 11.1 e 11.2 UNI-EN 934-2		
4	*Additivo ritardante*	Conforme al prospetto 2 della UNI-EN 934-2		
5	*Aggregati provvisti di marcatura CE*	Conformi alle norme UNI-EN 12620 e 8520-2		
6	*Cemento*	Conforme alla norma UNI-EN 197-1		
7	*Ceneri volanti*	Conformi alla norma UNI-EN 450		
8	*Fumi di silice*	Conformi alla norma UNI-EN 13263 parte 1 e 2		
9	*Filler calcarei*	Conformi alla norma UNI EN 12620		

Prescrizioni per il calcestruzzo

	Caratteristica	Requisito	Esito Prova	Verifica del
1	Calcestruzzo a prestazione garantita	Conforme alla norma UNI EN 206-1		
2	Classi di esposizione ambientale	XC2		
3	Rapporto acqua/cemento	Max: 0.60		
4	Classe di resistenza a compressione	Minima: C(25/30)		
5	Controllo di accettazione	Tipo A (volume complessivo non sup. a 1500 m3)		
6	Controllo di accettazione	Tipo B (volume complessivo sup. a 1500 m3)		
7	Dosaggio minimo di cemento	300 Kg/m3		
8	Aria intrappolata	Max. 2.5%		
9	Diametro massimo dell'aggregato (interferri sup. 35 mm)	32 mm		
10	Diametro massimo dell'aggregato (interferri inf. 35 mm)	20 mm		
11	Classe di contenuto di cloruri del calcestruzzo	Cl 0.4		
12	Classe di consistenza al getto	S4/S5 oppure slump di riferimento 23 ±3cm		
13	Volume di acqua di bleeding	< 0.1% (UNI 7122)		

Prescrizioni per la struttura

	Caratteristica	Requisito	Esito Prova	Verifica del
1	Copriferro minimo entro casserature	30 mm		
2	Copriferro minimo per getti contro terra su terreno preparato	40 mm		
3	Copriferro minimo per getti contro terra su terreno non preparato	70 mm		
4	Controllo dell'esecuzione dell'opera	Rck min in opera ≥25.5 N/mm2 (carote h/d=1)		
5	Durata minima della maturazione (umida: geotessile bagnato ogni 24h)	7 giorni		

Figure 3: Example of Check List used by bodies performing inspections

The contents of the technical control of the building closely follow, in the contents, what has been defined in terms of control of the project but they assume a style of voluntariness of the action which is finalized to identify some diversities and possible remedies.

4. Making the builder responsible during the planning

The planning activity is made of different refining moments and the building object is progressively defined in detail: the general rule consists in the passage from an intense phase in the relationship between purchasers and planners (definition of the preliminary project and of the architectural printouts which define shape and materials of the building), to a more technical phase (executive planning) where the action of the planner is referred to the structural, equipment and technological detail. Such an approach can be deduced by the historical organization of the factory since ancient times but it still represents a very strong model which conceives the building like an unrifined part and a finished part; in this sense the planning dichotomy has also developed. The role of the Director of works, in the construction phase, is to be the guarantee/counsel of the adopted project trying to spare the builder all the misunderstandings shown on the graphic printouts; the same technician in the building site assumes the role of the buyer's defence towards the builder, especially in terms of quality of the accomplished works and subsequently of the real costs. One of the most critical points consists in the planning extended to the whole phase of construction because new explanatory notes are given to support the builder. When the technician director of works has not been part of the planning of the works, it is easy to record a partial twisting of the original project (also in terms of costs and time): in the same way and with similar results this happens if the builder is not involved in the planning.

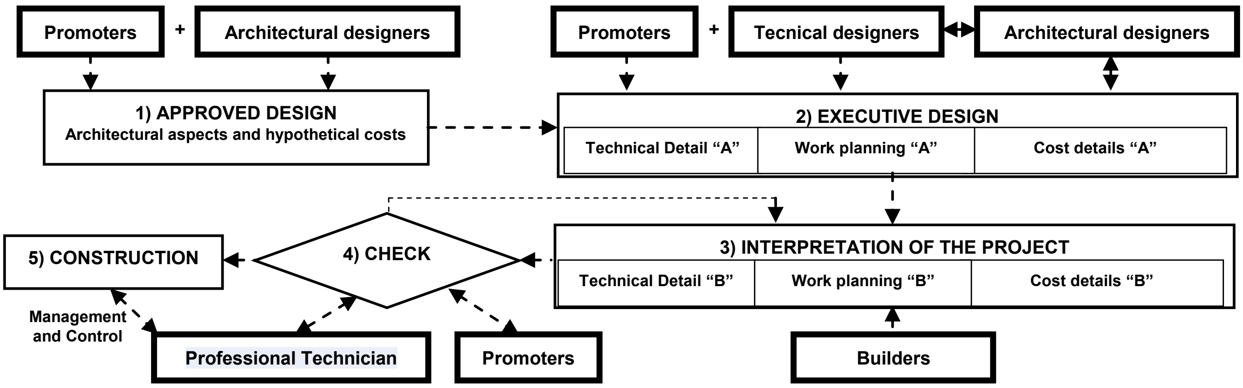

Figure 4: The process for the present procedure

The model, anyway, needs a definition phase (planning) and a control phase (in progress) especially because the activities of the enterprises pursue not only the qualitative objectives of the building but also the budget objectives and these last ones are, for sure, very different from the budget objectives of the buyers. Considering that the real estate market is based on the relationship between quality/cost but keeping in mind that it is very difficult to define the quality of a complex object like a building, it comes out that the quality thought by the proposing enterprise is something different from the one imagined by the buyer, even beside the specifications of details attached to contracts and/or in the project printouts. In this sense the actual model includes some guarantees which consist in the assessment of the project, in the action of the technician and the technical control of the building. Nevertheless the involvement of the bodies performing inspections appears like a further complication of the building process somehow derived from a cultural philosophy quite far from the construction sector. The real estate promoter, when this coincides with the builder, benefits from an organizational structure which reveals a strong management and scheduling activities and, consequently, the employment of resources: so the feeble actors have to secure guarantees for themselves. The case of the real estate promote who is different from the builder appears in this sense insufficient just because the promoter of the initiative (private) would concentrate on himself higher risks of non-quality and should make use of a too expensive control system. These are charges which should be split among buyers. Now it has been observed that the real estate promoters change their nature evolving their activity and acting directly on the construction with a sub-organization for the construction; in other cases temporary purpose Companies are formed between promoters and builders.

A strong novelty which is going to spread around the Italian (public) context is the direct involvement (so the responsibleness) of the construction enterprises in the phase of the executive planning. Besides the models of general contractor and project financing introduced in the national set of rules from the european regulations, it can be noticed, from the part of the public assignors, a growing proposition of models which propose the association between a technician and a builder: beside the achievement of the works it is requested the capacity to work out a detailed (executive) project and then present an economical proposal (time, costs and quality) for the carrying out of the work. If at first this approach has been adopted because it permits to cut time between planning and carrying out of the work , pushing the enterprises (made of planners and builders) to compete in terms of integrated proposal, at present we evaluate the advantages of the builder’s commitment when he declares, within the offer, the quality of the finished work, avoiding possible interpretative misunderstandings of the project which has been worked out by a planner outside the organization of the enterprises. An approach which is somehow similar is the one which proposes a tender economically more advantageous for the aspects linked to the assessment of different implications but coming from a declared availability of the builder.

The models we listed offer a starting point for a study and a definition of the model of an executive project carried out with the responsibility and involvement of the builder: this article summarizes some partial results of the accomplished researches:

- the activity of the enterprise is based on specific operators, means and assets, in other words a real organization which is different from other builders: prices, time and quality for a certain work is determined on these own parameters;
- the economical activity of the enterprise has to base itself on the “creation of value” , in other words, on the capacity to have a budget surplus: it is necessary to define in detail the prices the enterprise proposes for a certain work or for a certain product;
- temporal planning and economic quantification (cronoprograms, computational parts) are defined on the specificity of the organization; therefore they constitute the first step of a planning debug of what the builder has elaborated. The removal of the mistakes offers the opportunity, in the last phase, to find the internal correspondence in the graphic printouts;

- It is now clearly stated which are the moments when the presence of an external technician in the building site is fundamental. His presence should be temporarily punctual and non continuous.

The project worked out with the involvement of the builder is possible only through the new planning approach because the characteristics of the work planned by the enterprise take to an advanced service synthesis: the detailed set of rules offers extended guarantees on the planned quality but it cannot contain aspects of minimization of the costs for a defined quality. In fact this implies the reference to supplies, to the external organization and then to the subcontract and outsourcing which characterizes the enterprise

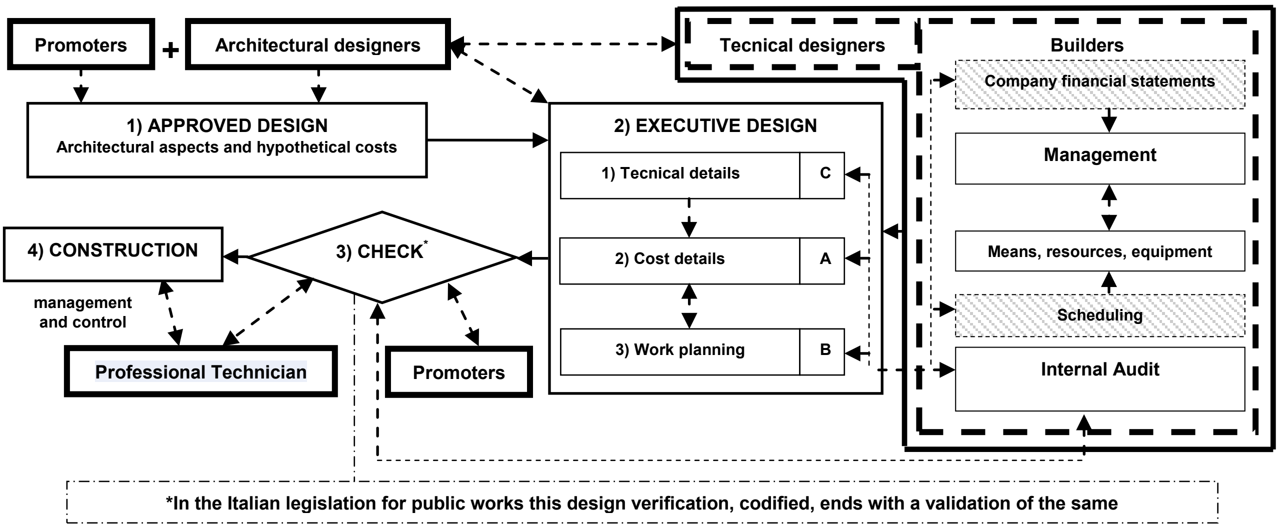

Figure 5: The process with the involvement of the builder in the planning

5. Assessment of the executive project with the involvement of the builder

If the builder is involved in the elaboration of the executive project it does not mean the exclusion of the promoter and the director of works from the management of the process. The role of the former is just like an actor who starts and supports the process mainly with his own financial exposure while the role of the latter still continues to be the controller of the same process and the person in charge in his position of technician responsible for the for the work in progress and its characteristics. The evaluation of the project before being completed and the technical control during the construction still leave their value unaltered but they need to be re-defined especially in their contents. The present procedure intends to interpret the evaluation of the project (for each phase of the planning) as being effected soon after the end of the printout and not considering the cooperation between the planner and the inspector just to guarantee the neutrality of the evaluation by the latter. Models in use even if not too common, for the evaluation of the project, take some experiences from the fast-track design. Considering an evaluation in progress in which this phase starts even before the entire conclusion of the planning, it is possible to point out some general trends of the project evaluation especially squeezing the time for the same phase, just being able to give an opinion on the project in a complete way in a short time after the conclusion of the planning.

Previuos experiences have shown that if we follow the planning course in order to proceed with the evaluation, this could lead to make the same mistakes both by the planner and by the inspector. An approach by phase permits to divide the evaluation in distinct steps without leaving the logic design for which we thought of its own course; in particular this first phase of the evaluation consists in:

- evaluation of the design process and choices chosen by the designer;
- evaluation of the graphic design, computational and operativa conventions of the designer.

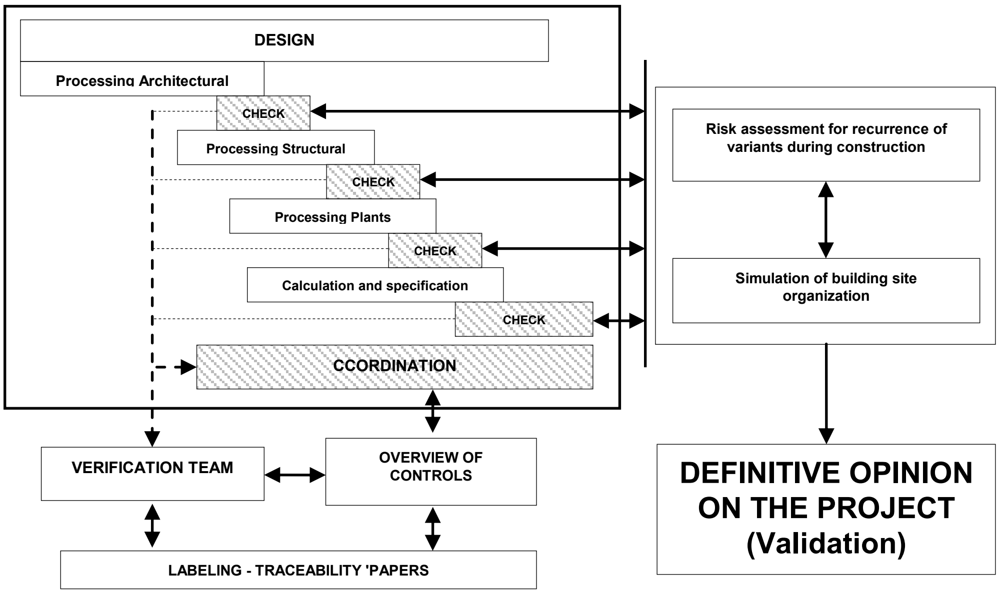

Figure 6: Plan of the evaluation in progress of the project

The importance of a project evaluation carried out by the audit inside the building company permits to make the evaluations effected to check the project clear, making the repetition and repeatability of the whole process: therefore this can be assessable (and certifiable) by an external body. Just like we defined a performance-based approach for the project, it is possible (even if not yet defined in standard rules) to consider a performance-based approach for the evaluation of the same project. The model, which is going to be defined, is based on a dialogue which considers all the involved actors co-respnsible (inspectors, builders and planners linked to builders): we start from a well defined structuring where the different characters preserve their independence and then we define the steps of the teamwork:

- the preliminary comparison is based on the project model adopted by the designer for a performance-based approach and the proposed methods, their divulgation and acceptance in the scientific and professional community are evaluated.
- the second phase of the teamwork, to be effected soon after the final assessment of the project made by the unique external inspector, consists of a comparison on the interpretation of doubtful points of the analysed project. This exchange in particular allows to use the prior work of assessment of the project effected by the internal audit;

- a third phase consists, after the formulation, of a definitive opinion on the project, in the definition of a calendar of specific and circumscribed controls for the assessment of the building: these controls derive from the planning of the works and from the choices effected with the project.

6. Conclusion: economic implications

The study of the development of the executive project by the enterprise moves the priorities from a purely technical level and highlights the primary importance that the financial and budgetary aspects have, especially in the practical management of the building company. It is important to underline that the priority of the budget is extremely valid particularly for the buyer (both public and real estate promoters) but the difference consists in the diversity of value which is attributed to the product which is the same, that is the building object: whereas the building work for the buyer has its value having in mind its use (or sale), for the builder it has got some value in consideration of the building, works, economic systems integrated in a complex system which involves different firms, sub-products … The technical implications due to the proposed model need to detail the instruments and to consider the role (maybe completely new) of the technician associated to the enterprise but the model planning-construction-management-control appears solid especially for the real and strong characters who hold a role of guarantee. The considerations on the economical implications, to be further developed, surely lead to some preliminary conclusions:

- The building contractors which are able to be responsible and participate to the working out of an executive project have an internal structure where an audit board is present, a managerial responsibility and non-improvised practice: this structure offers some guarantees in a scenery following the Basel Accords;
- The performance-based approach minimizes the costs for the construction in a way which is directly proportional to the project engineering;
- The technical control of the building becomes a virtuous “performance-based” activity and not only a guarantee for the strong actors of the project.

Zuo and Zillante (2006) strongly stress the fact that the transfer of the risks takes to a win-lose model which sets against a scenery where the dialogue between the actors and their mutual information let the process develop towards a win-win model of sharing risks. The model which is showing up in a synthetic and non-definitive way, stresses the importance of defining new advanced instruments for the technical control in order to overcome the present procedures of assurance models. A possible hypothesis proposed in this study is based on the evolution of the relationship among the different actors of the building process: their empowerment project in defining the object to be built coincides with a partnership model where each one og them has got an interest for the building object as a product besides being an economic investment (which, for its nature, exposes itself to important financial risks).

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Costs and Technological Evolution in Housing Construction in Brazil

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Abstract

This study presents the initial results of a research that aims at putting forth cost references for the construction of residential buildings so as to provide a better understanding of the current status of such figures, especially in the wake of the changes brought about by the latest technological developments in civil construction in the country.

This survey gathered data on approximately 100 construction cost estimates, prepared between 1997 and 2009. Altogether, the group encompassed residential, commercial, industrial, and institutional (hospitals and schools) buildings. Out of these, residential buildings, which make up the largest set and will contribute the most to the objectives of this study, were initially selected. The results of 13 construction cost estimates for such structures are displayed below.

The theoretical references on which this study is based, the methodology utilized, and the analyses of the results and conclusions are presented below in this paper.

Keywords: housing costs, housing technology, housing construction

1. Introduction

In Brazil references for construction costs called CUB's (Basic Unit Costs) have traditionally been used.

The CUB's are expressed in unit cost per square meter of the built-up area (R$/m2). When multiplied by the built-up area of the project, they result in their total estimated cost.

The use of CUB's, or another estimation technique, makes it possible to obtain an estimated cost figure in a simple, fast, and cheap way. They can be used when there are not enough data to estimate (conception and planning phases), when there is no time (need for fast decision making) or when the resources do not suffice, since regular estimates are more time consuming and costly.

The CUB's are also frequently used to estimate construction projects, as the prices of these services are calculated according to a percentage of the estimated cost of the construction work.

The estimate per square meter is the technique most frequently used in Brazil for assessing costs, however the indiscriminate use of CUB's can result in large errors in cost estimations.

This derives from the fact that CUB's are calculated on the basis of building typologies that do not correspond to those really in use in the housing market. Among these differences, the most conspicuous are: numbers of floors and height (far greater in existing buildings than in CBU's), shape and area of the designs, existence of undergrounds (non-existent in CUB's), in addition to the differences in finishes and facilities.

The construction technologies on which CUB's are based are conventional ones that do not account for the some considerable technological evolutions that have been taking place in this sector especially since the beginning of the 90s. Therefore, the influences of these evolutions on costs have not been incorporated into CUB's.

The CUB’s most used in São Paulo are calculated and published by SINDUSCON-SP (Union of building companies of the State of São Paulo), which follows the methodology issued by Norma Brasileira NBR-12721 and the SINAPI, calculated and published by Caixa Econômica Federal, according to its own methodology.

The price researches of the inputs that make up CUB's, although done with methodological rigor, by institutions of recognized competence, do not take into account aspects that can generate a great difference between the prices researched and those actually charged. In the case of materials, for example, amounts and payment terms, partnerships between suppliers and construction contractors, among others, can be pointed out as some variation factors.

In addition, CUB's do not account either for indirect production costs (construction site, vertical and horizontal transport, construction management, among others) or for design and technical services costs.

Given these considerations, CUB's are not recommended as reference costs, but they can still be useful more often as indices in contracts or when complying with registration and incorporation formalities.

This work aims at contributing to the generation of new cost references, which can effectively be utilized as such. In order to do so, estimates for the construction of buildings with architectural and constructive typologies were used as a basis; in addition to prices indeed charged by those developers and construction companies regarded as the market leaders in the field of real estate and construction in the City of São Paulo, the main urban center of the country. Such leadership takes place not only because these leaders offer products that are considered to be of higher quality, but also because they use technological innovations that are likely to be disseminated to the market . These estimates also take into account all construction costs.

This survey gathered data on approximately 100 construction cost estimates, prepared between 1997 and 2009. Altogether, the group encompassed residential, commercial, industrial, and institutional (hospitals and schools) buildings. Out of these, residential buildings, which make up the largest set and will contribute the most to the objectives of this study, were initially selected. The results of 13 construction cost estimates for such structures are displayed here.

The theoretical references on which this study is based, the methodology utilized, and the analyses of the results and conclusions are presented below in this paper.

2. Factors affecting the construction costs of building

There is vast international literature on this subject. In Brazil this subject can still be considered hardly studied, although there has been an increased interest and research in this area in recent years.

The literature review has covered both the international and the national production, focusing on two types of factors that affect costs: the ones related to typology and the ones related to technology. A summary of the ones we consider the most important is presented below.

2.1 Factors related to the typology

2.1.1 Minimum perimeter and compactness

This refers to the fact that geometric figures with the same area may have different shapes and perimeters. In the case of housing projects, the perimeter multiplied by the ceiling height defines the area of vertical partitions. Therefore, for the same built-up area, the geometry that defines the smallest perimeter/area ratio will be the most economical.

Related to this is also the fact that vertical partitions constitute the most expensive item in the construction of buildings (40 to 45%, according to Mascaró (1988)) and, among these, the external are significantly more expensive than the internal ones. According to Seeley (1996), external partitions are responsible for 20 to 30% of the total cost and still are two to four times more costly than the internal ones.

Given all this, the circle would be the most economical shape. However, the circular configuration is considered uneconomical, due to the restraints that this shape imposes on furniture, for instance. Thus, square or rectangular shapes are considered to be the most economical options because they are the ones that resemble it the most.

This geometry property can be defined as the compactness of the building (the more compact, the most economical) and the compactness can be expressed in area (ratio between the perimeter and the floor area of the design) and in volume (ratio between the area of the building and its volume).

2.1.2 Design plan format

For the same geometric shape, the more jagged, the more expensive. This happens not only due to the increase in the perimeter/area ratio, but also because designs that are more jagged will require more ground leveling work, drainage, renting and foundation excavation. Jagged designs will also require pricier roofs (Seeley, 1996). This does not mean that only square designs are the most suitable for any situation. It is also necessary to consider other aspects such as natural lighting and ventilation (which may be impaired in square designs), land utilization, besides aesthetic considerations.

2.1.3 Size of the building

Increases or decreases in built-up areas do not lead to increases or decreases in overall costs in the same proportion. This is because the vertical partitions, unlike the horizontal ones, do not increase or decrease in the same proportion as the built-up area. Thus, for the same shape, large buildings will have a lower unit cost because they will have an inferior ratio between wall and floor areas.

2.1.4 Storey height

Increases in ceiling heights cause cost increases because they increase the wall-floor ratio, the amount of finishes, fixtures, and the load of the building. In addition, they increase the following costs: piping, molds and props, staircases, roof coatings (due to scaffolding) and vertical transport (temporary and permanent).

2.1.5 Total height

In general, costs increase as height does. However, there are items whose costs decrease as height increases, such as roofs, basements, common areas, including the lot. There can also be, depending on the case, a better utilization of foundations and a repeated use of molds. Therefore, to a certain extent, that, according to Mascaró (1998), would range from 5 to 12 floors, it is possible to have some cost reduction. Advantages related to the increase in productivity, due to the increase in repetitiveness, as high as 20 floors, are pointed out in the literature, according to Cardoso (1999). From that point on, costs would be likely to hike. Nevertheless, the conclusion one draws, after studying publications by many authors, is that costs tend to increase as height does, because, in any situation, there will be additional costs of workplace safety (including maintenance), vertical transport, stairways, fixtures, fire safety installations, structures, due to efforts of wind and facades.

Besides, in the case of households, it should also be taken into consideration the fact that skyscrapers are unsuitable for people who suffer from altophobia, children and the elderly.

2.2 Factors related to technology

2.2.1 Brief history

In Brazil, the needs of housing construction in the country are estimated around 7 million new units (Abiko et al, 2005). Despite this huge housing deficit, there are factors that have hindered the industrialization of residential construction according to the patterns of developed countries, Cardoso (1999).

Innovations in the field of residential construction have come along mainly through the introduction of materials and construction processes that gradually increase the rationalization, the mechanization, and the prefabrication, without major investments and without making a break from the practices of manufacturing that characterize the traditional process.

This picture has been changing since the beginning of the 90s and especially since the middle of this decade, when new factors have been causing the expansion of housing production and the intensification of technological development. Among these factors, one can stress the changes in the legislation, which have fomented housing construction, facilitated access to loans and provided construction companies and developers with easier ways to acquire capital by going public. Moreover, the improvement of the economic outlook has enabled the decrease of interest rates and the increase of income, thus expanding access to financing and housing acquisition.

The international crisis that reached Brazil in the second semester of 2008 had a negative impact on this growth in 2009, but the prospects for 2010 indicate that expansion is supposed to be back, albeit at a lower pace.

Given these prospects, the pace of technological progress should continue to accelerate and, especially in the case of the production of low-income housing, it is possible that proposals for more radical technological progress will gain ground. However, the historical pattern of technological evolution has still been maintained, except for its quicker pace.

As some examples of the latest innovations that are likely to be widely adopted by the residential construction market, the following can be pointed out, according to CBIC (2009): precut and folded steel; use of high performance concrete; streamlined and prefabricated forms; structural masonry with prefabricated slab; precast concrete; use of industrial mortars; industrial facades; drywall; among many others.

2.2.2 Impact of innovations on costs

The introduction of innovations generates factors that lead to cost increases due to the substitution of materials and traditional processes for more sophisticated and technologically advanced ones, which are more expensive. On the other hand, these processes provide gains in productivity, reduced waste, and performance improvements that are translated into cost reductions.

There are factors that impact costs whose control is out of the boundaries the productive chain, as prices of materials that depend on the fluctuations of international markets and have a high impact on construction costs, such as cement, steel, aluminum, copper, and glass.

Construction labor costs have recently risen due to increased demand and there is already a shortage of this kind of labor in the Brazilian market. This tends to increase construction costs and stimulate the use of industrial processes, which reduce the cost of the labor force.

There are many interacting variables and the analysis of cost evolution is complex and difficult to predict. A prospective study done the author (Abiko et al, 2005) showed that, by the next decade, under a scenario of economic growth, construction costs are likely to appreciate a bit. The results of this present study should also contribute to a better understanding of this issue.

3. Methodology

3.1 Group of construction projects analyzed

About a hundred estimates for different types of buildings and typologies were initially gathered, from which were gradually selected those 13 that made up the initial sample of the work, corresponding to average standard residential buildings, all built in the City of São Paulo. The other projects correspond to other construction typologies, that will be analyzed as the study continues.

The criteria that led to the choice of this set of estimates were the availability of thorough data (not every estimate had all the information that the study required) and the characteristics of the projects that comprise three subgroups.

The first is composed of 5 projects, estimated between September/1999 and May/2000, executed by the same building company and with typologies quite alike. The second is composed of 3 projects, estimated between April/2003 and November/2004, executed by building companies different from the previous group and with typologies that are similar among themselves, but built according to patterns that are a bit superior in comparison with the ones in the first group. The third is composed of 5 projects recently estimated, between November/2008 and September/2009, executed by different building companies and with typologies quite similar among themselves, but a little different in relation to the ones in the aforementioned groups, especially in terms of height and built-up area, which are greater than the others.

The construction processes are quite similar in all three groups and present many innovations in relation to the conventional ones, as shown below. The projects chosen do not have sample representativeness in a statistical sense but can be representative of what was built, in terms of average standard residential buildings, in the past 10 years, by the leading companies of this market.

3.2 Data collected and analyzed

About 130 items were collected from each estimate and grouped as follows:

- typology (floors, apartments per floor, number of bedrooms in each apartment, ceiling height, total height);
- built-up areas (total and underground);
- compactness (surface and volume);
- construction characteristics for every stage of the work (description and rates of consumption);
- cost composition: direct (for every construction stage) and indirect (for all items), each item displaying total costs, cost per area, and impact on total costs.

An equalization of costs was factored in, given the fact that not all estimates had projects and some of them were endowed with special facilities while others were not, such as air conditioning and security. Thus, the same items are included in the costs of every construction work.

The following indices of cost evolution, referring to the period considered in the estimates, were collected: CUB-S (Sinduscon) and SINAPI, INNC (National Civil Construction Index, which measures inflation in civil construction), INPC (National Index of Consumer Prices, which measures inflation in the country), and the evolution of the exchange rates, comparing the Brazilian real against the U.S. dollar (R$/US$).

4. Presentation and analysis of the results

Two tables will be initially presented summarizing the typologies and construction features of the 13 projects, and then charts and abstracts of the analyses made will also be shown.

4.1 Summary of typologies, areas, and costs

Table 1: Summary of typologies, areas, and costs

Project	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*
Date	*Sep-99*	*Jan-00*	*Jan-00*	*Apr-00*	*May-00*	*Apr-03*	*Mar-04*	*Nov-04*	*Nov-08*	*Nov-08*	*Aug-09*	*Sep-09*	*Sep-09*
Typologies													
Number of floors (un)	*20*	*17*	*19*	*16*	*25*	*20*	*24*	*30*	*24*	*30*	*30*	*34*	*23*
Number of apartments (un)	*68*	*84*	*64*	*68*	*84*	*21*	*21*	*26*	*76*	*100*	*108*	*56*	*80*
Apartments per floor	*4*	*6*	*4*	*6*	*4*	*1*	*1*	*1*	*4*	*4*	*4*	*2*	*4*
Bedroons per apartments	*2*	*1 a 2*	*2 e 3*	*2*	*4*	*4*	*3*	*4*	*3*	*3*	*3*	*4*	*4*
Number of elevators (un)	*2*	*3*	*3*	*2*	*2*	*2*	*2*	*3*	*4*	*3*	*3*	*4*	*5*
Ceiling height (m)	*2.72*	*2.80*	*2.70*	*2.70*	*2.88*	*2.85*	*3.00*	*2.85*	*2.67*	*2.65*	*2.70*	*2.65*	*2.68*
Areas													
Total Area (m2)	*5739*	*8004*	*6803*	*6927*	*18554*	*6928*	*8400*	*10582*	*14820*	*17016*	*18238*	*23900*	*29726*
Building Area (m2)	*4633*	*5568*	*5490*	*5023*	*12695*	*5778*	*6314*	*8496*	*11645*	*12136*	*13219*	*15394*	*22512*
Basement Area(m2)	*1106*	*2436*	*1313*	*1904*	*5859*	*1150*	*2086*	*2087*	*3175*	*4880*	*5019*	*8506*	*7214*
% Basement Area/Total Area	*19%*	*30%*	*19%*	*27%*	*32%*	*17%*	*25%*	*20%*	*21%*	*29%*	*28%*	*36%*	*24%*
Compactness													
Compactness Area (m/m2)	*0.31*	*0.17*	*0.23*	*0.28*	*0.16*	*0.22*	*0.25*	*0.24*	*0.18*	*0.24*	*0.25*	*0.18*	*0.12*
Compactness Volume (m2/m3)	*0.33*	*0.19*	*0.25*	*0.30*	*0.18*	*0.23*	*0.26*	*0.25*	*0.20*	*0.26*	*0.26*	*0.19*	*0.13*
Cost per area													
Cost (R$/m2)	*242*	*284*	*299*	*260*	*278*	*257*	*325*	*377*	*420*	*434*	*543*	*546*	*522*
Cost (US$/m2)	*465*	*507*	*534*	*456*	*505*	*856*	*930*	*1076*	*894*	*924*	*1024*	*1030*	*985*

4.2 Summary of construction features for all projects

Table 2: Summary of construction features for all projects

Stage	*Construction Process*
Foundations	*Continuos flight auger / Footing in reinforced concrete*
Contention	*Steel beam / Curtain of reinforced concrete*
Structure	*Reinforced concrete cast on the site; industrial concrete; wooden forms; precut and folded steel*
Forms	*Wooden prefabricated forms with metal shores*
Sealing	*concrete/ceramic masonry block, industrialized mortar*
Frames	*Anodized aluminum*
Facade	*Texture/Paintng on industrialized stucco*
Coatings on cold areas	*Wall and floor ceramic tiles*
Wall coatings on dry areas	*Smooth plaster on blocks and painting on stucco*
Floors on dry areas	*Mortar bed for carpeting in the apartments; marbles/granites/ceramics for the common social areas*
Liners	*Smooth plaster on ceilings and plasterboards in bathroom ceilings*

4.3 Cost Evolution

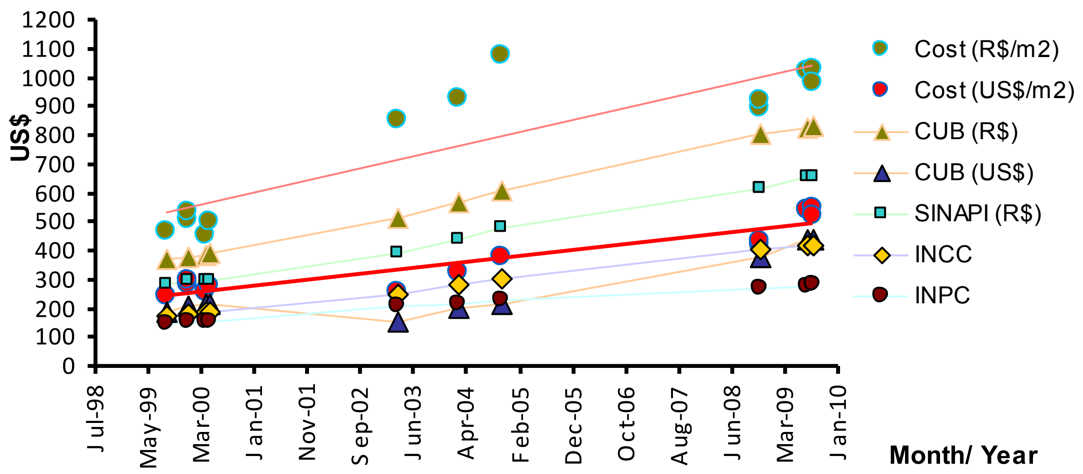

Figure 1: Cost Evolution

As noted in the table above, the cost of the construction projects estimated varies at rates that are especially similar to those of CUB-S, demonstrating that this is the best inflation index for the sector.

It is observed that all inflation indices of the construction sector rose above the INPC, which measures the general inflation in the country. This was expected due to the increased demand in civil construction, which occurred especially in recent years (between 2006 and 2008), and caused the prices of this sector to go up beyond the general inflation levels of the country. However, the surprising result was that the evolution of the costs of the construction projects estimated was lower than all the indices of construction costs, in spite of the increased demand mentioned above and in spite of the evolutions in typology that were supposed to bring costs up. In other words, the cost of the construction projects estimated decreased in real terms, while the contrary was expected. This will be analysed at the end of this chapter.

The costs of the construction projects estimated are higher than the other CUB's, as shown in the same table, with an average elevation of about 30% compared to the CUB-S and 70% in relation to the SINAPI. These differences were expected, as already explained in the introduction of this text and are especially due to the existence of items estimated that are not considered in the CUB's, such as indirect costs and special foundations, in addition to typology factors and construction features.

It is still noticeable that there are three projects (projects 6, 7 and 8), estimated between 2003 and 2004, with costs superior to the others. This is explained by their typologies, that can be considered of a higher standard. Among the characteristics that demonstrate this difference, there is the fact that they have only 1 apartment per floor, while all others have 4 apartments per floor, with the sole exception of the project 12, which has 2 apartments per floor. Moreover, there are items in these projects with a standard of finish superior to the others, such as frames, exterior wall coatings and linings.

4.4 Compactness and cost

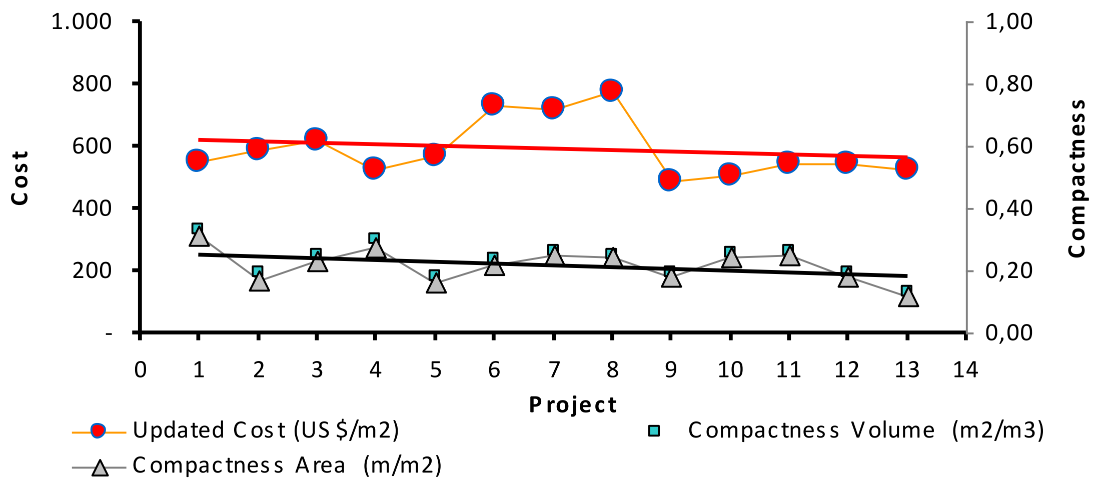

Figure 2: Compactness and cost

In this table, costs were all updated to September/2009, through the CUB-S and converted in US$. As noted, the average lines of the average cost and compactness are approximately parallel to each other, considering that costs tend to decrease as compactness does, which is an expected result that is in line with the theoretical grounding. On the other hand, there are some discrepant results, such as the ones for projects 2, 5, 9 and 13, which present low compactness and low costs in comparison to the others; as well as the ones for projects 6, 7 and 8, which present high compactness, but high costs. The reasons for these discrepancies are the differences in standards and in the characteristics of typologies. Thus, although compactness is an important factor in cost, it is not a determinant one to explain the differences in costs among the projects.

4.5 Total areas, basement areas and costs

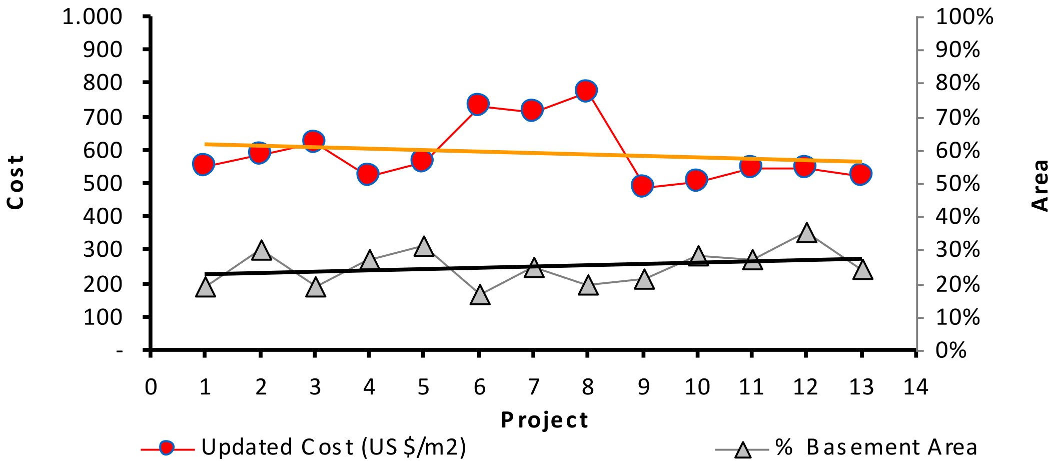

Figure 3: Total areas, basement areas and costs

In this table, costs were all also updated to September/2009, through the CUB-S and converted in US$. The trend line of cost is consistent with the trend line that tracks the total built-up areas and basements, that is, the greater the built-up areas and the higher the proportion of basements, the lower the costs. It is also noticeable the trend towards the increase of the the built-up area over time, especially deriving from the number of floors and the expansion of the garage area (one of the designs has a four-level basement while most of the others have two-level ones). The proportion of the basement area in relation to the total area is, on the average, 25%. There is a tendency in more recent designs to increase this proportion in comparison with the older ones (27% in the current ones against 24% in older ones).

4.6 Total height, ceiling height, and costs

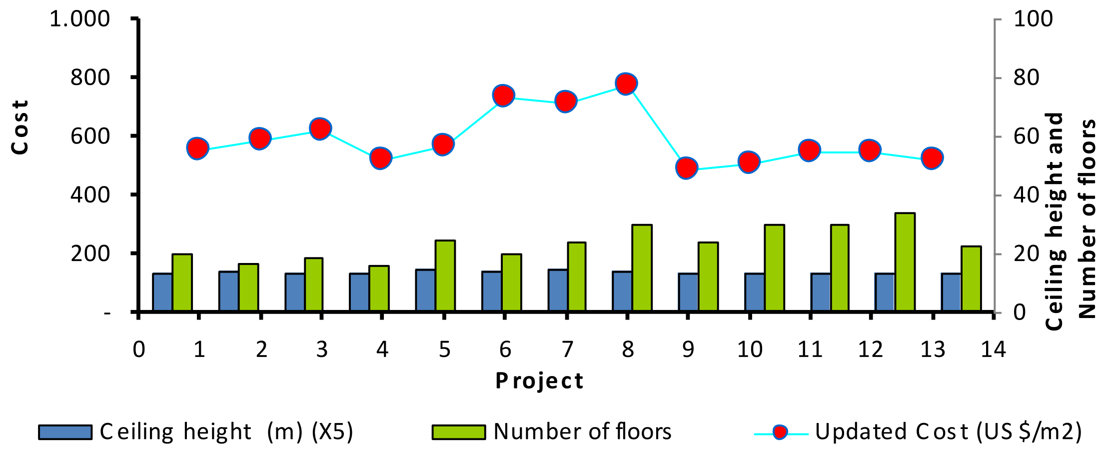

Figure 4: Total height, ceiling height, and costs

In this case the results are not consistent with the theoretical predictions, since there is a reduction in costs in relation to higher buildings, while the opposite was expected. This is partly explained by factors that are not associated with the typology, which will be seen below. It should also be noted that, despite the greater height of current buildings (28 floors on average, against an average of 19 in old ones), the ceiling height decreased (2.76m in the old, against 2,67 in the present ones) and this may have partly offset the effect of the number of floors.

4.7 Other factors in the evolution of costs

It has already been mentioned that the real cost of the construction projects estimated decreased over time, even with typology factors that should cause the contrary. This is due to at least two reasons.

The first is the fact that older projects had labor costs relatively superior compared to the others. There was a significant fall in labor costs starting in the year 2000 and, as these costs are responsible for 40 or 50% of the total cost, this ends up having a greater impact on the total cost than those factors linked to construction typology.

The second reason is that more recent projects present lower indirect costs than the older ones (11% against 16% of the total cost, on the average). This reduction is mainly due to the terms proportionally shorter in relation to the volume of the construction project. The old ones have terms between 15 and 24 months, while the present ones have terms between 22 and 24 months, but with built-up areas on the average three times as big. This shows that present projects are much faster than older ones, which is an important factor in technological evolution, with a positive impact on costs.

Still on the subject of the impact of technological evolution on costs, discussed in the theoretical grounding of this text, we understand that such impacts do not explain the differences found among the construction projects estimated, since all of them were executed according to basically the same construction processes. However, given the fact that the costs of the construction projects estimated with these technologies are superior to the CUB's, it is possible that these construction processes, in fact, present higher costs than the conventional ones. On the other hand, the construction projects have been executed in an increasingly fast way and this suggests that these modern construction processes enable a level of productivity that would not probably be obtainable according to conventional ones, thus becoming a cost reduction factor.

5. Conclusions

The costs of the construction projects estimated present values superior to the CUB's and evolutions similar to the CUB'S, confirming the initial hypothesis of the study, namely: the CUB-S, in general, are not recommended as cost references, but as indices of the inflation in the sector. For this use, the one that proved to be the most indicated is the CBU-S for the typologies estimated.

The cost results were, in general, consistent with the factors related to the architectural typology, with the exception of the total height, which did not prove to be a factor in cost increase, as it was expected. This factor was possibly offset by the decrease in ceiling height and also by other factors unrelated to typology. Among them, the prices of outputs should be stressed, especially labor, which plays a very important part in the total cost.

Costs were reduced in real terms over time, which is an unexpected result that can be explained not only by the reduction in labor costs that occurred in the period, but also by the reduction of indirect costs over time, due to the fact that construction today takes much less time, proportionally speaking, than it took ten years ago.

This positive cost evolution is possibly related to the use of constructive processes that, although probably more expensive than the conventional ones, enable greater productivity and a more efficient management of the construction project, with positive impacts on costs. It is possible that other factors that have not been identified yet are also contributing for the results found. The continuation of this study will shed light on this possibility.

It is considered that the results already obtained and the conclusions drawn from them are quite important, original, and contribute to the understanding of the subject under consideration. The continuation of the study, with the inclusion of more construction projects and the analysis of additional cost factors, will deepen and broaden this understanding.

The costs of the construction projects estimated and shown here can be used as cost references, considering their contextualization, presented in the study.

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Increasing Construction Value Added: A Malaysian Case study

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Abstract

The construction industry contributed only 3% to the gross domestic product of Malaysia. In view of the significance of the industry in constructing the infrastructure necessary for developing the nation and for generating economic growth, a strategic plan was initiated in 2006 to increase the contribution of the construction sector by increased public spending on infrastructure, export of construction products and services, enhancing productivity and efficiency by greater mechanization and adopting industrialized building systems, and improving built quality. An assessment of the impact of these strategies to increase the construction value added with reference to the 2000 national Input-Output tables indicates that only increased spending on infrastructure has a clear and direct effect on construction value added. The other measures were not observed to have obvious increases. The reduction of foreign labour and the increases in the maintenance and repair sub-sector have been identified as two potential areas of increasing value added. The economic assessment of these strategies established that construction value added provides only a limited perspective of the contributions of the construction industry in Malaysia, and that other economic measures such as forward and backward linkages, and output multipliers may be better indicators of the contribution of the construction sector to the national economy.

Keywords: value added, construction economics, strategy, input-output analysis

1. Introduction

The construction industry in Malaysia is one of the pillars of the domestic economy. The industry was reported to produce a gross output of some RM 54 billion in 2005, utilizes RM 35 billion worth of inputs from other industries, employs 552,000 people and pays out RM 19 billion in salary and wages (DOSM 2007) (exchange rate US$1.00 = RM 3.44 – Dec.2009). There was increasing concern, within the industry and the government, that the construction sector has been experiencing two years of negative growth between 2004 and 2005. In 2005, the construction industry accounted for only 3.07% of the gross domestic product (GDP). From the drop in total value of projects awarded in 2002 and 2003, followed by marginal increases in 2004 to 2006, the growth of the construction sector was clearly lagging the overall growth of the national economy leading to growing concerns of under-investments in infrastructure and general sluggishness within the industry. In 2007, the Construction Industry Development Board (CIDB) in concert with industry stakeholders launched the Construction Industry Master Plan 2006–2015 (CIDB 2007a) which charts the strategic position and future direction of the Malaysian construction industry for the next ten years. It proposed a number of strategic recommendations to enhance productivity and quality along the entire supply chain as the industry is seen as being critical to national wealth creation and has large multiplier effects on the economy. In that same year, the public sector doubled its spending on building infrastructure and increased the total value of projects awarded from RM 61 billion in 2006 to over RM 91 billion in 2007 (see Table 1). Increased public investment in infrastructure was one of the numerous measures to support the construction sector and to enhance economic growth.

The objective of this paper is to examine the initiatives recommended in the master plan to increase the share of the construction sector of the national economy. The recommendations were (a) to increase public spending on infrastructure, (b) to increase export of construction products and services, (c) to enhance productivity and efficiency by greater mechanisation and adopting the industrialised building system, and (d) to improve built quality. An input-output model for the national economy will be utilised to analyse these four initiatives to compute their resultant contributions to the GDP. Indicators developed from input-output tables, for instance forward and backward linkages and output multipliers will be utilised to compare and contract the effects of each of these initiatives. Alternative methods of increasing value-added, such as the reduction of foreign workers and increasing the maintenance and repair sub-sector were proposed and evaluated.

The first section examines the relative size of the construction sector in the national economy and compares this with developed countries, other developing economies and a sample of countries with a similar sized economy (adjusted for purchasing power parity). The purpose of this investigation was to determine if the size of the construction sector was appropriate relative to the output of the national economy. The second section introduces the input-output model as a tool for evaluating the initiatives to increase the contribution of the construction sector and reports on the output of these analyses. Section three explores other potential initiatives which may be proposed to increase the contribution of the construction sector to the national economy.

Table 1: Total value (RM'million) of project awarded in Malaysia 2000-2008

			Sector		*Type of development*					
Year	*No of projects*	*Total value*	*Public*	*Private*	*Resi-dential*	*Non-resi dential*	*Mixed*	*Social*	*Infra-structure*	*Others*
2000	*4411*	*50,297*	*24,340*	*25,957*	*10,095*	*10,490*	*1,271*	*10,040*	*15,543*	*2,858*
2001	*5155*	*51,807*	*26,461*	*25,340*	*10,978*	*10,121*	*1,031*	*9,565*	*20,065*	*47*
2002	*5392*	*48,249*	*24,780*	*23,46*	*14,602*	*7,625*	*2,08*	*9,473*	*14,153*	*311*
2003	*4519*	*49,016*	*19,946*	*29,070*	*12,482*	*9,022*	*929*	*4,953*	*21,414*	*216*
2004	*4881*	*52,964*	*13,996*	*38,214*	*15,259*	*10,452*	*982*	*3,272*	*22,404*	*326*
2005	*5590*	*54,761*	*16,978*	*37,783*	*16,756*	*15,467*	*1,072*	*4,620*	*16,367*	*480*
2006	*5854*	*60,927*	*22,455*	*38,472*	*16,555*	*17,703*	*455*	*3,989*	*21,627*	*598*
2007	*7220*	*91,485*	*47,821*	*43,664*	*15,908*	*25,150*	*996*	*11,241*	*36,960*	*203*
2008	*5961*	*78,548*	*33,770*	*44,778*	*13,797*	*15,731*	*1,709*	*16,294*	*15,540*	*79*

2. Relative size of the construction sector in the Malaysian economy

Researchers (Bon and Pietroforte 1990) have observed that, in early stages of economic development, the share of construction output in GDP increased but ultimately declined in industrially advanced countries. In view of the availability of time-series data from Department of Statistics Malaysia (DOSM 2005) and United Nations Statistics Division (UNSD 2009), a longitudinal study is carried out. Figure 1 shows the real rates of growth of the Malaysian construction sector and the growth of the nominal GDP from 1970 to 2005. It can be observed that changes in the construction sector output clearly amplifies the effect of GDP growth; i.e. providing a larger increase when there is an increase in GDP, and a larger deficit when there is a reduction in GDP.

The contribution of the construction sector to the GDP over the last 10-15 years average between 3 to 5%, which is relatively small compared to other sectors such as manufacturing and services. Nevertheless, the construction sector is particularly important to the economy as it is extensively linked with many other sectors, in particular related industries such as metal products, building materials, machinery, pre-fabrication, project management services, and design services. A close examination of the economic output from 1987 to 2005 (UNSD 2009) shows that Malaysian economy transformed rapidly from a manufacturing base in the late 1980's to a service centred economy in 2000. Growth in the primary sectors of agriculture, fisheries, and mining has been slow and occasionally erratic. Growth in the secondary sector peaked in 1990-1995. In 2005, the services sector contributed more than 54% to the GDP whereas manufacturing and construction only contributed a total of 32%.

In order to examine the construction output in Malaysia, a comparative analysis is conducted with data from Industrialised G8 countries, ASEAN (Association of South East Asian Nations) countries, emerging market countries of Brazil, Russia, India and China (collectively known as BRIC), and countries at a similar development stage. Figure 2 shows the comparison of the percentage of construction GDP for Malaysia with the averages from the G8 nations, ASEAN countries, BRIC countries, and a group of countries with similar GDP from 1970 to 2004. The percentage of construction output of the GDP in Malaysia ranged from 3.3% to 6.6% over the last thirty years. In comparison, the percentage of the construction output for the major industrialised countries was highest during the 1970's at more than 7% reducing to 5% in the 2004. The declined, typical of construction in industrialised countries, is attributed to lower capital investment in building and infrastructure as the economy progresses from manufacturing activities to a greater dependence on services, and the mechanization of the construction industry with a consequential move of a large number of activities from construction to manufacturing. The percentage of construction output in Malaysia was shown to be approximately similar to the average of the 10 ASEAN countries. It must be noted here that the individual countries of ASEAN have reported widely varying figures with Singapore, Indonesia, the Phillipines, Thailand and more recently Vietnam reporting figures higher than those from Malaysia. A similar comparison with the BRIC countries shows that their construction output ranged from 4.6% to 7.1% over the same period. This rising trend is consistent with the view that economies that are growing rapidly such as these emerging markets will invest heavily in construction. Although Malaysia is seen as a developing country, its construction output is approximately 2% lower compared to the average of countries with similar stage of economic development.

The picture that emerges from the comparative analysis suggests that the construction sector contributes to a larger proportion of GDP of a rapidly growing economy, especially those with high growth in the manufacturing sector. Conversely, for industrialized economies which are mature and growing in the area of services as opposed to manufacturing, the construction sector is less prominent.

3. Input-output analysis of the construction sector

The input-output method is an empirical study of the quantitative interdependence between inter-related economic activities. It was originally developed by Leontief (1986) to analyze and to measure the connections between the various producing and consuming sectors within a national economy. An input-output table describes the flow of goods and services between all the individual sectors of a national economy over a stated period of time, say a year. A detailed discussion on the macro-economic assessment of the construction industry in Malaysia using the input-output model is available from the CIDB (2007b).

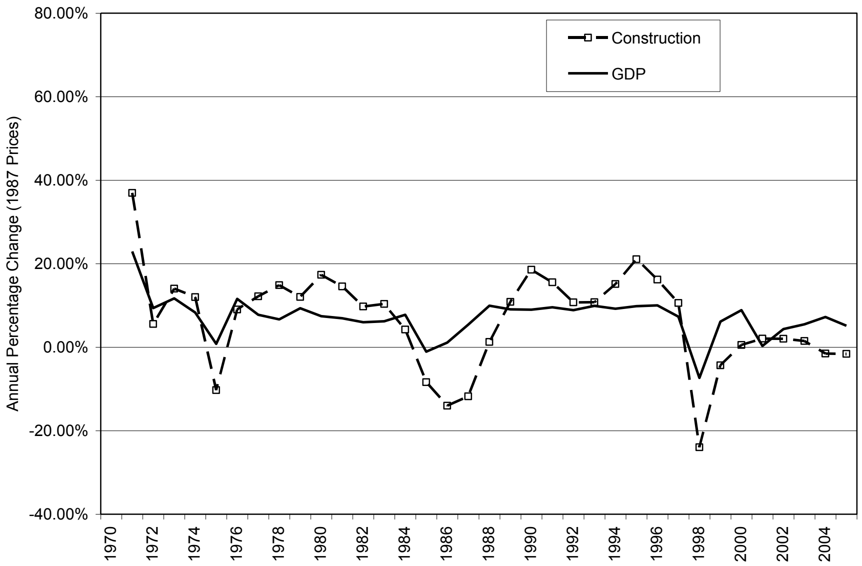

Figure 1: Construction sector and GDP growth comparison

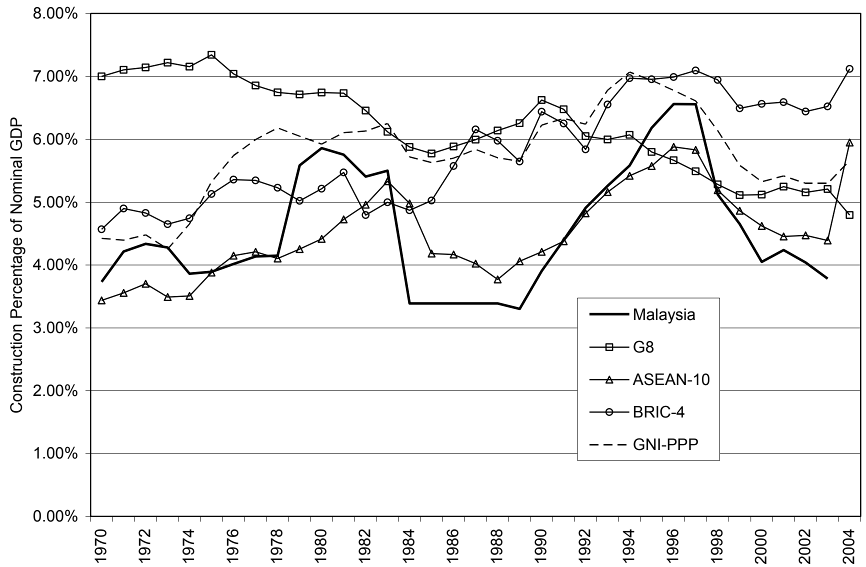

Figure 2: Construction output as percentage of GDP

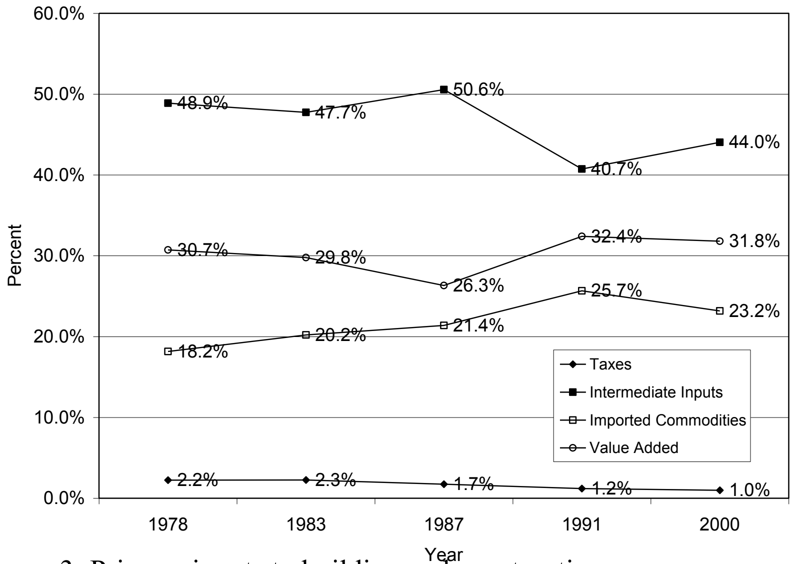

Figure 3: Primary inputs to building and construction

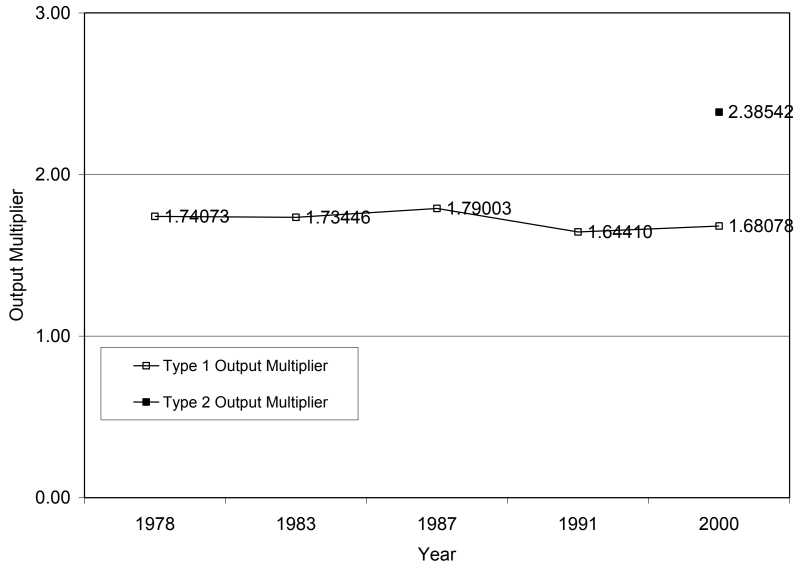

Figure 4: Output multipliers

Table 2: Total input and use for 11 sector activity x activity aggregated from Table 16 of Input-Output Tables 2000 (RM'000)

TOTAL INPUT AND USE, 11 SECTORS, ACT x ACT	**ACTIVITY**	Agriculture and Fishing	Mining and Quarrying	Manufacturing	Utilities	Building, construction	Wholesale Retail	Hotels and Restanurant	Transport and Communications	Financial Services	Real Estate, Renting and Business Activities	Education, Helath, Enternatinment, Other Services	**Total Intermediate Demand**
ACTIVITY		1	2	3	4	5	6	7	8	9	10	11	
Agriculture and Fishing (8 sectors)	1	2 888 260	6 894	20 446 466	2 044	139 797	23 809	2 198 233	7 123	713	15 659	203 272	25 932 269
Mining and Quarrying (3 sectors)	2	18 278	620 046	13 348 932	135 620	1 454 836	72 489	36 180	135 635	71 350	110 575	226 764	16 230 705
Manufacturing (54 sectors)	3	6 760 230	1 179 201	88 283 835	2 117 755	12 520 081	860 356	4 069 388	6 067 746	599 733	1 082 088	3 697 037	127 237 450
Utilities (Electricity, Gas and Water) (2 sectors)	4	110 295	104 182	8 215 558	991 790	227 025	922 357	856 555	608 739	594 865	512 222	1 123 141	14 266 729
Building, construction (1 sector)	5	86 499	103 249	1 424 650	102 465	202 239	526 365	152 437	133 144	61 323	310 681	448 966	3 552 017
Wholes.&retail trade (1)	6	1 499 532	340 500	29 578 191	439 347	2 335 084	228 862	682 769	1 083 981	181 994	438 513	859 860	37 668 633
Hotels & restaurants (1)	7	44 163	96 072	906 492	98 838	249 281	1 841 657	333 221	2 046 615	137 899	427 048	726 955	6 908 240
Transport and Communications (2)	8	365 145	651 219	5 437 151	198 571	1 061 518	1 232 120	655 622	5 217 424	1 790 076	1 067 546	1 351 083	19 027 476
Financial Services (3)	9	38 715	38 685	515 154	68 362	270 046	526 287	76 122	376 722	1 605 034	241 693	110 463	3 867 284
Real estate, Renting and Business Activities (3)	10	116 723	477 203	1 474 512	1 012 370	1 025 288	1 759 820	312 845	1 374 819	1 441 913	2 571 812	2 082 093	13 649 398
Education , Health, Entertainment, Other Services (16	11	117 984	72 616	273 824	104 480	130 208	231 977	119 968	484 855	79 067	271 489	1 473 276	3 359 744
Total Intermediate Input		12 045 824	3 689 868	169 904 766	5 271 641	19 615 402	8 226 098	9 493 340	17 536 803	6 563 967	7 049 326	12 302 910	271 699 945
Direct Purchase Abroad	96	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Services	97	0	0	0	0	0	0	0	0	0	0	153	153
Commodities Taxes (Dom.)	98	32 739	34 048	2 029 580	69 980	348 807	418 756	133 268	456 423	349 013	872 136	487 735	5 232 485
Commodities Taxes (Imports)	99	58 110	19 279	2 592 224	35 016	90 035	10 801	52 442	202 038	1 515	21 741	90 917	3 174 118
Imported Commodities	100	3 416 693	4 751 705	214 872 505	1 633 662	10 321 352	5 095 598	4 114 225	12 391 780	2 760 297	4 303 021	7 790 143	271 450 981
Value Added	101	29 873 327	38 249 146	101 078 390	11 457 689	14 162 040	38 223 829	7 580 269	22 736 727	26 292 376	26 151 811	29 464 507	345 270 111
- Compensation Of Employee	102	4 891 169	1 270 926	28 349 599	988 192	9 265 702	7 523 953	2 728 962	7 343 208	7 003 565	4 742 209	25 030 655	99 138 140
- Operating Surplus	103	24 982 158	36 978 220	72 728 791	10 469 497	4 896 338	30 699 876	4 851 307	15 393 519	19 288 811	21 409 602	4 433 852	246 131 971
Total Input		45 426 693	46 744 046	490 477 465	18 467 988	44 537 636	51 975 082	21 373 544	53 323 771	35 967 168	38 398 035	50 136 365	896 827 793

TOTAL INPUT AND USE, 11 SECTORS, ACT x ACT	**ACTIVITY**	**Total Intermediate Demand**	Private consumption	Government consumption -- Federal	Government consumption -- State	Government consumption -- Local	Changes in inventory	Gross fixed capital formation	Exports	**Total Final Demand**	**Total Use**
ACTIVITY			97	98	99	100	101	102	103		
Agriculture and Fishing (8 sectors)	1	25 932 269	8 334 670	214	0	0	929 167	1 156 051	9 074 321	19 494 424	45 426 693
Mining and Quarrying (3 sectors)	2	16 230 705	101 649	24 169	0	0	549 816	2 854 424	26 983 282	30 513 341	46 744 046
Manufacturing (54 sectors)	3	127 237 450	38 404 408	9 803	0	0	8 056	5 746 913	319 070 835	363 240 015	490 477 465
Utilities (Electricity, Gas and Water) (2 sectors)	4	14 266 729	3 964 659	4 353	0	0	- 297	4 200	228 343	4 201 259	18 467 988
Building, construction (1 sector)	5	3 552 017	460 196	2 097	0	0	23	38 500 958	2 022 344	40 985 619	44 537 636
Wholes.&retail trade (1)	6	37 668 633	2 332 165	2 294	0	0	22 624	2 562 663	9 386 703	14 306 449	51 975 082
Hotels & restaurants (1)	7	6 908 240	14 318 193	20 031	466	532	12	12 938	113 132	14 465 304	21 373 544
Transport and Communications (2)	8	19 027 476	13 414 436	12 428	1 097	474	5 381	185 992	20 676 487	34 296 295	53 323 771
Financial Services (3)	9	3 867 284	7 523 100	150	0	0	11	4 740	2 930 451	10 458 452	35 967 168
Real estate, Renting and Business Activities (3)	10	13 649 398	16 765 195	158 478	7 904	10 612	81	75 687	7 730 680	24 748 637	38 398 035
Education , Health, Entertainment, Other Services (16	11	3 359 744	10 964 074	30 669 487	1 845 558	2 091 728	19 762	23 182	1 162 830	46 776 621	50 136 365
Total Intermediate Input		271 699 945	116 582 745	30 903 505	1 855 024	2 103 346	1 534 637	51 127 750	399 379 409	603 486 416	896 827 793
Direct Purchase Abroad	96	0	-19 530 600	0	0	0	0	0	19 530 600	0	0
Domestic Services	97	153	677 998	0	0	0	0	0	0	677 998	678 151
Commodities Taxes (Dom.)	98	5 232 485	7 732 136	0	0	0	130 926	472 783	1 082 051	9 417 896	14 650 381
Commodities Taxes (Imports)	99	3 174 118	1 480 426	0	0	0	159 792	1 008 338	4 201	2 652 757	5 826 875
Imported Commodities	100	271 450 981	37 589 887	771 983	325	0	4 156 437	37 531 932	7 028 333	87 078 897	358 529 878
Value Added	101	345 270 111	0	0	0	0	0	0	0	0	323 628 679
- Compensation Of Employee	102	99 138 140	0	0	0	0	0	0	0	0	99 138 140
- Operating Surplus	103	246 131 971	0	0	0	0	0	0	0	0	224 490 539
Total Input		896 827 793	144 532 592	31 675 488	1 855 349	2 103 346	5 981 792	90 140 803	427 024 594	703 313 964	1 699 279 897

Table 2 shows that the Manufacturing sector contributes the largest of all domestically produced inputs used by the Building and Construction industry amounting to RM 12.5 billion, followed by the Wholesale and Retail trade at RM 2.3 billion. The total input to the building and construction sector was RM 44.5 billion, of which RM 19.6 billion (or 44%) consists of intermediate inputs and RM 24.9 billion (56%) of primary inputs. This high amount of intermediate inputs reflects the nature of construction operations involving the assembly of many different products purchased from a number of manufacturing activities. Out of a total Building and Construction industry output of RM 44.5 billion in 2000, the value added was only RM 14.2 billion, of which RM 9.3 billion was for compensation to employees, and RM 4.9 billion was for operating surplus. These figures indicate that each RM 1.00 of total output created RM 0.32 of value-add.

The degree of industrialization of the construction process can be measured by the extent to which building materials and components are manufactured off-site. Figure 3 shows the intermediate and primary inputs to building and construction from 1978 to 2000. It can be seen that the intermediate input (or direct backward linkage) from other industries to construction decreased from 48.9% in 1978 to a low of 40.7% in 1991 and increased slightly to 44.0% in 2000. This observation is contrary to the general trend in construction where greater use of mechanization and pre-fabrication move a large portion of the activities from construction to manufacturing. During the same period, imported commodities increased from 18.2% to more than 25.7% in 1991, indicating a greater use of imported items in construction. Adding the imported commodities to the intermediate inputs reveals that the inputs do not change significantly. The small reduction in intermediate inputs could be attributed to a greater use of imported commodities. Value added in the construction industry remained stable at 30-32% throughout the period under review.

Output multipliers (total backward linkage) measure total change throughout the economy from one unit change for a given sector. The Type I output multiplier includes direct spending, and indirect spending caused by businesses buying and selling to each other. In simple terms, output multiplier measures the total activity generated by a RM1.00 increased spending in that activity. Type II multiplier or induced output multiplier includes the Type I output multiplier effects plus household spending based on the income earned from the direct and indirect effects (businesses buying and selling to each other) and induced effects (household spending earned from direct and indirect effects). The Building and Construction sector Type I output multiplier is 1.62 for the 11-sector inverse matrix. In order to produce an additional RM 1.00 of output, the Building and Construction sector would cause production by all industries to increase by RM 1.68. The induced output multiplier is 2.39 for 2000 as shown in figure 4. In order to produce an additional RM 1.00 of output, the Building and Construction sector would cause production by all industries to increase by RM 2.39.

4. Value-adding strategies

One of the major thrusts in the CIMP was to increase construction output from the current 3% of GDP to 4% by 2010 and to 5% by 2015. Four of the most prominent strategies suggested in the master plan to increase construction value add were as follows:

i. increase demand – Increase in public spending for infrastructure
ii. increase export of construction products and services
iii. enhance productivity and efficiency through greater mechanisation and adoption of industralised building systems (IBS), and
iv. improve build quality.

Although the master plan did not specifically examine the concerns regarding a large foreign work force, the import of a substantial quantity of commodities and the expansion of the maintenance and repair sub-sectors, these have been included in this study as these factors were found to be particularly relevant.

4.1 Increase construction demand

The first strategy proposed to increase the construction value-add was to increase the annual budget allocation for public spending in infrastructure. The development allocation and expenditure for the Ninth Malaysia Development Plan (9MP 2006-2010) period is RM 200 billion compared to RM 170 billion for the Eighth Malaysia Plan (8MP 2001-2005) period. The spending for construction is estimated at RM 140 billion for the 9MP, an increase of nearly 30% over the 8MP spending of RM 110 billion. Data from 2000 to 2005 indicate that the total value of contracts awarded annually was constant at approximately RM 50 billion (combined public and private spending on construction). In 2007, the government increased public spending significantly by RM 30 billion over the preceding year bring the total value of projects awarded in that year to surge to RM 91.5 billion. The latest data, shown in Table 1, indicate that the total value of contracts awarded in 2008 was close to RM 80 billion. Two economic stimulus packages announced in November 2008 and March 2009, respectively, are expected to contribute an additional RM 25 billion in 2009 and 2010 (MOFM, 2009).

The input-output tables indicate that the input coefficient for building and construction is 0.32, meaning that each additional RM of demand creates RM 0.32 of value added. As such, an additional RM 30 billion of spending can potentially increase the construction sector value-add by RM 9.6 billion. Compared to the value-add of approximately RM 16 billion in 2007, this amount to a 60% increase. However, this additional value-add will not be immediately apparent given that projects awarded in 2007 will not be completed until 2009 or 2010. Assuming a typical construction period of 2 years, the net effect of the increase in infrastructure spending (RM 30 billion in 2007 and a total of RM 25 billion in 2009 and 2010) will be seen between 2008 and 2011. This works out to an average of RM 13.75 billion over four years, or equivalent to RM 4.4 billion of value-add annually, leading to an increase of construction sector contribution to 4% from the current 3% of GDP.

The output multiplier for building and construction is ranked highest amongst all eleven sectors of the Malaysian economy. The output multiplier of 1.68 reported for this sector potentially generates RM 23 billion (1.68 x RM 13.75 billion average additional annual spending) of activity in the overall economy. This comes as no surprise that the government has decided to invest in infrastructure as part of the economic stimulus packages in response to the 2008 global financial crisis.

4.2 Export of construction products and services

If the narrow definition of the construction sector, mainly an "assembly" activity, using many intermediate inputs such as sand, stone, timber, steel, cement, and many other building products produce a building or structure, is adhered to, then the export of construction services will not be captured as GDP. By definition, work on an overseas construction site by a Malaysian company will accrue to the foreign country. The financial benefit to the Malaysian economy will be profits and salaries repatriated to Malaysia by the company and their employees.

By the same definition, most construction products fabricated in Malaysia for export are captured under the Manufacturing industries as opposed to the construction industry. This does not mean that Malaysian contractors shall not be encouraged to venture overseas – in fact, many construction companies have ventured overseas and won projects worth in excess of RM 28 billion in 2006 – and contribute to large gains in corporate earnings.

4.3 Productivity, efficiency and quality

Contribution to the GDP is defined by value-add and not by the construction output or value of work done. This in turn requires that the industry expand into activities with higher value added rather than concentrating on the typical assembly type activities if increases in value-add are to be achieved. These measures may include developing specialised skills or construction techniques, developing building projects of higher value (premium product rather than commodity), demanding higher salaries for increased productivity and built quality, and adopting a partnering approach to project delivery (e.g., with clients, developers, consultants, major suppliers and sub-contractors) to increase efficiency. A direct method of linking these factors to construction value-add is not obvious at this point in time, and may evolve into a research project in the near future.

4.4 Salaries and wages

The Malaysian construction industry has long been characterised by the large number of foreign workers employed as skilled and unskilled labour. With an estimated 320,000 workers in this sector coming from neighbouring countries such as Indonesia, a large proportion of the salaries and wages are remitted back to the home countries of these workers each month. It has been reported (The Straits Times 2008) that each foreign worker remits RM 720 per month – totalling RM 2.8 billion each year. This amount corresponds to 25% of the total salaries and wages paid to the workers in the construction sector or 15% of the total value-add as shown in Table 3.

Utilising the input-output model again to analyse the impact of household spending back into the national economy, the construction sector is ranked second amongst the eleven sectors. The induced output multiplier is 2.44. If 25% of the salaries and wages are remitted overseas, this multiplier reduces to 2.30.

Table 3: Salaries and wages paid to workers in the construction sector

		2005 Workers	*%*	*Salaries and Wages (RM'000)*	*%*
A	***Total working proprietors and unpaid family workers***	***6,082***	***1%***	***-***	*0%*
	Working proprietors and active business partners	*5,784*	*1%*	*-*	*0%*
	Unpaid family workers	*298*	***0%***	*-*	*0%*
B	***Total paid employees (full-time)***	***541,301***	***98%***	***10,836,447***	*100%*
	Managerial and professional	*22,518*	*4%*	*1,426,391*	*13%*
	Technical and supervisory	*24,991*	*5%*	*743,680*	*7%*
	Clerical and related occupations	*21,364*	*4%*	*374,024*	*3%*
	General workers	*10,916*	*2%*	*157,518*	*1%*
	Production/operative workers directly employed				
	(i) Skilled	*91,199*	*17%*	*1,758,442*	*16%*
	(ii) Unskilled	*75,835*	*14%*	*1,043,007*	*10%*
	Production/operative workers employed through labour contractors				
	(i) Skilled	*149,521*	*27%*	*3,296,320*	*30%*
	(ii) Unskilled	*144,957*	*26%*	*2,037,065*	*19%*
C	***Total employees (part-time)***	***4,372***	***1%***	***31,218***	*0%*
	Total (A+B+C)	***551,755***	***100%***	***10,867,665***	***100%***
	Estimated remittances by 320,000 foreign workers	*320,000*		*2,764,800*	***25%***

4.5 Intermediate inputs and import of commodities

The construction sector demands as intermediate inputs, RM 19.6 billion of the outputs of other industries. The Manufacturing sector contributes the largest of all domestically produced inputs used by the Building and Construction industry amounting to RM 12.5 billion. This large amount of intermediate inputs reflects the nature of construction operations involving the assembly of many different products purchased from a number of manufacturing activities. On the other hand, imported inputs to the construction sector represent a net outflow of money from the national economy. In 2000 imported commodities add up to a total of RM 10.3 billion for iron and steel, electrical machinery, metal products, china, glass and pottery, business services and industrial machinery. The government shall be encouraged to examine the substitution of imports as an initiative to increasing the value-add. Greater mechanisation of the site assembly process will require a larger proportion of the construction products to be prefabricated, and thus shifting the recording of the value-add from construction to manufacturing. The net effect from both prefabrication and import substitution will be conventionally captured in the national accounting system, albeit in more towards manufacturing instead of construction.

4.6 Growth of maintenance and repair subsector

In 2000, the construction output that is transferred to intermediate users RM3.6 billion or approximately 8% of its total output. This amount is usually attributed to the maintenance and repair sub-sector where the construction output is not captured as capital investment but as an operating expense. This sub-sector is under-represented as compared to developed countries where a much larger percentage of the construction output is spent on maintenance and repair. Clearly, any additional demand for this sub-sector will add to the total construction demand and generate the requisite value-add plus the output multipliers.

5. Discussion

The results of the input-output analysis have clearly shown that increased construction demand has a clear and direct correlation to increasing construction value-add leading to an increase in the share of the construction sector in the national economy. However, increased construction demand has to be sustained over a continuous period to maintain the same level of percentage share. Any decrease in investment in infrastructure works due to the transition from a manufacturing base to a service led economy will quickly reduce the share of construction to pre-2007 levels. Another initiative that can bring about immediate benefit is to reduce the reliance of the construction sector on foreign workers. Approximately 25% of the salary and wages paid to employees in this sector is repatriated to the workers home country causing a large outflow of foreign exchange, a substantial reduction in net value-add and a reduction in the induced output multiplier. The development of the maintenance and repair sub-sector and the substitution of imports can potentially generate substantial growth for the construction industry. The benefits from other initiatives such as the export of construction products and services contribute to company profits and to employee salary and wages, but not directly to national GDP.

As the industry mechanises, many of the components will be pre-fabricated or pre-assembled in manufacturing plants, increasing the use of intermediate inputs from manufacturing. The economist’s definition of construction is limited to activities at the construction site. It does not include many of the off-site activities such as ready-mixed concrete, manufacture of cement, quarrying of sand and aggregates, pre-fabrication of structural steel, timber or steel trusses, manufacturing of bricks and tiles, which are all classified under manufacturing. Only construction activities such as pre-casting of bridge beams and other components made out of concrete are classified under construction. In view of the definition of construction as an assembly type of activity, the IBS concept will relegate many of the prefabrication activities of non-concrete products to manufacturing. In addition, professional services, such as architectural, engineering, quantity surveying, drafting, and construction project management, are all classified under services. The CIDB defines construction in the widest sense; i.e. categorized by the final product as opposed to the narrow definition of construction assembly. This is mainly due to the current role and function of the CIDB, which includes listing the type and value of construction projects, and its definition differs significantly in form and function from the activity that is compiled by the Department of Statistics as part of the system of national accounts. This broad classification of construction must be maintained by the CIDB to enable the Board to manage, monitor and benchmark the industry more effectively.

6. Conclusions

Among the four initiatives examined, increasing construction demand is the most direct and effective strategy to increase value-add. The other three initiatives require a structural change to the construction sector where many of the existing activities have to be transformed by greater prefabrication and mechanisation potentially through the adoption of IBS concepts. The transfer of many of these activities to a factory environment causes the activity to be captured as manufacturing instead of construction. This in itself may reduce the share of the construction output but will eventually be captured in the national system of accounting and any improvements to the construction sector will be reflected in the improved health of the national economy. Alternative policies such as the reduction in the number of foreign workers, substitution of imported commodities with locally manufactured ones, and the development of a maintenance and repair sub-sector have been shown to contribute positively to the value-add and to spur the growth of the construction sector in Malaysia.

As the engine of growth in Malaysia shifts from the manufacturing sector to the services sector, the demand for construction products and services from the private sector may no longer provide the impetus for growth. The vision of achieving a developed country status by 2020 may require additional investments from the public sector to continue to build and maintain high quality infrastructure in order to improve quality of life, and to support continued growth of the economy and for the socio-economic well-being of the people.

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Stronger Cooperation between Investors, Architects and Consultant Engineers in a Time of Financial Crisis

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Abstract

In the current financial crisis, investors or commercial construction builders of housing are facing problems such as selling the stock of housing and obtaining financial resources from banks for the realisation of new projects. One of the more important measures taken by companies to overcome the crisis is the search for new products. Since banks have become more careful in distributing loans, it is important that investors design and develop new projects which will prove interesting for the market. The demand for real estate has decreased in part indirectly due to the environment, because of stronger demands / new restrictions, and directly as a result of the economic crisis. Consequently, the market price of real estate and the investment cost have fallen. In order to successfully adapt to the specific requirements or circumstances on the market affected by the financial crisis, companies should also lower the anticipated profit or margin. In such cases, a closer cooperation between investors and design teams is necessary, especially in terms of project management and urban planning. By cooperating more actively in the early stage with architects and consulting engineers, investors can respond to the changed market conditions in terms of design and function, and at the same time oversee the cost rationalisation and the quality of constructed housing. This also will be a base for the analysis of life cycle costs. Environmental aspects which focus on minimizing energy consumption will increase the investment cost but, on the other hand, reduce the energy cost during the life time. This will benefit the user of the building, but when the user is renting the house, it is not certain that they will be willing to pay a higher rent for the capital cost.

Keywords: investment, economic crisis

1. Real estate funds as an instrument of the Slovenian housing policy

1.1 The origins of the financial and economic crisis

The global financial crisis, which grew out of the real estate crisis in the United States, has been aggravating the economic recession into an economic crisis. The financial crisis has been transferred into the real economic sector, firstly by the credit crunch: loans are rarely distributed anymore, if they are, they are short-term and have become too expensive. This leads into an increasing lack of financial discipline; since there is no loan support by the banks, companies finance their own production and trade by delaying payments. The other consequence is the decrease in export due to the recession abroad, leading into a drop of production and investment in companies. The third consequence is that due to the lower wages or even lack of employment and the insecure future prospects, consumption has been falling. Consumers are acting more rationally: consumption of luxury goods has been falling, there is less everyday consumption (Štiblar, 2008).

1.2 Influence factors on market value and market price

The value of real estate title is mostly adapted to the performance of the national economic environment, depending on the type and use of real estate. Pšunder and Torkar (2007) claim that due to these characteristics, factors of the national economic environment, such as Gross Domestic Product (GDP), investment and business efficiency, inflation and interest rate, branch of activity, competition and influence of the state must be determined when estimating the value of real estate. These factors are connected, directly or indirectly, to the dynamics and movements in prices of real estate. Besides these, characteristics of a specific item of housing, including its immediate environment, are also important. In summary, market value and market price are affected by the macroeconomic policy. As Samuelson and Nordhaus (2005) point out, the goals of the macroeconomic policy are generally a high and growing level of GDP, high level of employment and stable and slightly growing level of prices or moderate inflation.

Between 2004 and 2008, the great demand for owner-occupied dwelling in Slovenia was stimulated primarily by favourable commercial loans, measures of the national housing policy and an insufficient supply of rentable non-profit and for-profit real estate. These circumstances led to a 10 to 15% yearly growth in the prices of dwellings. The rise in prices of dwellings also had a stimulating effect on the growth of GDP, since housing construction, other than including the greatest number of different building firms, also affects the growth of other sectors of economy (Grižinič, Hribar Milič, 2009). The GDP in Slovenia has been falling since the last quarter of 2008. According to Institute of Macroeconomic Analysis and Development) forecast from February 2009, the actual fall in GDP this year will amount to 4%. The main reasons for this are the strongly aggravated circumstances in the international economic environment, which will above all affect the decrease in export and investment, i.e. the two key factors of economic growth in the past years. Due to the fall in foreign demand, a significant reduction in goods export is anticipated. Also expected is a drop in construction investments and investments in machinery and equipment (Internet source 1).

In Norway in the period between 2000 and 2006 (Internet source 3), the market prices for an appartment in a block of flats increased by approximately 65%, but the increase in building cost was only 26%. For small houses the price increased by 53% and the cost by 22%. In 2008 the prices fell by approximately 14% for blocks and approximately 9% for small houses.

1.3 Supply and demand for dwellings

According to the Real Estate Transactions Database, Slovenia has been undergoing a period of decreased volume of real estate transactions since the second half of 2007, especially with regards to dwellings, which is the consequence of the effects of the global crisis on the Slovene economy, as well as the current circumstances in Slovenia in capital and financial markets and the economic crisis. Data obtained from the database of real estate transactions show a steep fall in transactions in the first quarter of 2008 (dwellings –29 % compared to the previous quarter and family houses as much as –58 % compared to the previous quarter, and –44 % or –58 % compared to the first quarter of 2007). By the end of the third quarter of 2008, the fall in realised turnover with real estate had deepened still in comparison to the previous year. The total number of registered transactions, i.e. the turnover of real estate in the last quarter of 2008 has been the lowest in the last two years, since it has been systematically registered in the Real Estate Transactions Database (ETN 2009). The falling trend in the number of transactions for dwellings and family houses between 2007 and 2008 is shown in Figure 1.

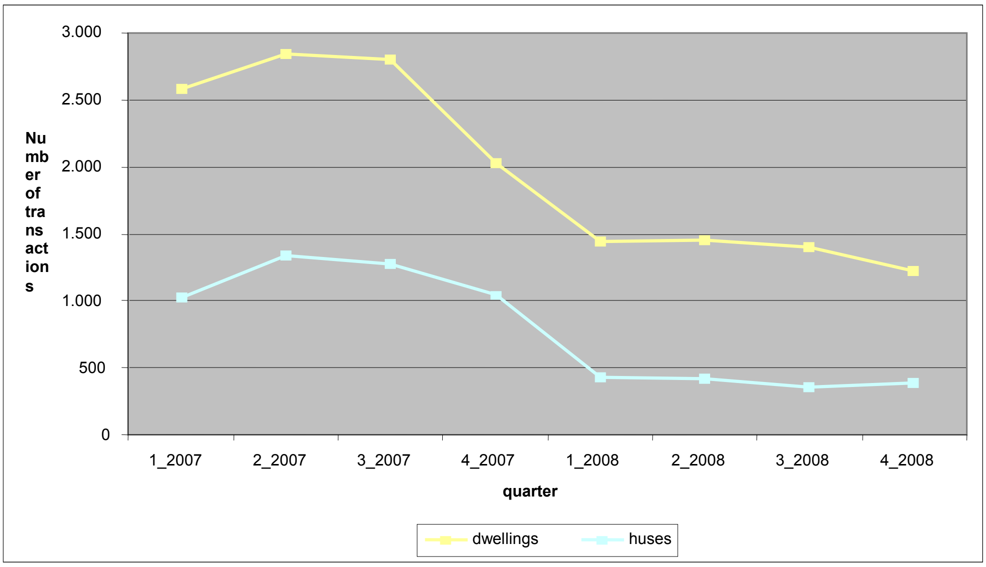

Figure 1: Number of real estate transactions in 2007 and 2008 - *s*ource: Real Estate Transactions Database, Surveying and Mapping Authority of the Republic of Slovenia (RETD)

Prices of real estate in Slovenia stopped growing in the middle of 2008. The prices for pre-owned real estate were too close (almost identical) to the prices of new real estate. Data shows that the average actual price per square meter of dwellings in Slovenia in the last quarter of 2008 fell by 2% in comparison to the third quarter, and grew by 5% in comparison to the last quarter of 2007. The average actual price for a family house in Slovenia in the last quarter of 2008 fell by 23% in comparison to the third quarter and by 6% in comparison to the final quarter of 2007. The transaction price for a family house in the final quarter of 2008 reached the level of the price in the second quarter of 2007 (ETN 2009).

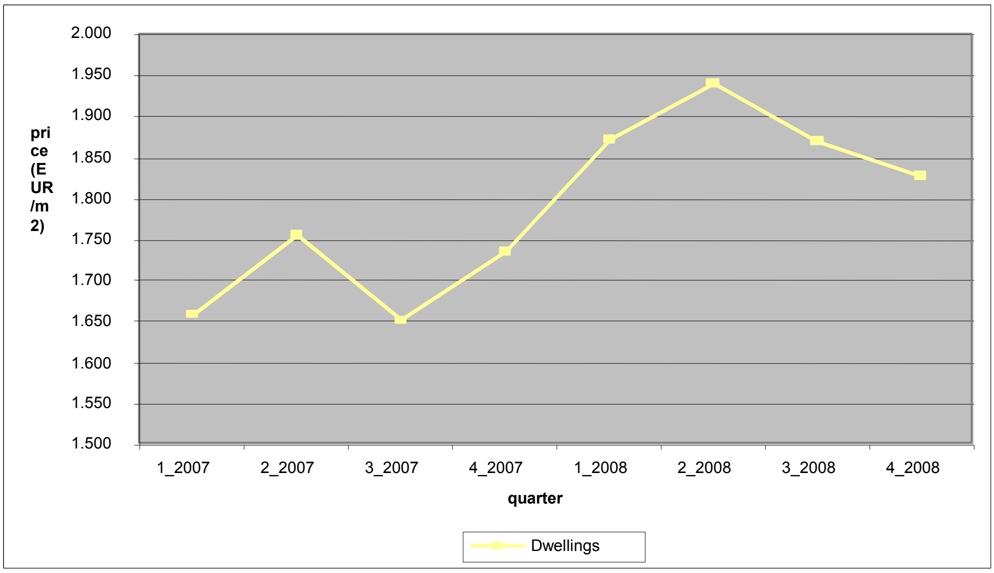

Figure 2: Price movements for dwellings in 2007 and 2008 - *s*ource: RETD

The supply of real estate is too high compared with the demand as displayed by the rising number of unsold built dwellings and family houses. The Economic Chamber of Slovenia estimates that the finished and currently unfinished dwellings financed by legal entities have absorbed approximately €650 million of investors' resources (Grižinič, Hribar Milič, 2009). The demand is falling due to the lower income of the population, following the cooling down of the economy and the more expensive mortgage loans offered by banks and stricter conditions for their obtainment. Realistic expectations are that prices for real estate will continue to fall.

From December 2008 and up until December 2009 the number of new appartments has decreased by approximately 32% and the price has decreased by 1.5% in Norway (Bjorberg, 2008). In the same period, the cost has increased by 2%. This shows that the margin between price and cost has decreased. The value of construction work has also been falling. The value of these services for January 2009 was by 20,7 % lower than in January 2008. The value of construction work carried out on buildings has fallen by 29,8 % and by 10,2 % for civil engineering (Internet source 2). The atmosphere in the construction industry has worsened for the fifth month in a row. The extent of construction work has decreased, as well as the extent of total orders; providers of construction services have been lowering their prices continually for the last six months (Usenik, 2009).

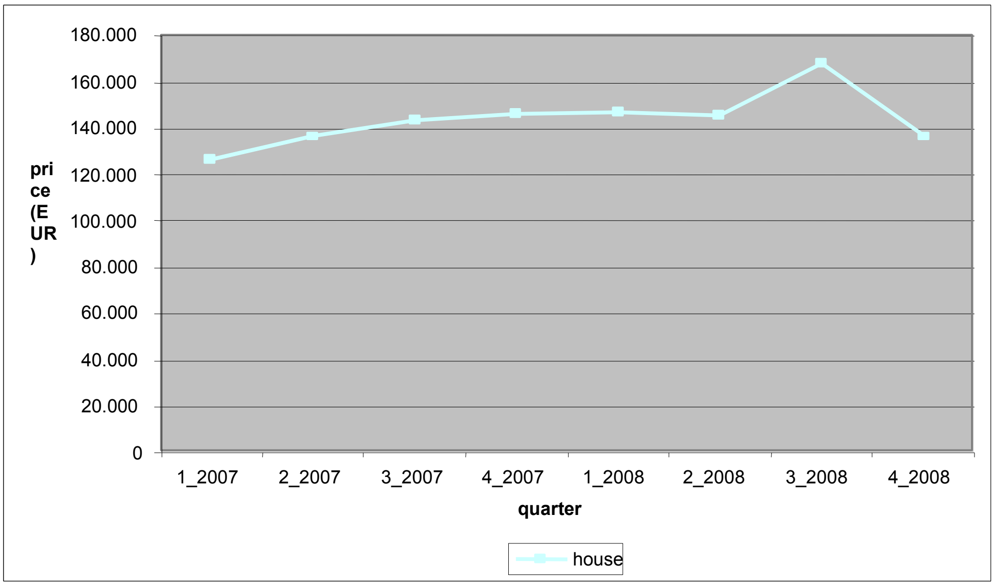

Figure 3: Price movements for family houses in 2007 and 2008 - source: RETD

2. Research

2.1 Research purpose and objective

The key purpose of this research is to build a model of the structure of sales price for commercial construction of housing in the time of economic crisis, in order to provide a potentially efficient response to the specific circumstances or requirements set forward by the economic crisis.

2.2 Research methodology and sample size

In order to achieve the objectives of the research, both qualitative (secondary data analysis and partially structured interview) and quantitative methodology (survey) were used. The method of secondary sources analysis was used for the research of the investment cost, which represents a significant share in the structure of the value of the investment project. With the aid of the database of real estate transactions, data on transactions with dwellings and price movements was obtained. The method of a partially structured interview was used for interviewing seven respondents: two real estate agents, a representative of the company managing sale and lease of real estate, representatives of three investment companies for commercial construction of housing and the manager of the Home for the Elderly. The method was used to obtain from real estate agents primarily the data on demand, supply and sales prices of standard dwellings, the influence of the economic crisis and location on the sales price of standard dwellings, demand for other real estate, such as sheltered housing for the elderly. Interviews with investment companies provided data on construction cost, pricing, advantages and disadvantages and potential tenants of sheltered housing for the elderly. The quantitative methodology of surveying was also used. The sample size included 56 respondents of different age groups living in the Dolenjska region. The method was used in order to obtain a greater amount of data on demand for sheltered housing for the elderly, the effect of the economic crisis on the financial resources of the applicants and data on age groups of the applicants.

2.3 Research results

The sales value of the investment project of commercial construction of housing is the sum of all the purchase prices paid for dwellings. The sales value consists of investment cost and the return or the anticipated profit of the investor. The investment cost therefore has a direct influence on the return and an indirect influence on the value of the project. Investment cost includes mainly the cost of material and services, as well as the cost of the purchase of the land for the construction building. The volume of these costs depends on the situation on the market. Investment cost was analysed on the basis of the data obtained from internal documentation (standards and experiential normative) of the investor or builder of the investment project of commercial construction of housing. A significant share of the structure of the investment cost is the construction of buildings and external works, which amounts to 65%. Obtaining and preparing land for construction, including the public utilities charge represents 19% and other costs 16%, of which approximately 3% is the cost for producing the project documentation. Investment cost is shown in the following Table 1.

The data on the number of transactions involving dwellings for 2007 and 2008 was obtained from the database of real estate transactions, according to which in the last months of the previous year the trend of further downfall of turnover started to settle down, whereas the first preliminary data for this year provide no basis for optimism regarding an imminent growth in market activity. The projections are that there isn't going to be a more significant growth in trade in real estate this year (ETN 2009). The supply of new and pre-owned standard dwellings has exceeded the demands, say the two interviewed real estate agents. All respondents claim that there is demand for purchase and rent of sheltered housing. The manager of the Home for the Elderly emphasised that the demand is registered and that a list of potential customers is compiled. The real estate agents estimate that there is a demand for building around 20 to 30 dwellings of this type a year, and that there is demand for the rent of this type of dwelling. If we take a look abroad, we can see that most member countries of the European Union have a smaller trend of owned housing, this holds true especially for Germany. It is to be expected that this trend will become typical in Slovenia, too. The survey results have shown that there is a majority interest for the purchase of sheltered housing (75% of the respondents). Exclusive interest for rent was expressed by 13% of the respondents.

Table 1: Investment cost

	Cost	*Share (%) in construction value (%)*	*Share in total cost (%)*
1	*Purchase and preparation of land for construction*	*29,1*	*19,0*
1.1	*Purchase of land*	*13,4*	*8,7*
1.2	*Detailed spatial plan*	*0,2*	*0,1*
1.3	*Public utilities charge*	*15,5*	*10,1*
2	*Producing the project documentation, geomechanic and land survey services and work supervision*	*5,2*	*3,4*
2.1	*Project documentation*	*3,3*	*2,2*
2.2	*Revisions*	*0,3*	*0,2*
2.3	*Geomechanic analysis and control*	*0,1*	*0,1*
2.4	*Land survey*	*0,3*	*0,2*
2.5	*Work supervision*	*1,0*	*0,7*
2.6	*Safety coordinator*	*0,3*	*0,2*
3	*Project financing, bank warranties and sale*	*8,0*	*5,2*
3.1	*Project financing*	*5,7*	*5,3*
3.2	*Bank warranties for elimination of defects*	*0,9*	*0,6*
3.3	*Advertising and sale*	*1,4*	*0,9*
4	*Other cost in the construction project*	*5,8*	*3,8*
4.1	*Construction insurance*	*0,3*	*0,2*
4.2	*Facility management cost*	*0,2*	*0,1*
4.3	*Obtaining consents and permits, contributions*	*0,9*	*0,6*
4.4	*Administrative and court fees, notary fees*	*0,2*	*0,1*
4.5	*Project risk and indemnities*	*4,3*	*2,8*
5	*Construction of facilities and external layout*	*100,00*	*65,3*
5.1	*Construction of facilities*	*90,7*	*59,3*
5.2	*External layout*	*9,3*	*6,1*
6	*Indirect cost of the company and engineering services*	*5,0*	*3,3*
TOTAL INVESTMENT COST		*153,1*	*100,00*

By comparing the supply and the demand on the real estate market we have established that the supply of standard dwellings is exceeding the demand. In line with the trend of demographic movements there is an increasing demand for housing for the elderly, concretely for the purchase of sheltered housing. This type of housing has not yet been built in Novo Mesto. If customers decide to lease the purchased sheltered housing because of the future benefits as well as the high investment cost, and assuming that the trend for rental dwellings in Slovenia will grow, there will be an offer of rental sheltered housing on the market later on. In this case those who seek to rent will have the opportunity to rent a sheltered dwelling in Novo Mesto.

The sales price per square meter of new sheltered housing was calculated by taking the anticipated average sales price per square meter of standard dwelling and modifying it appropriately. The supply for new standard one bedroom dwelling in Novo Mesto with the average size of 47 square meters was analysed. The sales surface is the surface modified by the correction factors for the intended use of dwelling. Sheltered housing typically includes one bedroom dwellings. The average advertised price per square meter of new one bedroom dwelling was calculated as the average of five advertised prices of similar dwellings at three different locations of newly constructed housing. We were told by the real estate agents that the advertised prices are by 5% higher than the actual sales or transaction prices. Considering that according to the projections made by the Institute of Macroeconomic Analysis and Research, the performance of national economy will decrease this year, this will lead to a further fall in the sales price of real estate. It is therefore estimated that the average anticipated sales price per square meter of new standard dwelling is by 10% lower than the average advertised price of a new standard dwelling per square meter.

Results of the SWOT analysis were also taken into account when determining the sales price. Sheltered housing includes technically adapted dwellings for the elderly, which are typically in the vicinity of the Home for the Elderly. Persons entitled to reside in this type of housing are persons under institutional care, which includes all people over 65 years of age. The advantage of sheltered housing is that they are technically adapted to the elderly, which means that they must meet special technical requirements in terms of the size of rooms and equipment; they must have an emergency device which provides 24-hour a day care and other services to the residents. These dwellings are used for the transitory period of relatively independent and active elderly persons before their accommodation in the Home for the Elderly. It is therefore important that architects place this type of dwelling in the immediate vicinity of Homes for the Elderly. The disadvantage of these dwellings is that not everyone can reside in them, which consequently provides less actual clients. The building of sheltered housing is currently considered to be a market niche, which, however, is of a short-term character. A fall in the demand for the purchase or rent of sheltered housing is to be expected when the Act on Long-term Care and Insurance for Long-Term Care enters into force (planned for 2012). The aim of this Act is to encourage the elderly to reside at home for as long as possible by distributing financial help for this type of residence. Should the economic crisis deepen, this help could stimulate the decision for the elderly to live at home. The risk of the investment project of commercial construction of housing is also that the Real Estate Fund of Pension and Disability Insurance could build subsidised sheltered housing which could lead to negative circumstances in leasing commercial sheltered housing. It is important to see sheltered housing together with homes for the elderly so both can use the health service connected to the Home. Services such as health care, meals, laundry, cleaning etc can be provided by the Home in accordance with the needs and demand from the elderly people in sheltered houses. Renting sheltered houses is also important because the authorities cannot afford the investments in the long run.

Taking into consideration the SWOT analysis and the results obtained by the interviews with the investors of commercial construction, the sales price for new sheltered dwelling per square meter was determined by modifying the anticipated sales price of new standard one bedroom dwelling per square meter by 10%. The value of the project is the sum of all the purchase prices for sheltered housing. The purchase price is calculated as the sales price of sheltered dwelling per square meter multiplied by the sales surface of the dwelling. The return or the expected profit of the project is the difference between the value of the investment project and the investment cost. The research has shown that the return of the project is 5% (non-discount value) of the value of the project. The actual profit depends on the effectiveness of the project. The profit can rise if the value of the projects rises, too, or if investment cost falls.

SINTEF-Byggforsk (2007), Norway, studied the effectiveness / productivity in 122 building projects in relatively comparable blocks of flats during the period from 2000 to 2005. If full effectiveness is said to be 100%, the investigated projects were at 79%. At the same time it is said that 100% effectiveness is impossible to achieve. Eight among fourteen important parameters are directly linked to project management. SINTEF-Byggforsk (2008) concluded that 5% of the turnover is due to repair and improvement caused by building failures and damages. A better way to execute the quality control is urgently needed. The same percentage is also found within planning and design. At the same time the project focused on how to achieve the appropriate quality in buildings (Bjørberg S 2008). Among several improvement areas, the main conclusion was the need for better quality control. This, among other inputs, has resulted in a revision in the Building Act. The main change is the introduction of obligatory quality control by a third party. This demonstrates that there is potential in better planning / design together with project management.

3. Conclusion

A significant share in the structure of the sales value of the project of commercial construction of housing is represented by the investment cost, in our example 95%. The research established that the level of this cost depends on the influence of the circumstances on the market. Investment cost represents primarily the cost of material and services. Due to the crisis, the cost of construction, which amounts to 65% of all cost, has fallen by 7%. This is primarily due to the fall in the price of iron and fuel which leads to lower price of all machinery and transport services. The lower cost of salaries decreases the cost of labour and the indirect cost of the company and engineering services. Contracted construction companies are prepared to perform their services (construction and installation) at on average a 10% lower price. Next to materials and services, purchasing the land for construction represents 9% of the investment cost. As for the majority of products, the sales price for land is determined by the market. The crisis has decreased the demand for housing, leading to a decreased investment in construction building by builders. The lower level of investment is also affected indirectly by business banks' stricter conditions for distributing loans for construction. Due to the fall in investment and the demand for the purchase of construction land, the prices of land have generally fallen. In Slovenia they started to fall in the second quarter of 2008 for 9% or 5%.

Decreasing investment cost is the consequence of the negative factors in the performance of the national economy that is generally measured by the level of GDP. Negative macroeconomic indicators have an indirect influence on the sales price of real estate. The supply for dwellings started to fall rapidly at the end of 2007. The accessibility of housing loans has diminished in the first half of 2008 due to the influence of the financial crisis; the relatively high rate of inflation and the growth of the effective interest rate have lowered the purchasing capacity of the population. It is typical for the Dolenjska region that the customers financed the purchase of real estate mostly by selling securities of the local company Krka, whose value of stock has fallen by more than 63% in one year. It is a fact that the demand for dwellings has fallen, and the supply of newly constructed dwellings has increased due to the finished construction projects stimulated by economic growth. In the time of crisis, it is important that companies, besides increasing internal efficiency by cutting down production cost, search for new markets and products and adapt them to the current circumstances in order to maximize the profit. Given the fact that the standard dwellings market is oversaturated, new products that will be attractive to customers must be provided.

On the other hand, Slovenia is facing a rapidly growing share of the third generation, which is the result of the increasing lifespan of the population. According to Eurostat projections, in 2005 over 15% of the population in Slovenia was over 65 years old; by 2050 this number is estimated to increase to 31%, which represents a 100% increase (Strategy of the Care for the elderly, 2007). In 2007 in Norway approximately 12% the population was over 67 years and by 2050 it is estimated that this number will increase to 21% (Statistics Norway Internet source 3). The Ministry of Labour, Family and Social Affairs in Slovenia is governing its policy regarding these matters on the basis of five-year strategies of care for the elderly. For the field of housing policy, these include the measure to secure as many sheltered dwellings as possible in order to provide suitable residential environment for the elderly. To investigate the effect of the economic crisis, market research was carried out in Slovenia in April 2009, prior to starting an investment project of commercial construction of housing. The research has shown that due to the changed conditions in the indirect environment the content of the project must be modified to fit the actual circumstances and requirements of the market.

The construction of sheltered housing in Novo Mesto represents an efficient response to the crisis. Sheltered housing is a product for which there is currently demand on the Novo Mesto market. The obtained data shows that there is, firstly, demand for the purchase of sheltered dwellings, since most customers will purchase the dwelling as an investment. In the second stage, a supply of commercial rental sheltered dwellings will appear on the market.

On the basis of the research and the results of the SWOT analysis, a model of the structure of the sales price for sheltered housing was compiled, by taking into consideration the influence of the investment cost and the influence of the indirect environment in the time of the crisis. The sales price for sheltered dwellings in Novo Mesto was set at 10% higher than the average sales price of standard newly-constructed housing. The market analysis was used to determine the expected sales price for newly-constructed real estate, which is by 10% lower that, the currently advertised prices. It seems sensible to advertise the sales price for sheltered housing somewhat higher than the actual value, since customers have become used to negotiating for the price.

If a company wishes to provide an efficient response to the specific requirements set forth by the economic crisis, it must lower its profit. The model of the structure of the sales price for sheltered dwellings in Novo Mesto was built by anticipating only a 5% profit, despite the 7% drop in investment cost. The construction of housing facilities and the external layout represent 62% in the structure of the value of the project. There are two opportunities for maximising the planned profit: decreasing the investment cost or increasing the sales price. As for the majority of products, the price of real estate is determined by the market. Economic theory teaches that the sales price of a product is determined by the intersection of supply and demand on the market. We therefore have no influence on increasing the sales price of real estate, but can work towards decreasing the investment cost. There is the need to increase effectiveness / productivity in execution of construction work through a greater emphasis on early planning / design phase and project management. By cooperating more actively with the architects and consulting engineers, the investors can respond to the changed market conditions in terms of design and function, and at the same time oversee the cost rationalisation and the quality of the housing.

We know that demands regarding functionality will change over time. In that respect the early design phase should incorporate issues like adaptability to meet future needs and not only current demand. Most people will think that this will lead to higher cost but this is predominantly a way of thinking, i.e. what building elements should be changed.

When designing sheltered housing facilities it is important that architects locate them in the immediate vicinity of Homes for the Elderly. In line with the strategy for the care of elderly by 2010, one of the goals of the housing policy is to design housing facilities for the elderly and neighbourhoods so that they are adapted to contemporary architectural trends, that they integrate to a maximum extent the needs for movement and other needs of the elderly, people with disabilities and all other categories and that they, on the level of spatial planning, stimulate the socialising of the elderly and the young at all levels. The new neighbourhoods should be designed as intergenerational and with different content, thus increasing the quality of harmonic coexistence of different generations.

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Property Linked Forecasting of Construction Activity

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Abstract

Forecasting of construction activity is mostly based on actual market information in terms of initiatives, design orders, land acquisition, building permits, construction orders and so on. This type of analysis is insufficient to forecast the (trend of) construction activity in the long run. The aim of this research is to provide a framework for modelling and forecasting non-residential construction activity (macro and sectoral). This is done by flow-stock-trend analysis.

The economic approach of the investment for expansion is based on the development of the production of an observed economic sector and of the economy as a whole. This is confronted with analysis based on the physical growth of the sectoral stock (in square meters or otherwise) and on the growth of the sectoral stock as production and accommodation capacity. Moreover with the growth on base of the use of the sectoral stock (employees in offices, scholars in schools, and so on). Future renewal of the building stock depends on the life time structure of the present building stock and on the future requirements in terms of needed facilities in relation with economic, social, environmental and technological development. The choice between replacement and refurbishment will heavily be influenced by the urge for the most sustainable production and use of built environment. Fortunately, the recent crisis encourages a shift from a downcycling scenario for the built environment into an upcycling scenario.

In The Netherlands and elsewhere the growth of non-residential building activity – especially for the Commercial Services sector (offices, shops, warehouses and others) - was booming in the nineties, followed by a downfall in the years 2001-2005. The recovery after 2005 ends with a general downfall in the years 2009-2011. After the actual crisis non-residential building activity will recover. Exceptionally, the need for construction activity is strongly growing in the Health care sector, this in relation with a growing shortage of facilities for an ageing population. Future growth of construction activity for the non-profit sector is weak and limited by financial conditions. Private investment in non-residential buildings collapses in the short run and the trend will become slightly upward on a lower level.

Keywords: forecasting, construction activity, building stock, property, flow-stock-trend analysis

1. Focus and objective

This research focuses on the past and future capital formation of buildings in terms of the annual investment and of the total stock over the years. The main research question is how better scientific and social information about the capital formation of buildings – about flows, stock and trends- has to be obtained and how this contributes to forecasting.

The need for more property –for extension of the building stock- is driven by a combination of population growth and economic growth. Nowadays the buildings stock originating from the sixties and seventies is object of investment for renewal. In the early 21st century population growth and economic growth are weakening. The social economic context of building activity has completely changed since the sixties. The economic approach of the investment for expansion of the building stock is based on the development of the production of an observed economic sector and of the economy as a whole.

2. Analysis of capital formation

Since J.M. Clark (1917) presented his version of the acceleration between final demand and capital formation economists became familiar with the difference between capital formation for expansion and for replacement of the capital stock. Investment for expansion is linked to the development of an industrial capital stock and the embedded production capacity. Industrial buildings provide accommodation for man-machine-activity. Nowadays the industry – limited to the production of physical commodities – in The Netherlands produces 14% of the Gross Domestic Product. The Clark-concept has to be adapted to the specific characteristics of the service oriented sectors.

3. Approaches in forecasting non-residential construction

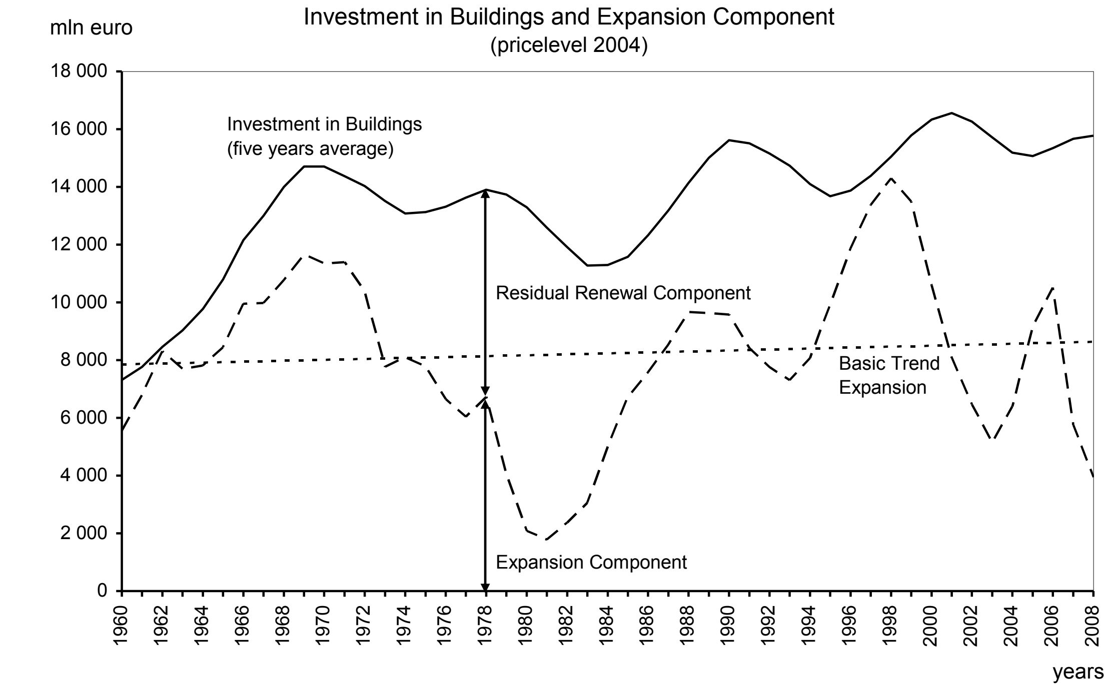
Analyzing and forecasting non-residential construction is difficult. The need and demand for new buildings and for refurbishment and repairs principally depends on the shortage of the available stock in terms of quantity (floor space) and quality (technical, physical and functional). The information available is much larger for the residential than for the more heterogeneous non-residential sector. Physical measuring of gross addition, replacement and withdrawal of the building stock is difficult and suffers from a lack of statistics. Measurement of stock is mostly done in monetary terms, but that hides valuation problems.

Roest distinguishes three methods:

- The integral approach. Then the need for construction activity is derived from the – on a certain moment in the future – (socially) required stock of buildings. For residential construction this traditionally is common use.

- The marginal approach. Then the need for non-residential construction activity is analyzed and forecasted as component of Total Gross Capital Formation (equipment included, and residential excluded). Hillebrandt (1974) argued that the confidence of this method for forecasting depends on a reliable forecast of industrial output and a reasonable apportion between “plant and equipment” and “buildings and works”. She warns for using this as the only method of forecasting (industrial) building activity.

- The complementary approach. Then the need and demand for non-residential construction is linked to residential construction and the apportionment between residential, non-residential and civil construction.



Sources: - CBS, Vijfennegentig jaren statistiek in tijdreeksen, 1899-1994 (annual changes 1948-1963)
- CBS National Accounts 1975 (data 1963-1969) and Statline (data 1969-2008)
- CPB (GDP growth 2009/2010)
- EIB (Construction Output 2009/2010)

Elaboration: DUT - RE&H Building Economics

Graph 1: Investment in buildings

In this study is fundamentally chosen for the integral approach. Due to a lack of statistical data about the building stock, the integral approach has to be combined with a marginal approach. On the macro level this is done by dividing fixed investment in buildings (the flow) in a component “Expansion” and a residual component “Renewal” (replacement, refurbishment and major repairs).

4. Macro forecasting of capital formation in buildings

Best regression for total investment in buildings in the period 1979-2004 is found as:

ΔINV.B. = 0.43 x ΔGDP_{t-2} + € 10,100 (euro's 2004)

With $R^2 = 0.794$ and 99% significance

Addition of real capital costs as second exogenous variable deteriorates the regression. GDP-growth is dominantly explanatory, but the investment effect has a two years lag and is since the nineties less intensive than the regression indicates. The base for modelling on regression is weak.

This led to an alternative approach (see also graph 1) to macro-modelling of INVestment in Buildings (INV.B):

$\text{INV.B.expansion}_t = f(\Delta GDP_t)$

$\text{INV.B.renewal}_t = \text{INV.B}_t - \text{INV.B.expansion}_t$

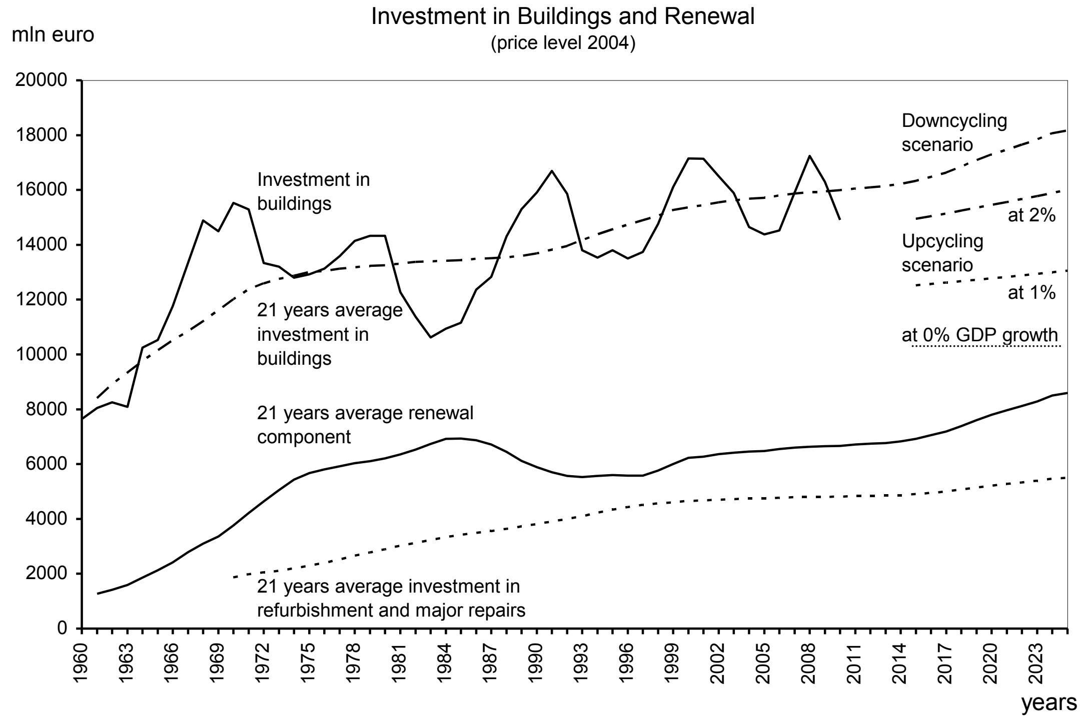
with: ΔGDP_t= smoothed GDP_t – smoothed GDP_{t-1}

INV.B_t and ΔGDP_t are smoothed inputs (5 years average).

This modelling is based on historical analysis of the building market relations. Extreme shortages of building supply were manifest in the early sixties and in the second part of the nineties. This is established in the model by accounting all investment in 1962 as investment for expansion. Furthermore – based on sector analysis – 95% of total investment in 1998 is allocated as investment for expansion. In the graph this modelling is rendered. The building stock grows from year to year with the investment for expansion. The investment for expansion is derived from – in accordance with the Clark-concept – the absolute increase of GDP, and is corrected for growing productivity of buildings. Net investment – normally defined as gross investment minus depreciation- is here defined as GDP-related expansion of stock. Within this concept Investment for Renewal is not equal to Depreciation of Building Stock. There is more depreciation than renewal because the depreciation of total stock is not completely covered by renewal activities. Due to technological developments and sectoral shifts in the production structure –from traditional industry to services- older buildings will fall outside the stock in use and outside the production capacity. The residual calculation of investment in buildings for renewal is rendered in the next graph as 21 years average and for the period 2000-2025 extrapolated on base of the relative growth of annual investment in buildings 25 years before.

In additional analysis the cumulative investment for renewal is compared with the original capital formation and that leads to a marginal circulation time of investment of circa 35 years in 2005. This implies that on average after 35 years investments are done –in the divergent mix of replacement, refurbishment and major repairs on divergent moments- that equal the original investment for expansion (+ a third of investment for renewal 35 years before). A substantial part of investment for renewal is investment for refurbishment and major repairs. The difference between total investment for renewal and investment for refurbishment and major repairs is indicated as replacement by new buildings.

After a first peak in the early seventies non-residential building has a cyclical loop with an overall top in 2001 (see graph 2). The strongest dip was in the early eighties. At that time investment shrunk heavily. In the meantime the economic growth diminished and the nominal interest got above 10%. The Dutch economy suffered from an international economic crisis and from a financial crisis. The government budget deficit grew and this led to a growing government debt and an increasing interest on that debt. Direct and indirect labour costs got higher and became an obstacle for growth of export of goods and services. The balance of payments (export minus import) nevertheless did not create further problems because the Dutch economy has an export surplus from growing natural gas export in combination with rising energy prices since the seventies. From 1983 on a rapid growth of non-residential building was part of a broad recovery of the Dutch economy. A better control and a strict limitation of the government deficit and debt and of labour costs contributed to growing economic initiatives and capital formation by the market sector.



Sources: - CBS, Vijfennegentig jaren statistiek in tijdreeksen 1899-1994 (annual changes 1960-1963)
- CBS National Accounts 1975 (data 1963-1969)
- CBS Statline (data 1969-2008)
- EIB (Construction Output 2008-2014)

Elaboration: DUT - RE&H Building Economics

Graph 2: Investment in Buildings and Renewal

After 1995 especially office construction was booming until 2001. This links further with the growth of investment in ICT (computers, databases, software). After 2001 Investment in buildings declined and revived in the period 2006-2008.

Total investment in buildings is registered as the upper line in graph 2 and the dotted line is the 21-years average. This line is forecasted for the period 2000-2025 as the sum of the investment for renewal line and the basic trend of the investment for expansion. This determination of total investment is labelled as Downcycling Scenario, because investment in new buildings in the last decades was higher than what was strictly required as addition of stock. In practice this is expressed by high vacancy of office buildings (nearly 14% in 2009) and dysfunctional and vacant other buildings and built areas.

Market allocation tends to overinvestment in new buildings, especially in the nineties when high economic growth was combined with low capital costs. Recent decline –due to the world wide financial and economic crisis in 2008 and after- creates the conditions for an alternative scenario. This is introduced in graph 2 as Upcycling Scenario.

The quantitative base of this scenario is steady 2% GDP-growth after recovery from the actual crisis. This has to be combined –within a normative scenario for a sustainable investment policy- with less investment in new buildings, a more intensive use of the existing stock and a shift from downgrading and withdrawal to upgrading of the building stock.

Long run zero growth would mean that –on base of regression on past investment- that investment in buildings would collapse to about 10,000 mln (euro's 2004), and would reach the 1983 level. The approach here is limited to trend analysis and trend forecasting. The year-to-year development of investment in buildings requires more information behind the conjunctural deviation of the trend.

5. Sectoral decomposition of capital formation in buildings

In a first decomposition the macro capital formation in buildings is split up in four economic sectors (see graph 3).

Since the nineties Industry and Agriculture are less important investment sectors in terms of buildings. Commercial Services definitely became the most important sector and investment in this sector increased due to a shift from investment in owner-occupied buildings to commercial development & lease.

The table and the graph show that investment in buildings in the nineties is driven by a growing Commercial Services sector. After 2001 the decline is tempered by again growing investment for the Budget Sector, especially for Health care and Education.

Table 1: Output Growth & Investment Peak Buildings 1989-200

Source: CBS/EIB, elaboration DUT Building Economics

Sector	*Peak Absolute Output Growth (5 years smoothed)*	*Corresponding 5 years average (%)*	*Investment Peak in Buildings (5 years smoothed)*	
			year	*in prices 2004*
Agriculture	*1990*	*+5,4%*	*1990*	*€ 1,70 bln*
Industry	*1998*	*+2,4%*	*1990*	*€ 3,20 bln*
Commercial Services	*1998*	*+6,0%*	*2001*	*€ 8,40 bln*
Σ Market Sector	*1998*	*+4,6%*	*2001*	*€ 12,05 bln*
Σ Budget Sector	*2001*	*+2,3%*		
Σ Total Economy	*1998*	*+4,0%*	*2001*	*€ 16,55 bln*

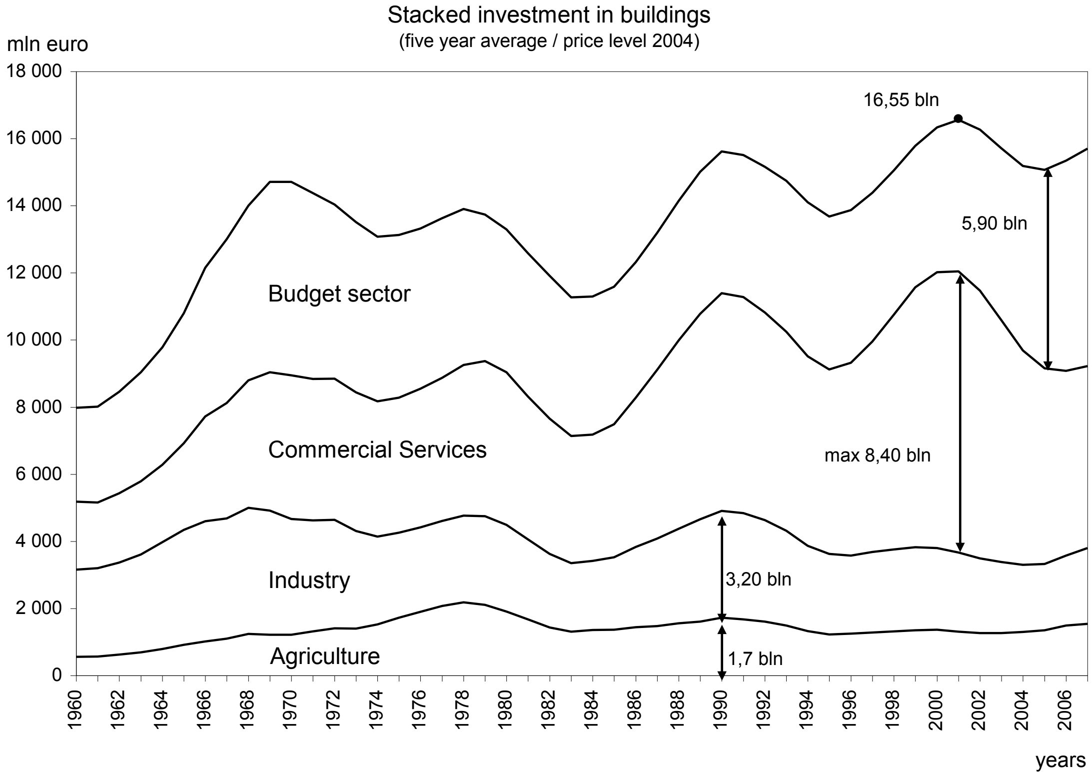
The first sector is Agriculture. Investment in buildings in this sector (mostly barns & sheds) lost importance in the eighties and in the nineties. Recent investment is mostly for renewal and is economic and technological driven.

The second sector is the Industry. Since the sixties economic activity shifted from industry to services. Traditional industrial sectors -like Textile- mainly disappeared. Others like Chemicals and Food became of more importance. Capital formation in industrial buildings gradually declined, with an ICT-linked revival in the eighties. The investment in renewal is market and technology driven.

The third sector -the Commercial Services- became the most important sector, also in terms of capital formation. This sector embraces Trade, Hotel & Catering, Transport, Storage & Communication and Financial & Business Services. Capital formation in this sector is including Commercial Development & Lease of office buildings, is including Buildings for Retail & Leisure and Commercial Development & Lease for Industry and Trade. In the period 1960-2000 the annual capital formation quadrupled. In the peak period 1999-2001 circa 45% of all building activity for the Commercial Services sector was commercial office development.

The fourth sector –the Budget Sector- consists of Health care, Education, Government and Non-profit services. In relation with demographic developments capital formation for Education became less important in the seventies and is nowadays mostly dependent on investment for renewal. Health care also lost importance in the seventies and eighties, but is nowadays a sector with growing need for investment in relation with an ageing population and its need for health care.

The principle of macro valuation and forecasting of the building stock, based on replacement value, is applied in the next modelling and calculation for the period 1988-2025



Sources: - Ministry VROM (construction output 1960-1980)
- CBS / EIB (construction output 1981-2009)

Elaboration: DUT - RE&H Building Economics

Graph 3: Stacked investment in buildings

The valuation of the 1988-2005-growth of the Sectoral Building Stock is based on analysis of the annual absolute growth of the sectoral output (in terms of Gross Added Value). In 1990 all investment in buildings for Agriculture is allocated as investment for expansion. The same is done for the Industry and the Commercial Services sector in 1998 and for the Budget sector in 2001. Sectoral investment for expansion in the other years (1989-2005) is interpolated on the base of annual output growth and stacked. The whole Stock of Buildings ultimo 1988 is valuated as:

$$\text{Building Stock}_{1988} = GDP_{1990} \times SSIE_{1989\text{-}2005} / (GDP_{2007} - GDP_{1990})$$

$$= € \ 288 \text{ bln (prices in 2004)}$$

SSIE = Stacked Sectoral Investment for Expansion

The Sectoral and Total Stock of Buildings ultimo 2005 of €442 bln is the sum of the 1988-Stock and the Expansion 1989-2005. In the period 1989-2005 total renewal varies from 26% of the Industrial Stock of Buildings to 48% of the Commercial Services Stock of Buildings. The average is 33%. The high percentage in the Commercial Sector is influenced by intersectoral replacement. Former owner-occupied buildings in the industrial sector and in the budget sector are replaced by new buildings, which are now leased from Commercial Developers & Lessors, and listed under Commercial

Services. Moreover the huge development for the free market in earlier years contributed after 2001 to a high vacancy of second hand (office) buildings and underutilization of existing industrial and commercial plants.

6. Macro forecasting building stock 2005-2025

The problem of valuation and forecasting in monetary values is that it hides the constructional and functional diversity of buildings. The prices per square meter invested in offices, hospitals and schools are a 5 to 10 fold of the price of a square meter glass house.

Statistical information about square meters per type of building is only available based on macro registration of building permits. The following table with the Typology of Building Stock in Use 2005 is constructed by combination of:

- Σ Building permits 1990-2004 in square meters gross floor area per type. (Source: CBS)
- The sectoral division of building permits 1996-2000 per type. (Source: CBS)
- Sectoral Output & Employment Growth 1991-1996-2005. (Source: CBS)

Table 2: Estimated Building Stock in Use 2005

Estimated Stock in Use 2005 (in mln square meters Gross Floor Area per ultimo 2005)	*Barns & Sheds*	*Glass Houses*	*Industry Buildings & Ware houses*	*Shopping Stores*	*Offices*	*Schools*	*Others*
Agriculture	*70*	*105*					*5*
Industry			*81*		*6*		*3*
Transport & Communication			*18*		*2*		*3*
Trade & Catering			*38*	*26*	*2*		*10*
Financial & Business Services			*26*		*33*		*3*
Health care					*1*		*24*
Education						*20*	*13*
Government			*2*		*12*		*12*
Non-profit			*5*		*2*		*13*
Total (535 mln)	*70*	*105*	*170*	*26*	*58*	*20*	*86*

- Additional information about 1991-1996-2005-development of stock of cattle, stock of glasshouses, stock of shops, stock of offices, beds in hospitals, number of scholars and so on. (Various sources)

- Pre-1990 information about sectoral investment and building permits per type, to correct for the historical structure of the nowadays building stock. (Source: CBS)

The resulting total floor areas are indicative.

After 1995 more detailed Sectoral Output, Employment and Investment information is available and applicable. In table 2 and 3 the Commercial Services are split in three subsectors: Transport & Communication, Trade & Catering and Financial & Business Services. The Budget Sector is split in Health care, Education, Governance and Non-profit Services. The investment for expansion in the period 1996-2005 is for the market sectors - like before - determined on base of sectoral output growth. This is completed for the Budget Sectors by calculation on base of employment growth in the distinctive sectors, which is in that sector the primary determinator of output growth.

Table 3: Macro Forecasting Building Stock (Downcycling Scenario)

Macro Forecasting Building Stock (in bln euro)	*Ultimo 1995*	*Expansion 1996-2005*	*Ultimo 2005*	*Expansion 2006-2025*	*Ultimo 2025**
Agriculture	*40*	*4*	*44*	*9*	*53*
Industry	*75*	*16*	*92*	*32*	*123*
Transport & Communication	*19*	*9*	*28*	*13*	*41*
Trade &Retail/Hotel & Catering	*46*	*16*	*62*	*34*	*96*
Financial & Business Services	*46*	*16*	*62*	*30*	*99*
Σ Commercial Services	*111*	*48*	*159*	*77*	*236*
Health care	*33*	*14*	*46*	*39*	*86*
Education	*27*	*5*	*31*	*8*	*40*
Government	*25*	*5*	*31*	*8*	*39*
Non-profit	*30*	*8*	*39*	*10*	*48*
ΣBudget Sectors	*115*	*32*	*147*	*64*	*211*
Total Economy	*342*	*100*	*442*	*182*	*624*

** Ultimo 2025 is given without disinvestment correction.*

The expansion in the period 2006-2025 is based on the expectations of future output growth:

- Agricultural investment for expansion is low, with a slight progressive growth-trend.

- a constant growth-trend –with tendency to decline- of investment for expansion by the Industry, the Transport & Communication sector, the Trade & Catering sector and the Financial & Business sector.

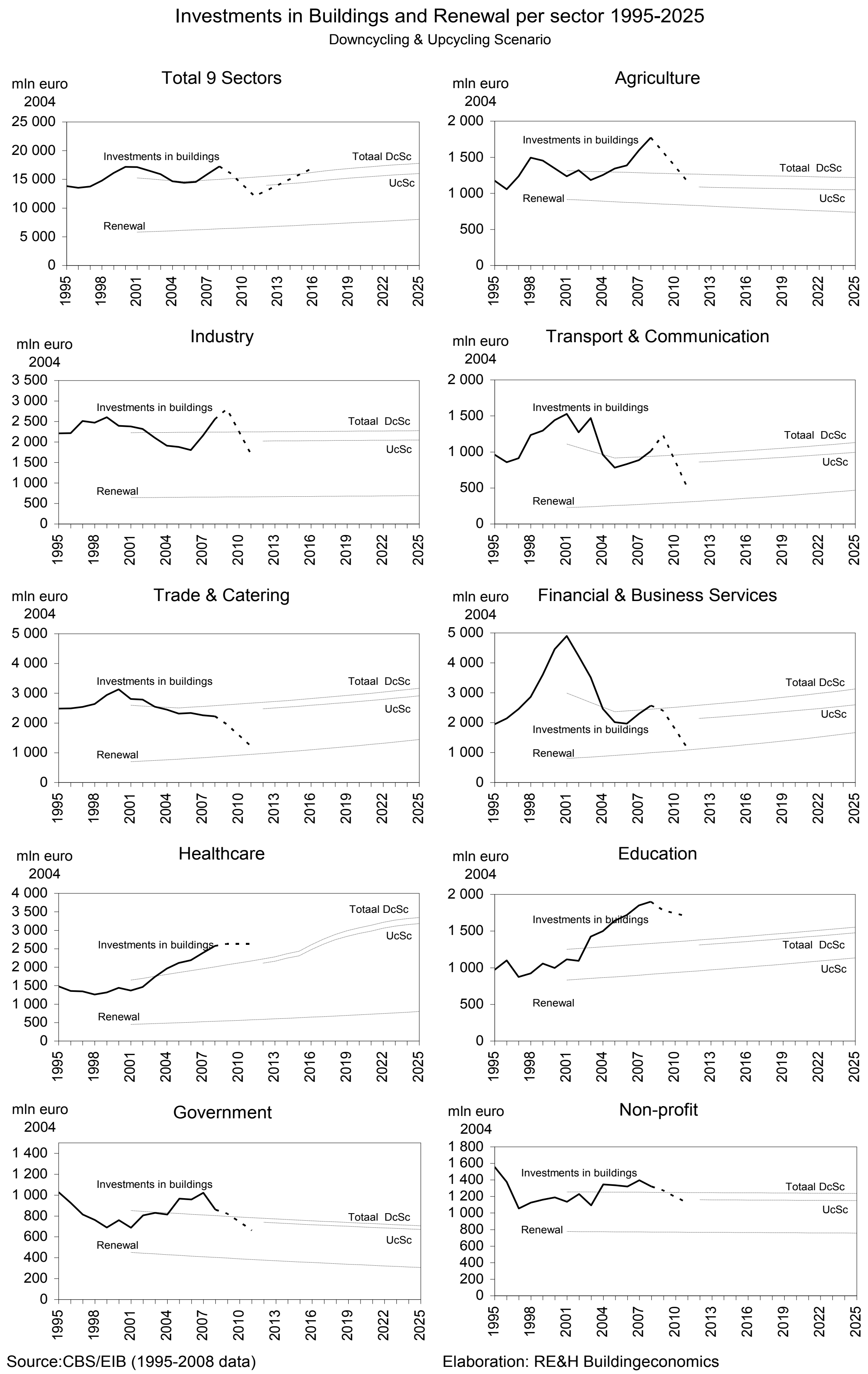
- a constant growth-trend –with tendency to decline- of investment for expansion by the Budget Sector. Exceptionally the need for investment for expansion in the Health care is growing in relation with an ageing population.

This macro forecasting of the Building Stock is based on continuation of the 1995-2005-expansion pattern, with general tendency to over-investment in new buildings for expansion and replacement. This is labelled as the Downcycling Scenario. The investment for renewal is based on actually indicated renewal and growth of annual investment in the eighties and the nineties. After the 2008 financial crisis and the ongoing economic crisis a structural decline in the investment trends must be expected.

7. Sectoral capital formation 1995-2025

The year-to-year Capital Formation 1995-2008 is split into five market sectors and four budget sectors. The Total of 9 Sectors (graph 4) equals the Investment in Buildings in graph 2. The dotted lines reflect the expected total investment per sector (expansion and renewal). The DownCycling Scenario is based on the economic investment conditions in the period 1995-2007. Based on construction data and the National Accounts 1995-2007 sector figures are constructed (graph 4 (solid lines), be aware of the differences in scale of the vertical axis). In additional analysis trends based on sectoral production links are compared with trends based on physical indicators (for instance stock in square meters) and with trends based on functional indicators (for instance office employment x square meters per fte).

The stock of buildings is permanently in transition due to a thrive for economics of scale and rising productivity, in relation with embedded ICT investments and due to a shift of economic activity within the sectors agriculture, industry, commercial services and non-market and shifts between these sectors. All individual sectors have in common a high demand for modernization by replacement and renewal refurbishment and major repairs. In terms of investments in buildings Agriculture and Industry became shrinking sectors. A slight growth of total agricultural production does not encourage further growth of total investment in buildings (barns, sheds, glass houses and so on). Most future investment is for modernization and for a more sustainable agricultural sector. The industry invests in growth of especially the food and chemical industry. Other parts of industrial production are declining. New investments are related to a combination of new industrial technologies, embedded ICT-investments and a more sustainable production.



Graph 4: Investment in buildings and renewal per sector

Investment in new buildings -to replace existing production capacity- prevails. Advanced new production processes are facilitated with rather rational designed new production halls. Commercial services nowadays claim roughly half of the investment in non-residential buildings. Around 2000 the investment was a fourfold of the investment in the early sixties. The Commercial services embraces: Trade, Hotels & Catering, Transport & Communication and Financial & Business Services.

In this sector the investment activity is related to growing production and distribution activity in relation with ICT and logistics. Commercial services and especially office buildings are most volatile under the stagnating economic growth after 2000. Investment for replacement is becoming more important.

Health care has a growing investment activity due to an ageing population. Further growth of investment is to be expected. In recent years Education gets a new priority, this in relation with higher social requirements for knowledge and job training. The need for growing investment in buildings for health care is derived from increasing growth of the 65+ population. The turning point of the 65+ growth is about 2015 and in the 75+ growth about 2025. The latter is reflected by an up to 2025 growing need for investment in buildings. Government and other non-profit is not growing because of less non-profit services and less government-linked jobs.

Due to the financial and economic crisis the economic conditions for investment are expected to change radically and a downward shift of the long run investment trend becomes a real possibility. This is established in analysis and forecasting as the Upcycling Scenario. In this Upcycling Scenario the lower investment levels fit with a more sustainable investment scenario, with longer building cycles and less investment for replacement.

The conjunctural development of sectoral investment in buildings is represented by solid lines 1995-2008. The recent financial and economic crisis leads to an investment collapse in the years 2009-2011. The dotted forecasts for this years are the consequences of the economic decline. Total investment in buildings recovers after 2011 (Upcycling scenario).

8. To conclude

After an historical peak in 2001, the Dutch development and construction market became more volatile. Decreasing growth of population, stagnating growth of the working population and lower economic growth characterise the present and coming decades. Consequently, demand for non-residential building activity depends more and more on modernisation, replacement and concentration of the stocks of office, industrial, commercial, public and other buildings. Economic growth has a strong influence on investment in buildings. Future investment in buildings is otherwise heavily depending on the renewal of the stock. Investors, developers and construction firms need a strategy for dealing with the structural shift, conjunctural volatility and growing risks of operations on the real estate market and its different segments.

Investment growth is concentrated in the health care sector, due to expansion of demand in relation with an ageing population. Further growth of refurbishment and repair is in accordance with a more sustainable building strategy, but finally restricted by a limited labour capacity in the construction sector.

After a long period with attractive financial conditions the relations between revenues, costs, finance and returns on investment become more critical. This is strengthened by the actual financial and economic crisis. The recent financial and economic crisis offers an opportunity for transition of the investment process into a more social-efficient and sustainable growth and adaptation of the stock of buildings. In the long run the non-residential construction market is characterised by a slight upward trend. A downfall of demand and production in the next years will be followed again by a growing urge for replacement and renewal of the non-residential stock of buildings.

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Construction and Economic Growth in Developing Countries of Africa: Evidence from Data of the Last Thirty Years

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Abstract

The role of construction in economic growth and development has been addressed by various writers and international bodies, many of whom have focused in developing countries. The main aspect derived from a seminal work in this field (Bon, 1992) is that there is a changing development pattern of the construction industry based on the stage of development of a country's economy. That is in the early stages of the economic development, the share of construction in gross domestic product (GDP) increases but ultimately decreases in industrially advanced countries. That finding was consistent with the classical approach in growth theory in which physical capital formation is the main engine of economic growth and development. Using most recent data spanning the last thirty years or so drawn from the United Nations (Yearbook of National Account Statistics: Main Aggregates and Detailed Tables) and World Bank publications (World Development Report and Africa Development Indicators), the results of the study corroborate, in the main, the assumptions of a previous work that posit that in the developing countries of Africa, the positive relationship between construction and the national economy concerns only a downturn economy, and an in an economic upward trend the pattern of the construction sector (measured as a share of value added in national output) tends to follow *pari passu* that of the rest of the economy.

Keywords: Africa, construction sector, developing countries, economic growth

1. Introduction

Development is the most important challenge facing human race (World Bank, 1991). Development and economic development are relatively recent pursuits of many writers from various research centres worldwide as well as international organisations. The majority of the international bodies to promote development, such as national development banks, The World Bank Group and agencies of the United Nations Organisation, all have been established since World War II. Since then economic policies urged on developing countries have produced significant progresses in many parts of Asia and Latin America. Regarding Sub-Saharan Africa, Lopes (1998) pointed out "most of the countries are not just standing still: for the last fifteen years they have been moving dramatically backwards". Although some successes have been noticeable in a significant number of countries, it is still the development pattern of the majority of Sub-Saharan African countries (see Fig.1).

Historically, the construction industry has been linked with the process of industrialisation and development. Railways systems and canals played an important role in the connection of different regions of Europe, North America and in some parts of Latin America (Rostow, 1963). Transport infrastructures facilitated trade and co-operation between countries and also the diffusion of technical innovations from the most advanced to the less advanced areas of the globe. The construction industry played a key role in the reconstruction of the war-ravaged Europe. The heavy programme of construction of improvement of housing and social infrastructure, beside its contribution to the national output, was also a reflex of a better re-distributive economic policy in Europe post World War II.

With regard to the relationship between construction and economic growth, Turin (1973) and Wells (1986), using cross-country comparisons, both found an association between construction investment and economic growth. That finding was consistent with the classical approach in growth theory in which physical capital formation is the main engine of economic growth and development. Bon (1992), in a longitudinal study covering the period 1970-1985, and in a worldwide perspective, presented an inverse U shape pattern of the development of the construction industry where in the latest stages of economic development, construction output tends to decrease not only relatively bur also absolutely.

In the aftermath of the 1979-980 oil-shock and the international financial crisis that followed in 1981, most of Sub- Saharan African countries experienced until the late 1990s a decreasing growth in per capita national income, despite heavy investment in construction and other physical capital over the preceding decade. Following the *Structural Adjustment Programme for Africa* that started in the mid-1980s, World Bank (1994) took the view that rather the quantity of infrastructures the main concern in developing countries should be the improvement of the quality of infrastructures. Thus, it is reasonable to argue that this would be achieved through an adequate maintenance of existing infrastructure stocks and by prioritising investments that modernise production and enhance international competitiveness. Lopes (1998), discussed the role of construction in economic development of countries in Sub-Saharan Africa. The development patterns of construction and related sectors were modelled based upon data from the period 1980-1993 and a sample of 15 countries comprising two different patterns of growth in that period. It was argued that construction and the national output grow at the same rate only in a declining economy, and that in a growing economy, the volume of construction, typically, should not grow faster than the rest of the economy

The remaining of this paper presents the statistical sources and the indicators of the economic activity chosen for the analysis. Secondly, it presents data on the measures of national output and of the construction industry in the developing countries of Sub-Saharan Africa. Next, it analyses the pattern of development of construction investment in two groups of countries in that region according to their stage of economic development: Low Income Countries (LICs) and Middle Income Countries (MICs). A concluding remark finalizes the analysis.

2. Statistical sources and methodology of data collection

The main statistical sources used in this analysis are the 1998 edition of the *Yearbook of National Account Statistics: Main Aggregates and Detailed Tables* from the United Nations, *Africa Development Indicators 2008-2009* and *World Development Report 2010* from the World Bank. The internet site of the UN statistical office presents data on gross domestic product (GDP) and its components both in the expenditure and production approaches. This publication presents various sets of economic series detailing the evolution of GDP and its components in different statistical formats over the long period 1970-2006, both in the world, world regions and countries: at current prices in national currencies; constant 1990 prices in national currencies; current prices in US dollars; constant 1990 prices in US dollars: The indicators of economic activity analysed are: GDP and construction value added (CVA). Unfortunately, data on gross fixed capital formation in construction (GFCFC) are not provided in the UN publication. Thus, CVA is used as a proxy for analysing the evolution pattern of construction investment across the Sub-Saharan African region. As construction value added is roughly a half of GFCFC, it appears reasonable that CVA can be used as a surrogate measure of construction investment. In order to facilitate international comparison as well as for aggregation purposes, constant 1990 prices in US dollars are used: With respect to the investigation of the relationship between the construction sector and economic development according to a country's (group of countries) stage of economic development, gross national income (GNI) per capita for the bench mark year 2008 has been chosen. This is provided by World Bank (2009). *The World Development Report 2010* presents the following definitions. Income Group: The economies are divided according to 2008 GNI per capita. The groups are: low income countries (LICs), US$ 975 or less; lower- middle- income (LMICs), US$ 976-3,855; upper-middle-income (UMICs), US$ 3,856 - 11,905; and high income countries (HICs), US$ 11,906 or more. Data on the evolution of economic and development indicators in the period 1980-2006 stem from the *Africa Development Indicators 2008-2009*.

3. Data

As referred earlier, the indicator used as a proxy for construction investment is construction value added. CVA is calculated the same way as in any other sector, but includes only the activities of the construction activity proper. For example, it excludes the building materials industry which is accounted in the manufacturing sector. The main indicator of economic activity used in this study is

GNI per capita. It adjusts the growth in the economy with the growth in population, thus it is a better economic indicator of welfare.

Using data adapted from the *UN Yearbook of National Accounts Statistics* (United Nations, 2008 internet edition), data are presented for the share of construction in gross domestic product (at constant1990 US$) for the period 1980-2006. GNI per capita is presented for the year 2008. The evolution of basic indicators both of Sub-Saharan Africa as a whole as well as excluding two important economic players of that region (South Africa and Nigeria) are presented for the period 1980-2006.

Cross-matching sources, data is available for 45 countries and these can be split into two groups according to the level of GNI per capita in 2008. Tables 2 and 3 and Figs. 1 and 2 illustrate these two groups: Group I - low income countries (LICs); Group II- middle income countries (MICs). Thus Group II comprises both LMICs and UMICs, and only Equatorial Guinea could, in theory, be considered a HIC.

Table 1: Gross Domestic Product in Sub-Saharan Africa in 1980-2006, real

	Constant prices (2000$)				*Average annual growth (%)*		
	1980	*1990*	*2000*	*2006*	*1980- 1989*	*1990- 1999*	*2000- 2006*
SSA	*593*	*532*	*508*	*580*	*-1.0*	*-0.6*	*2.2*
SSA exclud. South Africa	*371*	*339*	*332*	*368*	*-0.9*	*-0.3*	*2.6*
SSA exclud. South Africa and Nigeria	*348*	*331*	*323*	*379*	*-0.3*	*-0.2*	*2.3*

Table 2: GNI per capita and Share of CVA in GDP (%) for Selected Years (Group I)

Countries	*GNI per capita current US$ (2008)*	*CVA/GDP (1980)*	*CVA/GDP (1990)*	*CVA/GDP (2000)*	*CVA/GDP (2006)*
Benin	*690*	*3.65*	*3.11*	*3.56*	*3.91*
Burkina Faso	*480*	*2.90*	*4.67*	*5.05*	*5.49*
Burundi	*140*	*3.29*	*3.35*	*4.37*	*3.11*
C. African Rep.	*410*	*1.77*	*2.81*	*2.57*	*2.97*
Chad	*530*	*1.02*	*1.69*	*1.32*	*1.31*
Comoros	*374*	*9.39*	*3.17*	*5.38*	*6.01*
Congo, D. Rep.	*150*	*3.65*	*5.00*	*3.27*	*4.24*

Gambia, The	*390*	*4.86*	*4.51*	*4.05*	*4.77*
Ghana	*670*	*3.30*	*3.30*	*3.48*	*3.56*
Guinea	*390*	*10.23*	*10.20*	*11.49*	*12.41*
Guinea-Bissau	*250*	*13.71*	*9.99*	*6.76*	*10.63*
Kenya	*750*	*3.74*	*2.92*	*2.66*	*2.53*
Liberia	*170*	*3.89*	*3.33*	*2.07*	*3.45*
Madagascar	*410*	*1.69*	*1.11*	*1.45*	*2.83*
Malawi	*290*	*6.81*	*4.96*	*3.84*	*5.10*
Mali	*580*	*2.00*	*2.91*	*5.14*	*4.92*
Madagascar	*410*	*1.69*	*1.11*	*1.45*	*2.83*
Mauritania	*840*	*3.42*	*4.78*	*6.27*	*8.95*
Mozambique	*370*	*9.65*	*5.19*	*8.40*	*7.37*
Niger	*330*	*2.63*	*2.45*	*2.30*	*2.55*
Rwanda	*410*	*6.82*	*6.78*	*7.97*	*9.18*
Senegal	*970*	*2.82*	*3.29*	*3.94*	*5.13*
Sierra Leone	*320*	*3.31*	*2.12*	*2.07*	*3.96*
Tanzania	*430*	*3.57*	*4.76*	*6.84*	*7.81*
Togo	*400*	*5.84*	*5.14*	*4.44*	*5.20*
Uganda	*420*	*3.51*	*4,84*	*6.39*	*7.58*
Zambia	*950*	*2.71*	*2.56*	*2.15*	*3.40*
Zimbabwe	*340*	*3.88*	*2.86*	*2.22*	*0.86*

Table 3: GNI per capita and Share of CVA in GDP (%) for Selected Years (Group II)

Countries	*GNI per capita current US$ (2008)*	*CVA/GDP (1980)*	*CVA/GDP (1990)*	*CVA/GDP (2000)*	*CVA/GDP (2006)*
Angola	*3, 450*	*4.64*	*2.92*	*2.73*	*3.45*
Botswana	*6,470*	*9.11*	*7.28*	*5.88*	*5.13*
Cameron	*1,150*	*6.92*	*4.59*	*3.57*	*3.58*
Cape Verde	*3,130*	*10.39*	*11.92*	*8.47*	*8.76*
Congo, Rep.	*1,970*	*7.23*	*2.99*	*4.44*	*5.01*
Cote d'Ivoire	*980*	*3.63*	*1.79*	*4.04*	*3.29*
Djibouti	*1,130*	*4.19*	*9.62*	*5.89*	*6.84*

Equatorial Guinea	*14,980*	*7.25*	*4.51*	*3.05*	*3.38*
Gabon	*7,240*	*5.70*	*6.71*	*6.37*	*6.54*
Lesotho	*1,080*	*9.63*	*14.69*	*13.84*	*12.45*
Mauritius	*6,400*	*5.74*	*5.62*	*5.88*	*5.96*
Namibia	*4,200*	*6.51*	*2.30*	*2.33*	*3.20*
Nigeria	*1,160*	*3.90*	*1.69*	*2.14*	*2.40*
Seychelles	*10,290*	*9.26*	*4.79*	*8.51*	*9.14*
S. Africa	*5,820*	*3.82*	*2.98*	*2.29*	*2.62*
Sudan	*1,130*	*5.56*	*6.04*	*5.01*	*5.00*
Swaziland	*2,520*	*5.84*	*2.49*	*6.39*	*6.70*

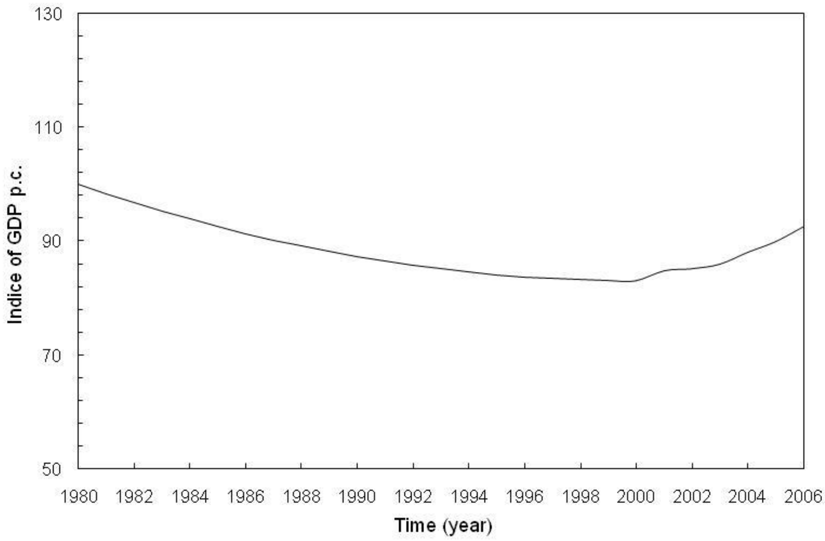

Figure 1: Indices of GNI per capita in Group I (mean average; 1980= 100)

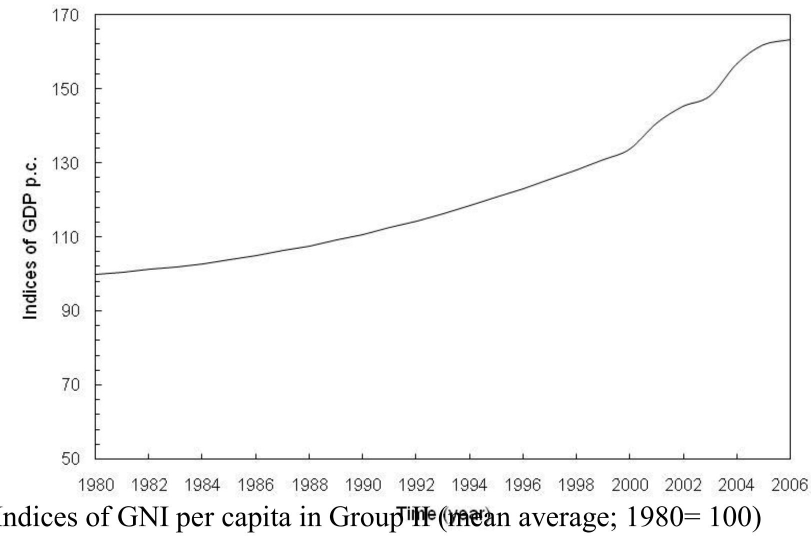

Figure 2: Indices of GNI per capita in Group II (mean average; 1980= 100)

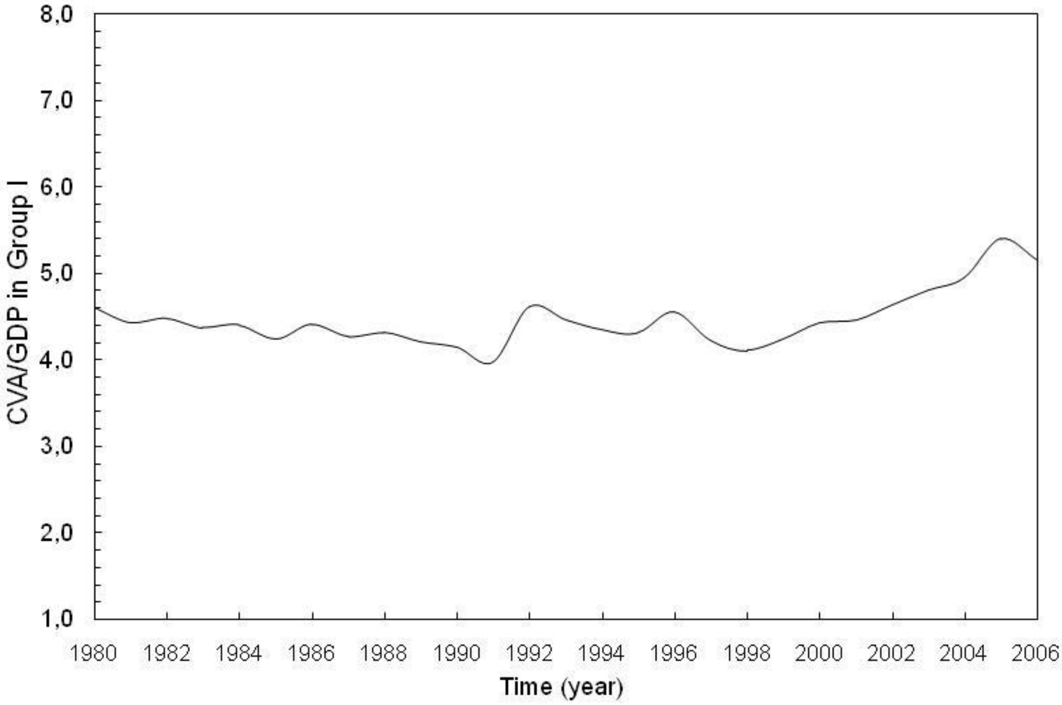

Figure 3: Evolution of the Share of CVA in GDP (%) in Group I (mean average)

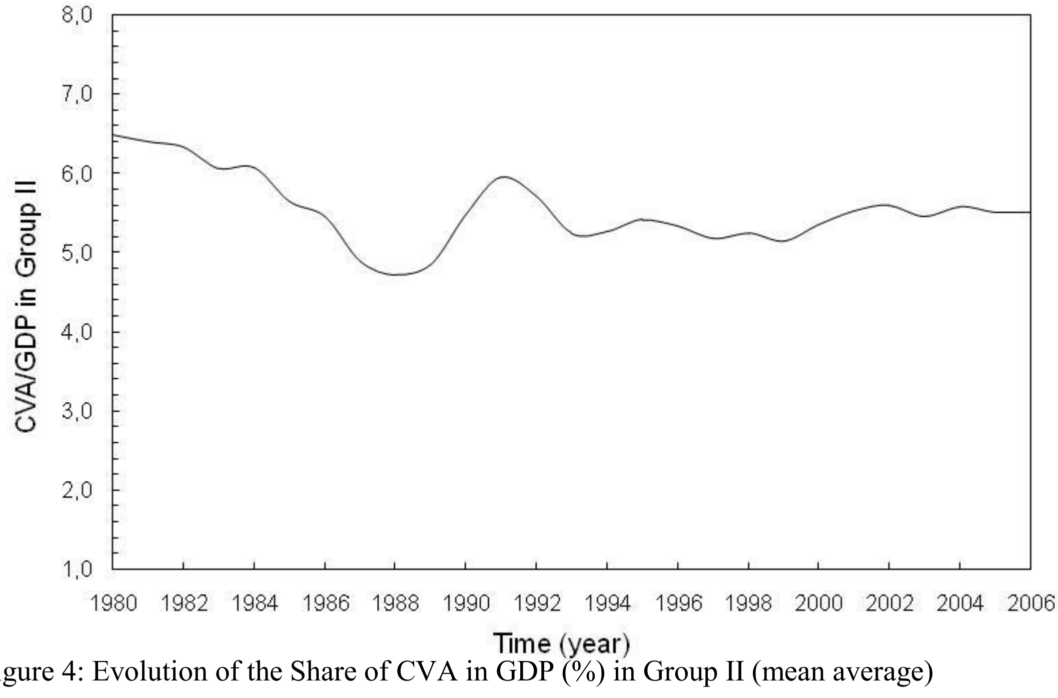

Figure 4: Evolution of the Share of CVA in GDP (%) in Group II (mean average)

4. Analysis

Table 1 shows the evolution of GDP per capita in Sub-Saharan Africa as well as that of Sub-Saharan Africa excluding South Africa and Sub-Saharan Africa excluding South Africa and Nigeria. The division shown in Table 1 is a reflexion of the clout those two countries represent for the Sub-Saharan African economy: The former because is by far the most populous country in the region and the latter for its unmatched industrial structure and technological development that makes it the economic pole of Sub-Saharan Africa. It can be seen that both the region and its subdivisions, in terms of GDP per capita, experienced a decreasing growth in the period 1980-2000 and a reasonable upturn in the period from 2000 onwards. This is in line with the evolution illustrated in Fig. 1. The low income countries (LCIs), as a group, experienced a dramatic decreasing growth in the period 1980-2000 and a rate of growth (annual average) of almost 2% in the period 200-2006. The striking aspect worthy of note concerning Group 1 is illustrated in Fig.1: GNI per capita in the LCIs in 2006 (group average) was lower than that in 1980. On the other hand, the countries comprising Group II (MICs) grew slightly in the period 1980-2000 (annual growth rate of about 1%) and notched up a spectacular rate of growth (more than 4% in terms of annual average) in the period 2000-2006. As illustrated in Fig. 2, GNI per capita in Group II in 2006 was about 1.65 times as that of 1980.

Now looking at the relationship between the construction sector and the national economy, it is shown from Tables 1 and 2 and also Figs 1 to 4 that the evolution pattern of the share of CVA in GDP in the developing countries of Africa is markedly different according to the stage of economic development. The share of CVA in GDP in the low income countries (Group I), despite differences across countries as well as taking into account annual fluctuations, varied, in general, from 4% to 5% of GDP .as is illustrated in Fig.3. In terms of the evolution in the period, the share of that indicator was in line with the development pattern of GNI per capita: decreased in the period 1980-1990, remained practically stagnant in the period 1990-2000 and grew reasonably in the period 2000-2006. It is worth of noting that in the late years of the period, the share of CVA in GDP was higher than that of the early years of the same period. That is, in the first stages of economic development, and in an increasing growth pattern, the construction industry tends to grow faster than national output. Conversely, in an economic downturn, the industry tends to decrease not only absolutely but also relatively. Regarding the middle income countries (Group II), Table 3 and Fig.4 show that the share of CVA in GDP varied, in general, from 5.0 % to 6.5% in the period 1980-2006, also disregarding differences across countries as well as annual fluctuations. Figs 2 and 4 also show that a small increase in GNI per capita corresponded to a fairly significant decrease in the share of CVA in GDP in the period 1980- mid 1990s. From then onwards, the share of construction in GDP remained practically stagnant at around 5.5% of GDP. The pattern experienced by the MICs is worthy of note: despite a significant increase in national income per capita, particularly in 2000-2006, the share of CVA in GDP in the late years of the period did not reach the value accounted in the beginning of the period. These results presented here seem to corroborate those of a previous work concerning the developing countries of Africa (Lopes 1998) that found that the association between the construction sector and the general economy is consistent only with a declining economy.

5. Concluding Remarks

The picture that emerges from the analysis suggests that the share of construction in gross output tends to increase with the level of per capita income in the first stages of economic development. When countries reach a certain level of economic development, the construction output will grow slower than national output in the latest stages of their recovery. That is, it decreases relatively but not absolutely. Thus, it is reasonable to assume that when a certain level is achieved (say the share of CVA in GDP at around 5% - 6% - it depends upon the year taken as base and the currency used) and countries enter into a period of sustained economic growth and development, the construction output tends to grow, in general, with the same rate of growth as that of the general economy.

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Construction Cost Claims, or Entitlements?

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Abstract

When submitting cost claims arising from variations and additional works as well as for entitlements for loss and expense due to disruption, prolongation and delay, contractors oftentimes encounter the perennial problem of having their legitimate claims being summarily rejected or denied. The source of this predicament can be multi-fold, and are usually due primarily to the lack of understanding by the contracting parties of the rudimentary and contractual principles governing such claims and entitlements. This paper will explore some of the salient issues that contractors, clients and consultants should be aware of when handling such important claims and entitlements.

Keywords: legitimate cost claims; contractual *quantum meruit*, disruption, prolongation, delay claims; contractual procedure

1. Introduction

A contractor‟s claim is often defined as “a legitimate request for additional compensation (whether in cost or time) on account of a change in the terms of the contract”. Invariably, most if not all, building construction projects will involve valid cost claims arising from not just variations and additional works, but also from other cost entitlements and compensations contractually allowed for under the relevant provisions in the contract. Ultimately, a contractor‟s objective in being conscientious in submitting such claims for compensation is to obtain adequate and equitable relief for such costs directly or indirectly incurred; which in reality he is entitled to a reasonable compensation under the law of contract, if not under common law.

Unfortunately, most consultants and developers are most wary of, and understandably averse to, the ubiquitous “claims conscious” contractor and his sneaky or frivolous practices in advancing unmeritorious claims or profiteering ploys by exploiting the many loopholes in the contract documentation. It is important therefore, for all parties to be able to distinguish between such legitimate claims from those dubious ones, and this requires a good grasp of the fundamental principles governing the procedure and assessment of such entitlements.

2. The building contract

Most sizeable building construction contracts are based on either bespoke or standard forms of contract, usually replete with provisions where the contractor, under given circumstances, is required to make the necessary application to the contracts administrator before he is entitled to extra payment and compensation. We shall examine a few common ones.

2.1 Valuation for variation orders and official instructions

Legitimate claims for payment due to valid variation orders and official instructions are hardly ever the contention of dispute or disagreement, as the contractors and quantity surveyors would normally comply with and follow the well established prescribed submission and assessment procedures encapsulated in the terms and conditions governing the works. Instead, it is beyond those straightforward remeasurement and valuation of the variations, where there may be other incidental entitlements to their cost claims submitted by the contractor, that can pose some challenges in terms of substantiation and assessment. The valuation of variations for these design revisions, variation and additional works regularised under the official proforma of an instruction or variation order are normally dealt with using the following regime.

2.1.1 Bills of quantities and schedule of unit rates

When the variations instructed at such time and locality can be readily absorbed into the regular progress of the works on the same basis of commercial profitability, the unit rates in the Bills of

Quantities or Schedule of Unit Rates are usually used for valuation purposes. Sometimes, this scenario differs slightly, and some incidental costs are incurred that ought to be compensated, and that is when contractors start facing difficulty convincing the certifier that they are entitled to such additional payment. Despite prevailing contract provision, it is still not easy for the contractor to succeed on submitting an adjustment on the unit rates for similar materials but which by reason of material increase or decrease, or its sequence of ordering or location, or postponement, or any resultant dislocation or other special physical or technical circumstance, which will in essence differ in cost or commercial profitability or working methods from the original scope of works priced at the time of tender.

And then there may be additional preliminaries of expenditure which need to be allowed for in the light of the quantities or time of instruction. For instance, varied works sanctioned when the original scope of works have already been completed, and all site facilities and equipment fully de-mobilised, would obviously require fresh materials to be procured under new terms, and incurring additional preliminaries to re-mobilise all resources to execute the additional quantum of works. Such intangible costs are not easy to substantiate, to produce invoices and records, but are nonetheless genuine and direct costs incurred by the contractor. The usual defence relied upon by the certifier is when the contract is based on unit rates which are deemed to be fixed and applicable throughout the duration of the contract, and not subject to adjustment by reasons of inflation or whatever. Hence the contractor is compelled to absorb the cost differential under these circumstances.

2.1.2 Pro-rated unit rates

Where the varied work is of similar character to work described in the contract, but not executed under similar conditions, or involves significant changes in the quantity of such work, the contracted rates may be used as a basis for valuation, but with a fair allowance for any differences in such conditions or quantity. However, it is not always the straightforward approach of using extrapolated means to adjust the unit rates for the varied work and evaluated arithmetically proportionate to the original scope of works; since allowance must also be taken for the adjustment for the quantities, varied site conditions, and of course the additional preliminaries of expenditure that need to be accounted for as well.

When the varied work involving some material is say, half the size in dimensions of the similar work described in the contract, it is not always necessary that the unit rate for the supply and installation would therefore logically be half the amount of the similar work described in the contract. This is because the scope and extent of resources involved to execute the varied work may actually be the same, if not more, than the original scope of work described in the contract.

2.1.3 Commercial market rates

Sometimes called actual prime cost rates, or star rates, these are used for varied works where there are no contract rates available, with allowance made for material, transport and labour and a standard percentage for profit and attendance including site preliminaries. This form of claim is usually based on strict proof before assessment by the certifier. Sometimes daywork rates are used to substantiate other piecemeal work, in situations where there are no comparable contract rates available. There are varying approaches for dealing with such prime cost daywork rates. One such option is based on a percentage addition, which uses the traditional method of pricing labour in daywork, and allows for a percentage addition (ranging from 10 to 15 percent) to be made for incidental costs, overheads and profit, to the prime cost of labour applicable at the time the daywork is carried out. Another method uses an all inclusive daywork rates, which includes not only the prime cost of labour but also includes an allowance for incidental costs, overheads and profit. The all-inclusive rates are deemed to be fixed for the period of the contract. However, where a fluctuating price contract is used, or where the rates in the contract are to be index-linked, the all-inclusive rates can be adjusted by a suitable index in accordance with the contract conditions.

Other important considerations include the length of contract, whether the contract is fixed, firm or fluctuating price, or whether the costs are to be index linked, like to a professional body that periodically publishes a number of cost indices for the various trades and activities. However, there is no exact objective and scientific approach towards the management, evaluation and assessment of such daywork rates. This is because such daywork rates are not contingent on the varying worker‟s productivity, and subjected very much to the integrity of the claimant and the level of supervision on the actual works done. Therefore the employer can effectively render an open cheque to the contractor for unbridled claims if they are not adequately monitored or controlled; whilst the contractor on the other hand may encounter stiff resistance from the certifier in allowing claims based on daywork rates, or rather on the number of manhours submitted to carry out a parcel of work valuated using such daywork rates.

2.2 Loss and expense claims

The repercussion of late site possession; late issuance of information or instruction or late nomination of a sub-contractor or supplier; suspension of works; tests and examinations instructed by the contract administrator; or even late response on review and approval of shop drawings and submissions for material procurement; etc., is that the contractor‟s regular progress is unduly and adversely affected as a result. Under contract law, and unless expressly instructed to expedite the works, the contractor is only contractually obliged to exercise reasonable measures to mitigate any incurred delay and to prevent delay to the completion of the works. He can reschedule his programme or change his sequence of works, but only when the implementation of such measures will not incur unnecessary additional costs to him. Beyond that, when the regular progress of the works occurs which cannot be mitigated without incurring costs, the contractor must contractually be entitled to be compensated accordingly. Therefore, contract provisions exist to compensate the contractor for such costs sustained or incurred and for which the contractor would not otherwise be reimbursed by any other provisions of the contract. These entitlements include such loss, expense, costs or damages of whatsoever nature and howsoever arising as a result of the regular progress, sequence of works or methods of construction having been disrupted, prolonged or otherwise affected by such valid compensable events. This policy of recognising the contractor‟s entitlement to such claims is to circumvent the acts and omissions by the employer and employer‟s agents, which would otherwise be constituted as a breach of contract, and rendering the contract voidable.

The valuation of the physical quantum of the variation works arising from such instructions would naturally not have captured such direct costs incurred. Though theoretically and contractually entitled to the recovery of such costs, the claims are never easy to quantify, let alone substantiate. The heads of claims under this category include all direct relevant costs of labour, plant and materials, or goods actually incurred; all site overheads and costs actually and necessarily incurred; and including a standard percentage for profits, head office or other administrative overheads, financing charges and any other costs, loss or expense of whatsoever nature and howsoever arising.

Claims for head office overheads are always subjected to dispute. In the case of *JF Finnegan v Sheffield City Council*[1], Sir William Stabb QC sitting as the Official Referee noted:

"It is generally accepted that, on principle, a contractor who is delayed in completing a contract due to the default of his employer; may properly have a claim for head office or off-site overheads during the period of delay, on the basis that the work-force, but for the delay, might have had the opportunity of being employed on another contract which would have had the effect of funding the overheads during the overrun period."

The difficulty lies in substantiating claims for head office overheads, where the onus of proof is on the contractor to establish that other work was available which, but for the delay, would have been secured. Whether that means a potential tender that was shortlisted for award but subsequently declined by the contractor due to the non availability of available resources is never easy to prove. The contractor must also quantify the actual loss of contribution. Use of formulae, such as Hudson, Emden and Eichleay, to calculate such claims are usually met with varying degree of resistance by the courts, even though some courts were prepared to admit such approach.[2]

Also included, idling time for site resources, rescheduling or suspension of works, costs of inefficient working and changes to productivity, demobilisation and remobilisation of site equipment and facilities, resubmission of shop drawings and materials for approval, and such like. As an example, idling time is claimable only when actual site resources are being put on hold and on standby because of instructions requiring that the scheduled works are to be suspended or postponed. The problem starts when the contractor proceeds to channel and deploy the resources away instead of allowing them to stay idle. When that happens, the contractor is not allowed to claim costs for idling time by virtue of his exercising such diligence to mitigate delay!

When it becomes apparent that the disruption to the regular progress has taken place, it is usually a condition precedent to an entitlement to any payment that the contractor be required to comply with the contract provisions pertaining the notice and application of such claims, together with all relevant supporting particulars of the circumstances giving rise to the claim, failing which the contractor is

[1] (1989) 43 BLR 124 QB

[2] see *Whittal Builders v Chester Le Street District Council* (1987) 40 BLR 82

deemed to have waived his rights to such entitlement. To substantiate these claims, the contractor is expected to be efficient and diligent in keeping accurate, up to date, and verified contemporaneous site records of all the time and resources which are expended independently, exclusively and directly due to such circumstances which would contractually allow his entitlement of such recovery. He would be required to furnish complete and verified site records and detailed site diary; technical query sheets; proceedings of discussion and confirmation of instructions; daily site labour and equipment allocation; plus head office overheads, loss of profit and ancillary finance charges, just to name a few. These are not easy to upkeep, prove and quantify, or translate into manhours and costs, especially when the contractor is too caught up with mitigating the disruption and delay rather than diligently maintaining site records for this category. The onus of proof in showing all these causes and effects of such actual and direct loss and expenses incurred will always lie on the contractor complete with all his inefficiencies, laggardness and tardiness in maintaining contemporaneous records, thrown in for good measure.

The end result of such consequences is that, in the midst of the contractor"s urgency to complete the remaining works, and not to mention the seemingly high attrition rate of site quantity surveyors, such tabulation and compilation of claims are more often than not inevitably left on the back burner. Eventually, the contractor is compelled to be content with the barest entitlement of the costs amounting to the actual remeasurement of the variation works, without any possible contest to the forfeiture of his entitlement of costs for loss and expense.

2.3 Constructive instructions

Practically all projects large and small will encounter inevitable design revisions, variations and additional works which are insidiously or inadvertently sanctioned and ordered by the contract administrator or his representatives. These may or may not be regularised as official instructions under the ambit of the contract provisions which would enable the contractor to comply with the contract procedure to submit cost and time claims thereafter. Such design revisions, modifications and instructions constituting as variations may arise from on-site adjustments to suit design intent; design revisions made on shop drawings; other additional information and design modifications which are not otherwise provided; or are necessary in order to resolve some technical discrepancies, conflicts and omissions not otherwise reasonably foreseen at the outset; or else works which are necessary in order to comply with local authorities regulations and code of practice, so on and so forth. Note all these mentioned may not be arising from any changes sanctioned or requested by the employer.

The contractor is obliged to notify in writing to the certifier in a timely manner of such variations in order that they may be affirmed, rescinded, modified or contradicted in writing, before the contractor is entitled to any compensation. While it may be possible that the contractor"s failure to comply with the requirement for the provision of notification and information might potentially deny him the entitlement to additional costs arising, it is still deemed inequitable that the contractor could be exposed to liquidated damages as a result. This would mean that the employer was effectively being paid for delay that he had caused.

In the event that the contractor duly notifies the contract administrator with due diligence; and inspite there being no official instruction to confirm the variation, proceeds to carry out and complete the additional works, such variations and additional works would be deemed to be „constructive instructions".[3] The usual problem that the contractor would face in this scenario is when the certifier would reject the claims based on the premise that there had been no official instruction from the architect or employer in writing, in standard or official proforma, to sanction such instructions; hence the certifier is purportedly not empowered to assess and allow such claims. The contractor is logically entitled to be compensated for the works based on „contractual *quantum meruit*", commercial market rates, or reasonable sum basis, since such works are carried out under the existing contract based on the acceptance and compliance of this instruction.[4]

2.4 Constructive acceleration costs

The concept of constructive acceleration is that the contractor is not being granted or being unjustifiably denied an extension of time that he ought reasonably to have received due to valid and excuseable delay which are not caused by his own default or breach; and due to the implied contract term, or express instruction by the contract administrator to complete the remaining works within the unadjusted completion date; and in fear of exposure to liquidated damages for any likely delay, the contractor is compelled to increase resources and work longer hours in order to mitigate and overcome such delay.

It is important however, to note that in order to qualify for any equitable entitlement to compensation due to constructive acceleration, the contractor must first show that there is an express or implied obligation on the part of the employer to ensure that the contract administrator performs his obligations in discharging his contractual duties, in order to prove a breach by the employer on the express or implied term to accelerate the works in the absence of an extension of time.[5] The contractor must then show that the loss that he has suffered by way of acceleration costs was caused by the alleged breach. The employer may argue that when a contractor decides to accelerate his works, it is his decision which causes the loss and not the breach by the employer. The contractor"s response is that he is subject to an express contractual obligation to complete the works by the due date earlier than if he were entitled to an extended completion date. Far from causing the loss by his own decision, he must incur the acceleration costs in order to avoid being in breach of contract. An alternative is to regard acceleration costs as a matter of mitigation of loss. A well established principle of English law is that a claimant must take all reasonable steps to minimise the loss he

[3] *Gaymark Investments Property v Walter Construction Group Ltd* [1999] NTSC 143

[4] *ACT Construction Ltd v E Clarke & Sons (Coaches) Ltd*, [2002] EWCA Civ 972, 85 ConLR 1

[5] *Perini Corporation v Commonwealth of Australia* (1969)

suffers resulting from a breach of contract, and usually the costs of acceleration will be less than the prolongation costs caused by a delay.

Then the contractor must demonstrate how his costs with acceleration exceeded those he would have incurred if he had not accelerated. Acceleration is one form of disruption. In *Whittal Builders v Chester Le Street District Council*[6] the court accepted a scientific calculation based on the difference between the value of work undertaken in a non-disrupted period with that undertaken in a disrupted period. To produce a similar calculation for acceleration the contractor must have maintained sufficient records, together with an updated contract programme, complete with comprehensive plant and labour records, to demonstrate both the planned resourcing and programming for the work as it would have been carried out but for the acceleration, and the actual resourcing and programming of the accelerated work.

The Scottish Court of Appeal case of *John Doyle Construction Ltd v Laing Management (Scotland) Ltd*[7] examined another technique known as the "measured mile" where productivity achieved in a non-disrupted period of work (the measured mile) was compared with productivity achieved in a disrupted area where acceleration of works was implemented. This involved the use of daily labour allocation sheets to record the site resources based on normal productivity levels and compared against those actually expended, the difference of which amounts to the disruption costs.

3. Main obstacles and excuses proffered

Despite the high probability of success in the recovery of such claims, anecdotal evidence showed that the actual nett returns of contractors to recompense inclusive of such costs are surprising not very high. Most of the time, such submissions are rightfully, and justifiably rejected due to various grounds and factors which are in reality preventable.

3.1 Timely notice

Many construction contracts have prescribed protocol where, upon the receipt of an instruction and to the extent that the said instruction does not state that it requires a variation, but the contractor considers that it does require a variation, the contractor is thence contractually obliged to notify the contract administrator in writing, within a stipulated period upon receipt of such instruction, to challenge the validity of the instruction which ought to constitute a variation. The contract administrator is then obliged to respond, within a stipulated period upon receipt of the contractor‟s

[6] (1987) 40 BLR 82

[7] [2004] ScotCS 141 (11 June 2004)

notification in writing, to modify, rescind or contradict in writing the instruction and the contractor shall then comply forthwith.

This is usually a condition precedent to the contractor‟s entitlement for any cost compensation. Any failure therefore to comply with this requirement would forfeit the contractor‟s rights of claims, and he is bound to comply with the said instruction without any cost or time entitlement. More often than not, the contractor is usually too engrossed in complying with the instruction so as not to affect the regular progress of the works, rather than to conscientiously ensure that the necessary paperwork is followed up to seek a proper formalisation of the instruction constituting a variation.

3.2 Late claims

Late claims are often frowned upon, as this is already a fundamental breach of contract procedures. Ideally, and in accordance with proper contract protocol, the proper timing to submit any such claims is whenever such entitlement becomes apparent that there will be additional cost implications or consequential costs and other implications. Sometimes, the real cause for claims may not materialize until after the events have transpired. For instance, there may be accumulative impact of a series of apparently insignificant changes, cumulating into a disruptive effect and impeding regular progress, and resulting in prolongation and loss of production and increased engineering time. As such impacts are often difficult to quantify and back-tracked accurately to the original source, contractors are eventually compelled to abandon any hopes of seeking compensation.

An alert and prudent contractor should, upon sensing of any potential delay arising, notify the owner at the earliest opportune of his intent to claim and the anticipated grounds for so doing. Although perceived as being overly claim-conscious, this is an acceptable approach, as the contractor is then able to preserve his contractual rights to claims at the outset until such time when the purported delay factor has ceased to operate and when all necessary information are available for substantiation and submission.

3.3 Breach of contract procedure

Contract procedures are prescribed in the agreement and meant to be followed and adhered to closely. Either party failing to conform to this procedure will constitute a breach, and will prejudice the rights and obligations of parties to the contract in imposing or enforcing any entitlement conferred under the contract provisions.

3.4 Contemporaneous records

Construction and engineering projects being an extremely fragmented industry often involve a plethora of records, correspondence, reports and mountains of administrative paperwork. Needless to say, proper site records must be well maintained and systematically managed on a regular and up to date basis so as to serve as ready substantiation in all submissions of claims.

These may include time sheets of office personnel including those expended to prepare shop drawings for approval; dockets and invoices; daily job diaries of manpower, supervision, equipment and materials; reports, tests and investigation records; notes and minutes of meetings during resolving of technical issues like discrepancies, design deficiencies and outstanding information; weather and its effect on progress; as-built progress of site works including dated photographs; updated impacted and as-built programmes; records of all design revisions, modifications and variations received and any adverse impact on actual site works; daywork records on incidental works which cannot be evaluated under normal contract provisions such as abortive works and works outside the ambit of the contract; obstructions and obstacles encountered not otherwise foreseen; etcetera, ecetera.

The extent and level of information required in collating and compiling all the legitimate claims are clearly not limited to senior management or the head office only; but very well the rank and file from the project managers to foremen and supervisors, quantity surveyors, draughtspersons and store personnel, nominated and domestic sub-contractors, suppliers and such like. Such contemporaneous records, are extremely instrumental in facilitating and verifying actual and direct costs and delays in connection with each and every claim for entitlement for costs, especially costs associated with disruption and prolongation claims, other than loss and expense claims. Of course, measures must be implemented to ensure that all such records are properly verified, endorsed, authenticated to ensure accuracy, reliability and credibility; since unreliable and fictitious records are not only counterproductive and a waste of resources, but can be adversely detrimental in the evaluation of any entitlement of claims.

The alternative yet popular approach is to use „global" claims and engaging of claims consultants to concoct well articulated claims and academic entitlement; which are generally disdained upon and unsurprisingly treated with scepticism. [8]

3.5 Validity of claims

Calculation for all kinds of cost claims due to delays, prolongation, disruption, acceleration or impact costs alike, involve finite estimating, engineering evaluations, statistical analyses; scientific theories and formulae; complete with software generated as-built programmes, as supporting documentation for such claims. Except in fairly exceptional circumstances, where it is practically not possible to identify the specific cause and effect of each class of claims, submission of claims on a purely theoretical basis are often popular but unlikely to succeed. The contractor is expected to prove strictly such actual loss from verified records. Only where this is not possible, and as an exception rather than the rule, will calculation be allowed by reference to formulae such as the Eichleay formula, and

[8] *John Doyle Construction Ltd v Laing Management (Scotland) Ltd* [2004]

the Hudson or Emden formulae. These formulae are applied to assess loss where certain things have been established proving that the contractor did actually suffer loss.[9] [10] Otherwise, and unless there are evidentiary facts adduced and based on contemporaneous records to substantiate the factual sequence of events and effects on the works resulting in delay, disruption and interruption, with loss and expense incurred, any such claims are likely to be deemed as defective and subject to rejection.[11]

3.6 Budget control

Historically, building and engineering projects were far less complex and tend to be of conventional design with few specialized sub-contract works. Overall costs were rather moderate with reasonable construction periods; and profit margins were generous with even a budget for contingencies thrown in for good measure. Under such ambience, relationships between the owner, architects, engineers and contractors, as well as between the main contractor, sub-contractors and suppliers, were less formal and more cordial. Any extra cost not contemplated in this piece of work could always be built into the next, and commercial decisions and resolutions were always geared towards dispute and litigation avoidance.

Nowadays, with the dismal state of economy and acute accountability, high interest rates, and the current trend of speculative development businesses, building owners are ever anxious to hold down original capital outlay, seeking to avoid budget overruns at all costs. It is not surprising to find agreements between the owners and principal consultants containing explicit terms and arbitrary conditions to take control of funds out of the consultants‟ jurisdiction; with the owner‟s liability to any costs overrun limited only to employer sanctioned design revisions, variations and additional works! This is compounded by the fact that standard forms of contracts are even amended to transfer the ever increasing degree of liability to the contractors and sub-contractors, with more onerous contractual rubric and warranties.

Conversely, on the part of the contractors, with cut-throat pricing and stiff competition amongst an abundant pool of eager tenderers hungry for any project, profit margins are razor thin to the extent of barely being able to sustain the site resources. It is not uncommon therefore, that some contractors and sub-contractors alike are driven by desperation to resort to sharp practices in order to recover costs, exploiting contractual loopholes and engaging dubious claims consultants in conniving unsubstantiated and unjustifiable claims to maximize their revenue and profit. All these can only culminate to higher incidence of disputes and litigious claims; with one party denying or refusing to

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[9] *Alfred McAlpine v Property and Land Contractors* [1995] 76 BLR 59

[10] *Norwest Holst v Co-Operative Wholesale Society* [1998]

[11] *McAlpine Humberoak v McDermott International* [1002] 58 BLR 1

allow budget overrun, and the other desperately attempting to recoup losses and alleviating a potential financial meltdown.

4. Conclusion

To be able to efficiently execute, administer and complete any project successfully and be gainfully profitable; and without any unnecessary frittering away of valuable resources, both contractors and consultants alike should be conscientiously and reasonably familiar with established and proper contractual protocol in each and every stage of the contract until fruition, so as to be able to preserve the respective positions, rights, remedies and interests of all parties to the contract. Ultimately, the failure to keep adequate contemporaneous records to substantiate legitimate claims and entitlement could be a very expensive lapse.

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A Multiple Regression Model for Predicting the Volume of Public Construction Works in Hong Kong

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Abstract

The economic development of a country is believed to be closely related to its construction activities and vice versa. In order to stimulate a declining economy, many governments would drastically increase their expenditure on public infrastructure and construction works. Nevertheless, increasing the volume of public construction relentlessly may not be desirable especially when the economy begins to pick up again. Excessive competition created by public construction works would result in an escalation in construction price and exacerbate the inflation of a country. It is, therefore, necessary to monitor and plan for the volume of public construction works carefully. Until now, not much effort has been devoted to predict the future public construction activities. Acknowledging that the public capital works programme may be influenced by a series of economic and social factors, it may be sensible to consider the possibility of applying the regression techniques to develop models for forecasting the short to medium-term public construction volume. In this paper, the factors which might affect the volume of public construction works are highlighted. Due to the peculiar nature of the data series, some data has to be transformed to facilitate the analysis. Following an outline of the data collection and transformation strategies, the development of a regression model for forecasting the public construction volume is reported. To better understand the impacts caused by the use of various data series, the length of the data series and the applicability of the raw data, eight regression models are developed. The performance of the derived models is compared by referring to their average relative errors. The results indicate that regression analysis is capable of accurately predicting the public construction volume for short to medium term. Besides, the inclusion of more independent variables and the use of a shorter data series may help improve the forecasting accuracy.

Keywords: public works, construction volume, economic condition, regression analysis

1. Introduction

Regulating and stabilising a country's economy is a compelling role of its government. Being adversely affected by the recent global financial crisis, governments around the world have injected sizable amount of funding to public construction programme with no exception to Hong Kong. The ten major infrastructure projects amounting to around US$27 billions are expected to flourish the territory's economy for next ten to fifteen years to come. While timely fiscal policy is critical to economic revival, excessive market stimulation could lead to an overheated economy as time evolves. The consequence is inflation as demonstrated by the aftermath of the Airport Core Project just before the handover of sovereignty of the territory. The increasing demand for construction materials and labours would create an unnecessary pressure to the private construction sector if the government does not monitor and plan for the volume of public construction activities carefully.

Deriving a forward looking plan on public construction volume depends on the existence of reliable forecasting tools. Despite that, construction demand analysis and forecasting has never been seriously taken up by practitioners and researchers, as *"attempts to estimate construction demand are fraught with difficulties"* (Ofori, 1990). While several research models have been developed to analyse the construction demand (e.g. Killingsworth, 1990; Tang *et al*, 1990; Akintoye and Skitmore, 1994; Goh and Teo, 2000; Goh, 2000, 2005), these models focused on the demand for the overall construction activities, private constructions, industrial buildings, etc. Not much attention has been attributed to develop a model for predicting the public construction volume. This may be due to the fact that the demand for public construction facilities can be influenced by an amalgamation of social and economic factors not least the general economic outlook, financial strength of government and needs of the society.

Regression techniques, being widely applied to various types of predictions, may have a strong avenue in modelling and predicting the public construction volume accurately. In this paper, the factors which might influence the volume of public construction works are first identified. The key considerations in developing a regression model for forecasting the public construction volume are then outlined. Based on that, various models are developed and the resultant regression model is presented. Finally, the accuracy of the model is evaluated through an out-of-sample test.

2. Factors affecting public construction volume

Public construction works are usually related to those structures and facilities which could benefit the community at large, and examples of these include new towns, roads and highways, railways, water purification centres, sewage treatment facilities, hospitals, schools, and the like. Apart from satisfying the escalating needs of the society as income and living standard improve, this type of projects would also serve to sustain and improve the local labour market during the construction and operation stages. Therefore, when determining the level of public capital work programme, it is vital for the government to consider the rate of economic growth, level of income, unemployment rate, fluctuation in interest rate, projection of population increase, pattern of household formation, number of existing housing stock, etc. (*cf:* Goh, 1999). Consequently, the following indicators shall be considered when determining the volume of public construction works.

Gross domestic product (GDP): GDP is the most commonly used indicator to portray the economic condition of a country. Obviously, the prevailing and prospective economic condition would determine the amount of public construction works of a country. One would expect that the demand for infrastructure facilities shall increase as the economy prospers. In contrast, the government would also introduce apposite fiscal policy to stimulate the economy at times of recession.

Interest rate: Interest rate is a thermometer of a country's economy, and a relatively low interest rate will be maintained during economic downturn in order to attract investment. As public works may not be entirely funded by a country's reserve, a lower interest rate should be more favourable to the development of major infrastructure projects.

Unemployment rate: A high unemployment rate is usually related to a weak economy and vice versa. Injecting a huge amount of money in public construction works may fuel the employment market when the job market is stagnant. This could lead to a surge in the salary level and eventually give rise to inflation. In contrast, excessive unemployment would result in social unrest, and any delay in public works programme would attract criticisms from the society.

Household or population: Any increase in household or population will generate a demand for facilities, such as new towns, housings, hospitals, schools, etc. Population growth is going to be a major concern of Hong Kong, as the territory is expected to have a sharp increase in population in future. The problem is aggravated as the ageing population in the territory would induce a huge demand for elderly and health care facilities for the years to come.

Average income: Being severely hit by the Asian economic turmoil, the outbreak of SARS epidemic and the recent global financial crisis, the wealth of Hong Kong citizens have diminished substantially. Nowadays, many companies in the territory recruit staff on contract basis and the salary of low and middle income groups may not be as attractive as before. With a drop in the average income, the propensity to spend would become more cautious. It is reasonable to expect that the needs for public housings and facilities would increase if the situation persists.

Construction cost: The cost of construction somehow reflects the overall activities within the construction industry. In construction, the cost is made up of labour wages, prices of materials, and costs of equipments. An increase in construction activities would drive up the prices of those components. Therefore, when the construction industry is already very active, the government should avoid competing with the private sector for construction resources.

Government's financial strength: Hong Kong is fortunate enough to have accumulated a modest sum of reserve over the years. However, as public construction works inevitably require a huge capital sum, it may not be easy for a government to promote ambitious public programmes without a healthy financial condition.

3. Modelling data

All the data for this study was collected from the Census and Statistics Department (C&SD) of the Government of the Hong Kong Special Administrative Region. The data series which were found to be related to the factors identified in the preceding section include: (i) GDP; (ii) implicit price deflator of GDP and per capita GDP; (iii) interest rates; (iv) unemployment rate; (v) population by sex; (vi) statistics on domestic household; (vii) average wage rates for employees up to supervisory level (excluding managerial and professional employees) by broad occupational group by selected industry sector; (ix) gross value of construction works performed by main contractors as analysed by broad trade group; (x) index numbers of the costs of labour and materials used in public sector construction projects; (xi) government revenue (general revenue account and funds); and public construction volume (Figure 1).

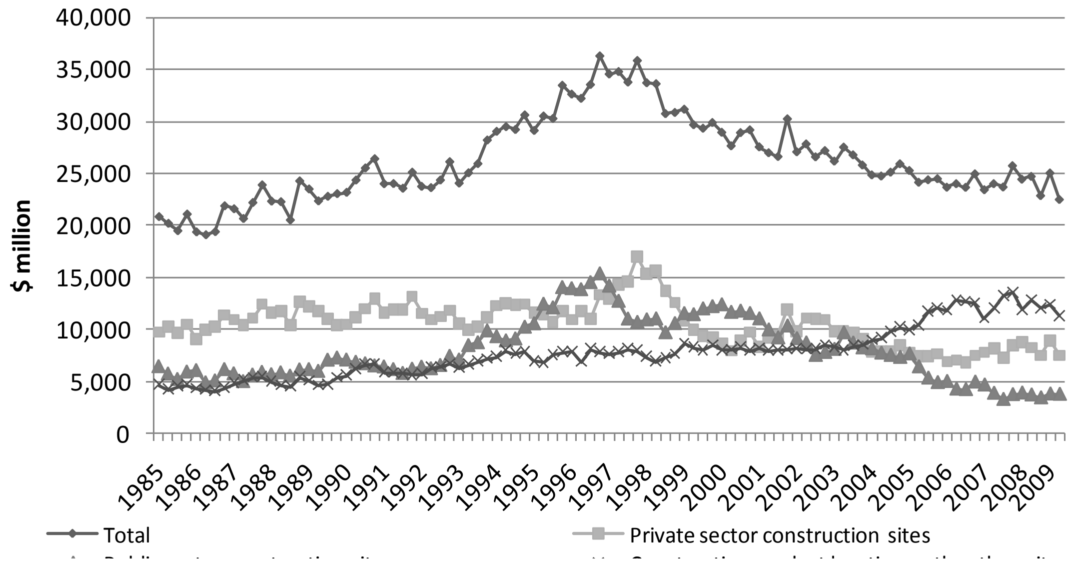

Figure 1: Gross value of construction work in Hong Kong at constant 2000 prices
(Source: Report on the Quarter Survey of Construction Output, C&SD, The HKSAR Government)

To improve the modelling accuracy, data was solicited on a quarterly basis. An inspection of the available data reveals that the time spans of each set of data being maintained by C&SD are not exactly the same. The starting points of the data series can be broadly grouped as those starting on the first quarter of 1983 and those on the third quarter of 1995.

3.1 Constant price transformation

Amongst various data collected, some such as GDP, average income, gross value of construction works, government revenue, etc., are represented by monetary values. This data is, however, represented in nominal value representing that the value is measured in the price at the time when the data was recorded. While the economic condition should have changed over time, the value of money should also vary with time according to inflation. As a result, transformation shall be conducted to ensure the prices at different years become comparable. To transform the data from nominal values to constant prices, the implicit price deflator of GDP was considered. The implicit price deflator of GDP is given as a ratio between the current dollar GDP and the constant dollar GDP. This ratio is used to account for the effects of inflation, by reflecting the change in the prices of the bundle of goods making up the GDP as well as the changes to the bundle itself. In this study, all the data related to monetary values were converted to values at constant 2006 price as follows:

$$\text{Price at 2006} = \frac{\text{Price at current year}}{\text{GDP implicit price deflator at current year}} \times 100$$

3.2 Logarithm transformation

In many previous forecasting models, researchers applied the values of variables after they had been logarithm transformed. This is because many variables collected from statistics records do not meet the assumptions of parametric statistical tests, i.e. (i) they are not normally distributed; (ii) the variances are not homogeneous; or (iii) both. Logarithm transformation was, therefore, carried out by researchers in case the data in the series violates the normal distribution. Through the logarithm transformation, the skewness of the observed data may be appropriately corrected. In this paper, a natural logarithm was used to convert the data and the forecasting performing will be compared with those models developed using the raw data.

3.3 Lag effect

In determining the volume of public construction works, it is necessary to consider the lag effect of various social and economic variables as it is obvious that those factors will not pose an immediate effect to the government's decisions. In other words, certain lagging between the change in economic and social conditions and the adjustments in the volume of public construction works should be expected. Akintoye and Skitmore (1994) believed that the *a priori* restriction of finite lag distribution should be adopted for two reasons: (i) it was expected that the influence of a change in a factor on the private sector construction demand would be completed after a finite period, that is, there is a finite maximum lag; and (ii) the total maximum lag length (i.e. the number of parameter to be estimated) may be so large relative to the sample size, that too many degrees of freedom may be lost. Based on previous research of comparable nature, a maximum time lag of eight quarters was adopted as the period should be lengthy enough for the effects of the influencing factors to be reflected in the amount of public construction works. Here, the lag effect is considered by shifting each of the independent variables by zero to eight quarters later when developing the forecasting models.

4. Regression analysis

While various factors could contribute to a change in the volume of public construction works, it is necessary to identify which social and economic factors are most influential to this type of projects. Applying the regression analysis, the variable-selection procedure which aims at identifying a set of independent variables leading to the best-fit model is performed (Dunteman and Ho, 2006). Accordingly, a stepwise analysis was adopted for the eliminating those factors which do not contribute much to the public construction volume. Being an iterative procedure, the stepwise analysis would remove any factors already included in the model progressively (Bowerman *et al*, 2005). If none of the factors can be eliminated, then a factor which is yet to be included will be considered. The criterion for adding or removing a variable is based on the *F*-statistics, with the probability of *F*-to-enter and the probability of *F*-to-remove set at 0.05 and 0.10 respectively.

The data was fed into a statistical package SPSS version 17.0 for analysis. Various models have been developed based on different settings, e.g. whether to use a longer series as compared to a shorter one; should the constant 2006 data or the nominal data be used; is log transformation necessary; etc. Amongst the various models developed, the following model which was based on more factors, shorter time series, constant 2006 price, and logarithm transformed values is presented. The data series being incorporated for model derivation include the: (i) GDP; (ii) unemployment rate; (iii) interest rate; (iv) household (instead of population as it should better represent the need of the public for new housing); (v) average income; (vi) volume of public works; (vii) index of cost of labour in the construction industry; and (viii) government revenue. The expression of the model is:

$$LnQ = f\left(LnG_n, LnI_n, LnH_n, LNRi_n, LnIp_n, LnGi_n, LnRu_n\right)$$

where:

LnQ = volume of public works at constant 2006 price, natural logarithm transformed

LnG = GDP at constant 2006 price, natural logarithm transformed

LnI = average income at constant 2006 price, natural logarithm transformed

LnH = number of household, natural logarithm transformed

$LnRi$ = real interest rate, natural logarithm transformed

$LnIp$ = index number of labour cost, natural logarithm transformed

$LnGi$ = government revenue at constant 2006 price, natural logarithm transformed

$LnRu$ = unemployment rate, natural logarithm transformed

n = period of lag in the number of quarters

With a maximum lag of eight quarters, there are altogether sixty-three independent variables. Through the stepwise analysis, the factors as shown in Table 1 are included in the model. These are:

a) *LnH:* number of household with a lagging of 2 quarters
b) *LnIp:* index number of labour cost with a lagging of 7 quarters

c) *LnRu:* unemployment rate with a lagging of 5 quarters
d) *LnG:* GDP with a lagging of 6 quarters
e) *LnGi:* government revenue with a lagging of 4 quarters

Table 1: Factors entered or removed through the stepwise procedures

Model	*Variables Entered*	*Variables Removed*	*Method*
1	*LAGS(LnH,2)*	-	*Stepwise (criteria: probability-of-F-to-enter <= .050, probability-of-F-to-remove >= .100)*
2	*LAGS(LnIp,7)*	-	*Stepwise (criteria: probability-of-F-to-enter <= .050, probability-of-F-to-remove >= .100)*
3	*LAGS(LnRu,5)*	-	*Stepwise (criteria: probability-of-F-to-enter <= .050, probability-of-F-to-remove >= .100)*
4	*LAGS(LnG,6)*	-	*Stepwise (criteria: probability-of-F-to-enter <= .050, probability-of-F-to-remove >= .100)*
5	*LAGS(LnGi,4)*	-	*Stepwise (criteria: probability-of-F-to-enter <= .050, probability-of-F-to-remove >= .100)*

As illustrated in Table 2, the adjusted R^2 of 0.962 shows that the goodness of fit of the model is quite high. The model can explain 96.2% of the change of the dependent variables.

Table 2: Model summary

Model	*R*	*R2*	*Adjusted R2*	*Std. Error of Estimate*
1	*0.821a*	*0.675*	*0.667*	*0.221*
2	*0.965b*	*0.932*	*0.929*	*0.102*
3	*0.973c*	*0.948*	*0.944*	*0.091*
4	*0.979d*	*0.959*	*0.955*	*0.081*
5	*0.983e*	*0.966*	*0.962*	*0.075*

Based on the findings as shown in the table of coefficients (Table 3), the final model (LnQ) can be expressed as:

$$LnQ = 66.55 - 9.945 LnH_2 + 1.478 LnIp_7 + 0.41 LnRu_5 + 0.723 LnG_6 + 0.057 LnGi_4$$

Table 3: Table of coefficients

Model 5	*Unstandardised Coefficients*		*Standardised Coefficients*		
	B	*Std. Error*	*Beta*	*t*	*Sig.*
(Constant)	*66.550*	*2.362*		*28.180*	*0*
LAGS(LnH,2)	*-9.945*	*0.393*	*-1.330*	*-25.323*	*0*
LAGS(LnIp,7)	*1.478*	*0.237*	*0.361*	*6.225*	*0*
LAGS(LnRu,5)	*0.410*	*0.076*	*0.402*	*5.396*	*0*
LAGS(LnG,6)	*0.723*	*0.248*	*0.142*	*2.915*	*0.006*
LAGS(LnGi,4)	*0.057*	*0.020*	*0.091*	*2.796*	*0.008*

5. Model accuracy

To confirm whether the model can accurately predict the construction volume, the data related to the five selected factors was entered into the model to check the accuracy of the forecast between the first quarter of 2004 and the fourth quarter of 2008. The predicted values are compared with the actual value of public construction works during that time period by examining the residual and relative error:

Predicted Value = EXP (Predicted *LnQ*)

Residual = Actual Value – Predicted Value

Relative Error = Residual ÷ Actual Value

From Table 4, it is apparent that most of the relative errors are smaller than 10%, with the most significant error appeared in second quarter of 2005 while a predictive accuracy of less than 5% is recorded in many quarters. This confirms that the regression model derived is reasonably reliable.

Table 4: Predictive accuracy of the derived regression model

Year	*Quarter*	*Actual Value*	*Predicted LnQ*	*Predicted Value*	*Residual*	*Relative Error*
2004	*1*	*7379.5*	*8.93473*	*7591.086*	*-211.586*	*-0.029*
	2	*7435.2*	*8.90007*	*7332.487*	*102.713*	*0.014*
	3	*7191.3*	*8.94836*	*7695.261*	*-503.961*	*-0.070*
	4	*6931.6*	*8.74280*	*6265.414*	*666.186*	*0.096*
2005	*1*	*6859.2*	*8.73527*	*6218.413*	*640.787*	*0.093*
	2	*6924.0*	*8.68743*	*5927.928*	*996.072*	*0.144*
	3	*5859.8*	*8.67355*	*5846.217*	*13.583*	*0.002*

	4	*4946.1*	*8.47398*	*4788.536*	*157.564*	*0.032*
2006	*1*	*4542.3*	*8.52410*	*5034.654*	*-492.354*	*-0.108*
	2	*4707.1*	*8.49921*	*4910.888*	*-203.788*	*-0.043*
	3	*3990.0*	*8.45458*	*4696.534*	*-706.534*	*-0.177*
	4	*3957.6*	*8.34070*	*4191.022*	*-233.422*	*-0.059*
2007	*1*	*4481.2*	*8.35532*	*4252.745*	*228.455*	*0.051*
	2	*4250.5*	*8.28230*	*3953.276*	*297.224*	*0.070*
	3	*3508.3*	*8.22062*	*3716.806*	*-208.506*	*-0.059*
	4	*3023.4*	*8.13585*	*3414.717*	*-391.317*	*-0.129*
2008	*1*	*3336.5*	*8.20152*	*3646.489*	*-309.989*	*-0.093*
	2	*3689.9*	*8.17243*	*3541.940*	*147.960*	*0.040*
	3	*3624.3*	*8.16129*	*3502.702*	*121.598*	*0.034*
	4	*3495.7*	*8.12289*	*3370.748*	*124.952*	*0.036*

6. Discussions

As mentioned in the preceding section, various models have been developed based on different considerations. The performance of those models is shown in Table 5. In the Table, the values of adjusted R^2 which measures the proportion of the variation in the dependent variable accounted for by the explanatory variables, i.e. the goodness of fit of a model, are presented. A model is considered acceptable when the adjusted R^2 is greater than 0.90. As illustrated in Table 5, virtually all the models derived with the exception of Models A and B have reasonably high adjusted R^2 values, which confirm their reliability.

Besides, the relative errors and the residuals also help confirm the predictive performance of the models derived. Models E to H have an average relative error of lower than 10% indicating that the accuracy of public construction works forecast would improve when more factors but a shorter time span are used for model development. This may be due to:

1) While data with a longer time span would have captured more fluctuations, the linear regression approach may not perform well when fitting excessive changes of dependent variable.

2) By increasing the number of independent variables, the stepwise procedures would be selected which are the most candidates with the highest explanation power for being included in the model especially when the reasons for a change in public construction volume is rather complicated.

Table 5: Performance of different regression models derived

Model	*Characteristics*	*Adjusted R2*	*Average Relative Error*	*Maximum Relative Error*
A	*Less variables, longer series, constant 2006 price, raw data*	*0.813*	*0.133*	*0.712*
B	*Less variables, longer series, constant 2006 price, logarithm transformed data*	*0.813*	*0.131*	*0.372*
C	*Less variables, longer series, nominal price, raw data*	*0.954*	*0.115*	*0.647*
D	*Less variables, longer series, nominal price, logarithm transformed data*	*0.950*	*0.110*	*0.360*
E	*More variables, shorter series, constant 2006 price, raw data*	*0.983*	*0.034*	*0.131*
*F**	*More variables, shorter series, constant 2006 price, logarithm transformed data*	*0.962*	*0.055*	*0.177*
G	*More variables, shorter series, nominal price, raw data*	*0.989*	*0.036*	*0.145*
H	*More variables, shorter series, nominal price, logarithm transformed data*	*0.983*	*0.035*	*0.159*

*Note: * Model F is the model presented in the preceding section of this paper*

Despite yielding a better prediction, the use of nominal price for modelling the volume of public construction works should be avoided as this has ignored the change in money value over time. The distortion may not be too significant when the economy is stable, but the fluctuating economy will give rise to inflation which could seriously affect the accuracy of prediction. In order to avoid the risk, decision-makers should ensure all the prices are transformed into a constant price to facilitate a fair and accurate analysis.

As discussed before, the logarithm transformation is to eliminate the effects of those variables which do not satisfy the assumptions of parametric statistical tests, i.e. those which are not normally distributed, not homogeneous, or both. Yet, using the logarithm values may not necessarily result in the best prediction (refer to Models E and F) especially when the data meets the parametric statistical tests. Therefore, one should not convert the data blindly without first testing the normality of the data series.

7. Conclusions

In this paper, the factors that may influence the volume of public construction works have been identified and discussed. It is found that the gross domestic product, unemployment rate, number of household, wage of construction labours, and government revenue play an important role in determining the size of the public capital works programme. Despite that, the lag effect between the public construction volume and the social / economic factors should be carefully considered as it is reasonable to assume that the government would adjust its construction output according to the social needs and economic conditions.

To test the performance of multiple regression analysis for forecasting the volume of public construction works, eight models have been derived based on different considerations. The results indicate that those models with more independent variables and a shorter data series outperform the others confirming that the volume of public construction works can be influenced by many social and economic factors within a relatively short-term fluctuation.

Nonetheless, whether the regression models serve well in a long-term forecast and when there is an unprecedented drop in the economy is yet to be confirmed. Therefore, it is advisable to revise the model from time-to-time in order to ensure the model developed is reflective of the reality. More importantly, further research studies should be conducted to test the predictive performance of the regression models in the few years as the economy begins to revive. The application of other modelling techniques such as the Box-Jenkins approach and econometric modelling techniques should also be carefully examined in future.

Acknowledgement

The authors would like to thank the Research Grants Council of the Government of Hong Kong Special Administrative Region and The University of Hong Kong for their financial support through the General Research Fund (grant no.: 7152/07E) and the CRCG Seed Funding for Basic Research (grant no.: 10207434) respectively.

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Constructed Environment or Constructing Environment – is Construction Involved, or is it a Part of Change?

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Abstract

While demand for construction is at its highest in newly industrializing and urbanizing societies, in post-industrialised society the role of construction is diminished. This claim embodies the theory that society can be built to completion in such a way that no further future investment would be required. The pattern of construction development in recent years, however, exposes the weakness of this theory. Many Western countries have been building extensively and have a backlog of construction demand in the pipeline, pending the next economic upswing. Why should these “ready-built” environments have such a high need for further construction? Or could it be that the construction industry itself strives, through active supply, to generate construction needs and changes in the operating environment? The source data for this study includes Finnish construction and economic time series data and databases produced by the Euroconstruct network. The study seeks to build the framework for an assessment model to illustrate the mutual interaction between construction and the operating environment.

Keywords: construction, built environment, change, demand and supply,

1. Background

1.1 Previous studies

A constructed environment is a fundamental precondition for human activity. Urbanizing and industrializing societies therefore naturally need to invest in construction, and this requirement is logically tied to the structural changes that occur in society. Construction is needed in the transition from an agricultural society to an industrialised and urbanised society in order to build the transport routes, infrastructure networks, production facilities, housing and service facilities, etc., that a constructed society requires. In theory, once this infrastructure has been built and begun to fully function, the role of construction then diminishes. This theory has been developed, for example, by the International Council for Research and Innovation in Building and Construction (CIB) Working Commission W82: Futures Studies in Construction. The theory was presented, for example, during the First International Symposium of CIB Working Commission W 82: Construction Beyond 2000 held in Espoo, Finland in 1992.

The so-called BON curve, named after Ranko Bon, is used to describe the percentage spent of GDP on construction activity [Ruddock, Lopes 2006]. The shape of the curve, which is estimated to be either ∩- or Λ-shaped, has been the focus of some debate. The practical validity of the theory has also been evaluated in several studies based on observations from several countries. This data has enabled the validity of the theory to be shown for a cross-section of these countries during a given time period [Crosthwaite 2000]. Time series analyses have also been conducted for the same countries [Wong, Chiang & Ng 2008].

The theory can be applied when examining and anticipating the development of heterogeneous construction markets: for example, how the construction market will develop in connection with European Union expansion or how the global construction market will develop. Regions of heterogeneous social structure contain agriculture-dominated, industrialised and urbanised national economies and economies that have surpassed these stages which follow the theory. Economies that have advanced beyond the developmental phase can be used as points of comparison when estimating the future of the developing economies.

1.2 Phrasing of a question

According to the theory, the amount of construction expenditure in relation to GDP decreases once the urbanization and industrialization stage is surpassed. The new construction needs which then arise are smaller in comparison to those during the transformation period from an agricultural society to an industrialised and urbanised environment. The theory takes into consideration the need for environmental investment since, for example, few environmental risks are likely to have been identified or taken seriously into account during the industrialization phase, or possibly the technology and resources needed to prevent negative environmental impacts have not been available.

Furthermore, environmental investment is needed to repair the negative environmental effects of industrialization and urbanization. One must also remember that the constructed environment is unable to meet needs infinitely for the simple reason that it has a finite life span: the technical service life of buildings and structures varies from 30 to 100 years.

The purpose of this paper is to discuss what role has construction in the Western industrialised countries in future. The market development in Finland is used as an example. The construction market development during years 1990-2005 is analysed thoroughly in chapter 2. The attention is paid both to causes and effects of market development. In chapter 3 I have thought over the answer to question is construction involved, or is it a part of change?

1.3 Methodology and data

This case study covers the Finnish construction market as that of the predominantly Western European Euroconstruct countries. The market development data used is derived from statistical summaries presented at Euroconstruct conferences dating from 1980. Time series analyses were conducted as based on this data. The key variables were GDP, population, residential construction output, non-residential construction output, building renovation output and civil engineering output. Although the statistics drawn up from one country to another inevitably differ and thus introduce a degree of uncertainty, the largest disparities in the statistics have since been eroded though long-standing international cooperation. Other time series and literature sources have also been used for Finland. The research methods employed were thus based on time series analyses and literary research.

2. Case Finland

2.1 Structural change

The study Coping with structural change in construction [Ng et al. 2009] analyses structural changes in construction activity in five advanced economies (Australia, Japan, Singapore, South Korea and the UK). The article refers to a study [Machlup 1958] conducted 50 years ago, according to which – unlike other areas of the economy which are subject to elastic economic fluctuations – changes in construction are irreversible.

The common concept of structural change is one of a gradual, unavoidable event which can nevertheless be identified and prepared for in advance. According to the above-mentioned study, however, structural change in fact occurs as a consequence of a partially unforeseeable event, and the change itself takes place both compulsively and rapidly. The causes and effects of structural change can, case permitting, be grouped together under the concept of "creative destruction", as demonstrated by the Finland case presented in my study.

2.2 The cause of "destruction"

The Finnish construction market in 1990 has been characterised in these words: "Never before has so much been built in Finland than in 1989" [Pajakkala, P. et al. 1990]. At this time Finland was not, in fact, a society undergoing industrialization or urbanization. Only 20 per cent of its population lived in rural areas. Only six per cent of GDP came from the primary sector, 34 per cent from the secondary sector and 60 per cent from service industries. This very same statement was to later prove equally applicable to the years 2006–2008. During this period, building renovation output continued to grow due to Finland's ageing building stock and residential and non-residential construction were also brisk [Euroconstruct].

The overheating of the construction industry at the turn of the 1980s–1990s can be explained by the change in Finnish money market game rules. Residential construction was heavy due to the sudden deregulation of the money market, which in turn released the backlog in housing demand created by the formerly regulated financial markets [Koskela, Loikkanen & Virén 1992]. Similar over-demand was created in the early 1970s after structural changes in the economy brought about a mass migration of the Finnish population to urban centres.

High demand for industrial goods created construction needs, and low confidence in stock investments channelled investment assets into non-residential construction as well. The brisk residential and non-residential construction market together generated over-demand which was reflected in rising construction costs and prices and, subsequently, heightened inflation. An attempt was made without success to check the pace of construction by levying an additional tax on the construction of buildings.

Finland's GDP collapsed during the years 1991–1993, figure 1. The turn in the economy signalled a rapid change in demand for construction. Building firms began to accumulate backlogs of unsold properties and many fell into bankruptcy. For a brief period, privately financed housing construction ground to a virtual standstill. The only owner-occupied properties built in 1995 were state-subsidised homes built in the Helsinki metropolitan area under the HITAS price control system. Two of Finland's four leading construction firms folded. [Vainio 2008]

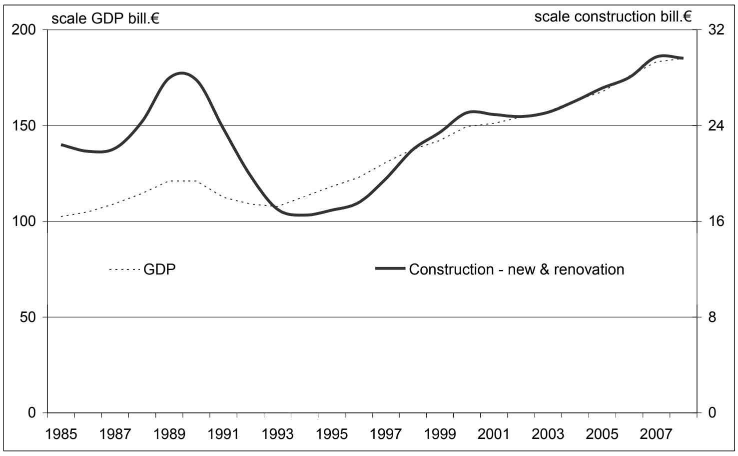

Figure 1. Volume of the economy (left scale) and construction (right scale) in Finland, year 2008 constant prices. Source: Statistic Finland, National Accounts & Euroconstruct, Total Construction in Finland.

2.3 Survival tactics

2.3.1 Policy solutions to the rescue…

The availability of financing has had a significant impact on creating a need for construction. Restricted financing created a needs backlog and caused overheating of the market following deregulation. The joining of Finland to the European Economic and Monetary Union (EMU) improved the availability in Finland of financing for construction, and lowered, for example, mortgage rates (Figure 2). The average interest rate on mortgage loans during the years 1990–1993 was over 13 per cent. In 1994, the rate fell to 8 per cent and subsequently continued to fall even further.

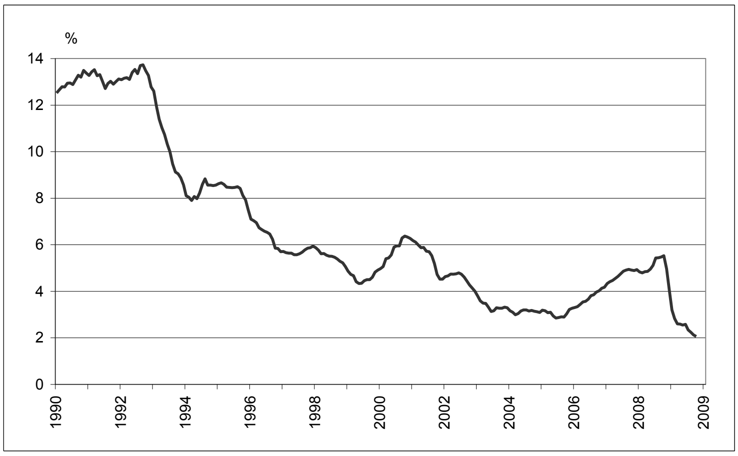

Figure 2. Average interest rates in new loans for homebuyers. Source: Bank of Finland.

Government subsidies assisted the availability of financing on the regulated financial markets and reduced interest expenses. The deregulation of the financial markets removed these requirements and moved the focus of state support from residential construction to housing support (figure 3).

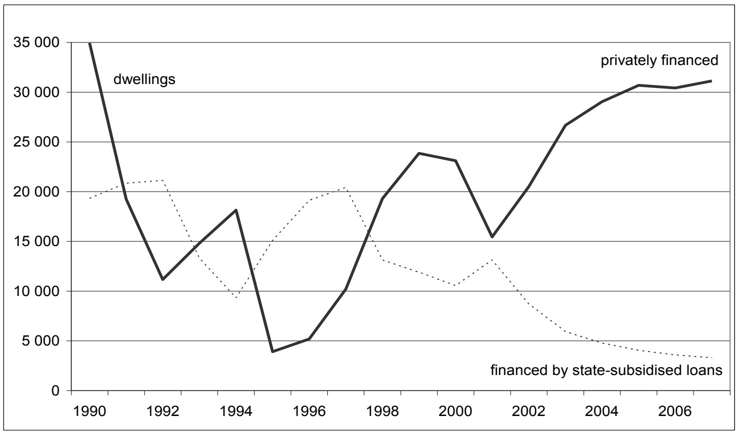

Figure 3. State-subsidised residential construction in Finland. Sources: Statistics Finland, Building and Dwelling Production & The Housing Finance and Development Centre of Finland, Financing.

During the deepest point of the recession, the objective was to ensure price stability and the affordability of housing. Concrete measures included deregulation of the rental market in 1995 and increasing rental housing production, i.e. timing the introduction of subsidised production with the adverse economic cycle, but these measures also brought challenges for construction.

2.3.2 … but first and foremost brought challanges

The reduction in financing costs made room for expansion of the construction tax base. Construction work was brought within the sphere of value-added taxation while new construction was experiencing its deepest downswing in 1994. Local governments were urged to utilise the mainstay taxation instrument on built property – property tax.

The recession in the new construction sector was interpreted as a sign that construction had reached its limit. As society was seen to have been "built to completion", the education and training of the construction workforce was radically reduced. One in three faculties aimed at training construction workers was abolished, and those students which remained in the remaining faculties were enlisted, for example, in information technology educational programmes, site management training was abolished, and the number of vocational training places was reduced. The few remaining study places were in scant demand due to the poor image of the industry.

2.4 Industry's response

2.4.1 Collaboration

Industrial companies participating in the construction process came together under the leadership of the Finnish Funding Agency for Technology and Innovation (TEKES) to agree on a common strategy for the future [Matilainen, Pajakkala & Lehtinen 1994]. The stated future vision was for an internationally operating construction industry. The main market area was defined as the Baltic Sea Region and the EU as well as other special global sectors. Finland's strategic position as a neighbour and established trading partner of Russia was not to be underestimated, even though the breakup of the Soviet Union brought a temporary collapse in exports. Internationalization was seen as two-way – imports were also to be expanded as well as exports and, in this way, competition increased in what was viewed as a largely closed construction market. Instead of supply, the mode of operation was to be changed from production-orientated to customer- and service-orientated.

This strategy required a change in operating practices and the adoption of new forms of cooperation. To attain these objectives, TEKES launched several research programmes within the construction industry in the mid 1990s. The programmes sought new cooperation models and developed new technologies for the industry. The cooperation building process took place phase-by-phase. During the first stage, in the first half of 1990, cooperation goals were set for the various parties in the construction process – namely, the construction, construction products and construction design sectors. During the second stage focused on the second half of 1990, customers were also included in the cooperation, and the Finnish real estate and construction sector concept was thereby established. The same concept has been developed by construction industry researchers as part of CIB research cooperation [Barret 2007].

The stimulus and input provided by these research-based initiatives has carried through to the present day, with participant companies having remained in collaboration for more than a decade. The companies' core objectives [Vision 2010] were: the life cycle and partnership perspective, the service perspective, the customer relationship perspective, internationalisation and an open environment for development. As the vision period now draws to an end, cooperation will continue as more specifically enterprise-oriented research and development. For this purpose a research company – the Strategic Centre for Science, Technology and Innovation in the Built Environment Sector (RYM Oy) – was established in Finland in 2009. The Strategic Centre's research agenda covers [RYM Oy – research agenda]: the operational environment; business and commercialization; life-cycle processes, concepts, services and products; and the production, distribution and storage of energy. So far as is known, no other country has implemented such a long-term joint action of this kind, with various branches of industry pooling together to secure a sustainable future.

2.4.2 From demand to supply

During the recession years, construction firms carried out contracts predominantly for public utility developers, which for a brief period accounted for up to 80 per cent of construction activity. Of these contracts, some were carried out as DB projects, i.e. with design and building included within the same contract in cases where the construction firm had earmarked the site for the construction of state-subsidised housing. After the peak of the recession, construction firms moved from a demand-oriented market towards an active supply-oriented market. For example, in residential construction, the share of construction completed by private construction firms rose to nearly 80 per cent (figure 4).

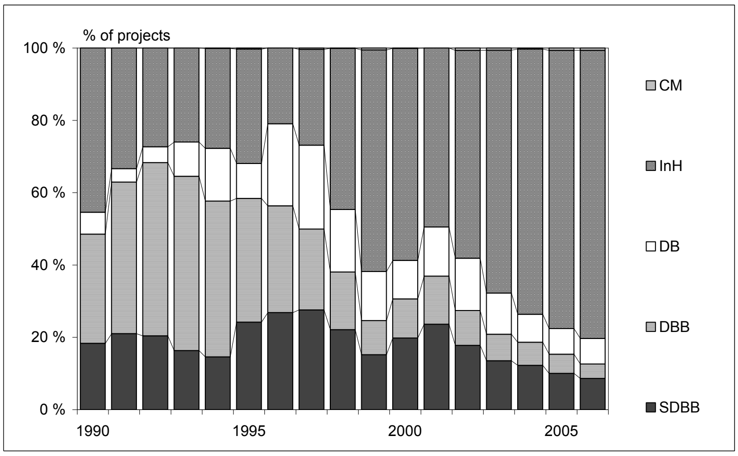

Figure 4. Implementation models of terraced houses and apartment buildings (% of projects).
Sources: Reed Business Information Finland and VTT.

2.5 Impacts

2.5.1 Efficiency?

The construction industry, particularly the civil engineering sector, underwent a transition from a closed to an open market. State organisations differentiated their client and producer functions, turning producer functions into public corporations or private companies. Some local government bodies gave up their producer activities and began outsourcing construction and maintenance projects to companies. This has significantly increased the productivity of construction projects and processes [Vainio et al. 2006].

Within the housing construction sector, development and ownership became differentiated as a separate branch from the core business of companies and scope of operations of state authorities. The transition from owned premises to leased premises caused user organisations to consider their premises' requirements more closely. As a result, higher requirements began to be placed on the functionality of premises. Backlogged renovation and repair requirements could be eliminated by payment through lease instalments instead of lump sums [Vainio et al.].

The transition of property ownership away from user companies opened up opportunities for property trading. In the globalised economy, the property industry followed a model which was itself to prove instrumental in bringing about the subsequent global economic crisis.

The key challenge which had risen from the recession of the early 1990's was controlling economic risk. This was done by splitting construction into separate outsourceable product components and work types. Site production was streamlined, work types adopted the most efficient production technologies available, and cost-efficient products were produced. Part of the productivity and cost-efficiency of companies during the recession period can also be explained by their use of a very highly skilled workforce.

Efficiency levels did not reach those of the 1970s and 1980s, however, because modern residential buildings are more individually designed and better equipped, and sites are of a smaller scale than the extensive housing developments seen in the preceding decades. Efficient industrial production methods are now used in place of old-fashioned in-situ construction. For example, the construction time for an apartment building, from building permit receipt to project completion, has lengthened – even though the average project size (number of dwellings built) has remained virtually unchanged (Table 1).

Table 1. Apartment building construction time from building permit receipt to project completion (figures are averages for all buildings completed per year)
Source: Statistics Finland, Building and Dwelling Production.

Year / *Duration*	*1989*	*1990*	*1999*	*2000*	*2001*	*2005*
Month / building	*15.3*	*14.3*	*13.6*	*13.6*	*14.2*	*16.5*
Month / dwelling	*0.88*	*0.93*	*1.03*	*0.99*	*0.99*	*1.22*
No. of dwellings per building	*16.9*	*16.6*	*21.7*	*22.8*	*22.9*	*23.0*

2.5.2 Virtual structural changes

Let us return to where we began: the dependence of construction investment on social structure. Over the long-term and upon cursory examination, one can accept the claim that the share of services of GDP has increased and the shares of agriculture and industry have correspondingly fallen in Finland since the recession of the early 1990s. Closer examination reveals, however, that the change appears greater than it actually is. When a company gives up ownership of its premises in favour of leasing and outsources its service operations, construction projects which would previously have belonged to the secondary sector are transferred to the service sector. The reverse change takes place when the public sector relinquishes its own infrastructure construction, thus changing, statistically, from service activity to secondary activity.

The dependence of construction on social structure should be viewed critically. Are we dealing with actual change? Or do the statistics provide only a coarse model and one which is partly also open to definition?

2.5.3 Actual changes in demand

The Finnish economy shrank during the years 1991–92, as the construction industry followed suit in 1991–1994. Construction remained at an exceptionally low level throughout the 1993–1997 period. Before the collapse, in the 1980s, the share of construction output of GDP stood at more than 20 per cent, whereas after the collapse the figure stabilised at 15 per cent. As building stock maintenance repair accounts for around 3 per cent of this figure, the total figure for newly built projects stands at 12 per cent. Despite the reduction in the construction industry's share of GDP, the total level of construction in 2006–2008 was a record high [Euroconstruct].

The focusing of companies and partly the public sector as well on core functions has led to a situation in which the vast majority of construction projects are carried out by sectors whose core task is in building stock and infrastructure maintenance. These property companies own buildings which can be used by industrial or service sector companies alike. However, the current need for industrial premises reveals something of the structural changes which have taken place in Finnish industry. Whereas the role of wood processing has diminished in Finland, the importance of metal industries and technology industries has increased [Statistic Finland, National Accounts]. This structural change has had a significant concrete effect on the need for premises, i.e. demand for construction, within the secondary sector. Developments have, however, been carried out by real estate sector companies operating in the service sector, from whom the companies needing premises then lease the buildings they require. The same real estate sector companies have also built the premises for the service companies which provide the industry's outsourced business support services.

The factors influencing construction demand are blurred by structural reorganisation. Previously, the need for premises could be clearly and more logically linked with current and predicted changes in production levels or frequently with historical trends.

Another way of classifying national economies is according to GDP per capita. This variable depends on the development stage of society, so that in the least developing countries (LDC) which concentrate on primary production GNP, per inhabitant is low, in newly industrialised countries (NIC) it is growing, and in advanced industrialised countries (AIC) it is the highest. An analysis of the global construction market [Crosthwaite 2000] shows that middle-income newly industrialised countries invest the majority of their GDP in construction. Investment diminishes in comparison in advanced economies. The logical explanation for this is that the percentage spent of GDP on construction following an economic collapse will be lower than prior to the crash – as happened after the shock to Finland during the early 1990s. So why, despite this, did construction once again hit record-breaking levels in 2006–2008?

Using Euroconstruct data, we can conduct a focussed construction sector-specific analysis of the economies of Western Europe. The curve data (output, GDP) illustrated in Figure 5 is for the years 2006, 2007 and 2008. For Western European countries, a very gradual ∩-shaped dependence between new residential construction and building renovation output and GDP is evident. The biggest investors in these sectors are therefore the middle-income countries, as measured on the European scale. Conversely, the relationship of civil engineering and non-residential construction with GDP is the opposite, i.e. U-shaped. Investment in these sectors is lowest in the middle-income countries on the European scale.

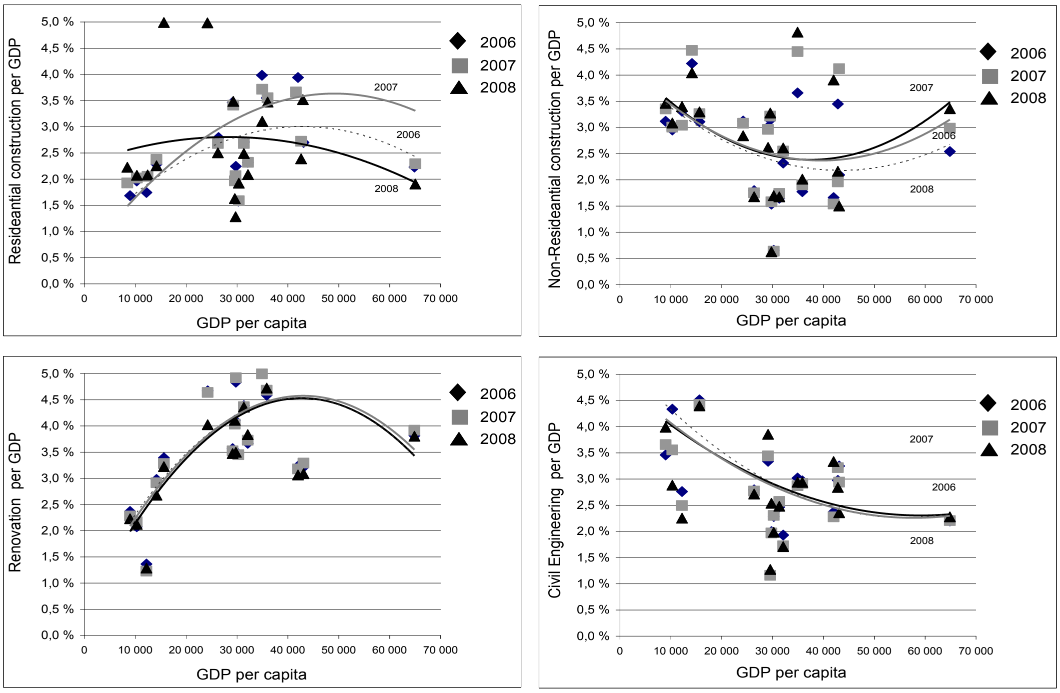

Figure 5. Residential and non-residential construction, renovation and civil engineering per GDP and GDP per capita in Western European Countries (old EU members, Switzerland and Norway). Source: Euroconstruct.

3. Conclusion

The 1980–1990 Finland case proves the claim that construction does not return to its former level following an economic crash. The corrective measures implemented during a recession are permanent. During the recession of the 1990s, Finland underwent a transition from a closed domestic market to direct competition on the global construction market. Public sector production was scrapped and construction services began to be purchased from companies operating on the open market. Foreign companies came into Finland in order to own and build property. International trade in construction products picked up in both directions. Construction products-based companies sought new markets for their products and contractors strove to cut production costs.

The change in market structure changed the attitude of the public sector towards the construction industry. It was no longer viewed as a balancing instrument used for controlling economic cycles, to which projects or employment obligations could be allocated as and when the need arose. Construction began to be viewed as an industry like any other. This reappraisal did not work in the industry's favour, and many educational faculties, training places and research allowances experienced losses to high-tech fields.

In answer to this, the companies operating in the fragmented construction sector began to re-organise. The core focus of the construction process was shifted from mutual trade to the end product and the customer. Companies underwent a reinvention from passive suppliers of demand to active solution providers, particularly in residential and non-residential construction. The traditional path of home ownership was also changed in Finland. Buyers no longer needed to work their way up through smaller housing units; instead, the easy availability of big loans put large houses and flats within reach of the first-time buyer. This generated solvent demand for housing. The non-residential property market was boosted by structural changes in the customer base and by the global property and financial markets. Private financing was also invested in infrastructure construction using the PPP model.

The quantitative increase in construction can, of course, also be explained by economic growth. In addition to growth, changes in the economic structure were also fundamental factors. However, these changes are not evident if only the primary production / manufacturing and construction / services three-sector division is examined. For example, the industry's share of GDP and employment effect have remained virtually unchanged, whereas the basic and processing industries have switched to the production and assembly of prefabricated products.

To achieve construction growth and to address the subsequent over-demand which arrested this growth, Finland has needed both the demand created by the operating environment and the restructuring of the construction industry, in addition to the active supply that this has generated.

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The impact of Building Information Modelling on Construction Cost estimation

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Abstract

Construction, and of course, estimation processes are vulnerable to the limitations of spatiality in design and fragmented processes in entity-based CAD and manual design procedures. Whilst this challenge often leads to some tragic consequences, building information modelling (BIM) provides platforms for innovative and integrated design processes, and automated measurement. This development triggers the need for exceptional skills for intensive collaboration, project simulation, electronic data management, manipulation and handling of automated quantity measurement, simultaneous access to BIM design server and object-oriented design procedures wherein robust, clear and comprehensive information are underlain into project components. This study explores the impact of BIM on construction cost estimation. Samples of auto-measured BIM models are compared with existing standards and estimation procedures. Misconceptions about automated capacities of BIM and cost estimation are discussed. Recommendations are focused on further areas of research on the expectations of estimators on BIM models.

Keywords: building information modelling (BIM), estimation, measurement, models

1. Introduction and background of study

Cost and time estimates are imperative to the success of any construction project, both during construction and throughout the project life. According to (Serpell 2005), effective estimates are based on processes and procedures which are stipulated in the conventions and standards being used in the estimating industry. These standards (e.g. Standard Method of Measurement for Building Works, Editions 1 to 8, Civil Engineering Standard of Measurement, Editions 1 to 3, Heavy Engineering Standard Method of Measurement, Edition 1, and Building and Engineering Standard Method of Measurement) were developed to guide and improve professional judgments regarding indicators of value and accuracy in quantity measurement. (Akintoye and Fitzgerald 2000) have summarized some of estimating methods being used in the UK. The goal of estimating includes systematic reflection on inherent risks such that they are comprehensively quantified and analysed in manners that control and entrench balance between tangible and intangible variables of project costs. The Association for the Advancement of Cost Estimating (AACE 2003) defines construction cost estimation procedures as the comprehensive consideration of stochastic and deterministic variables, which include the evaluation of risks (indirect) and direct costs involved in the procurement and application of materials, labour, management and professional services, the cost of finance and other factors deemed necessary in a project.

Evidently however, construction and facilities management industries still grapple with inefficient estimation procedures and standards (Penttilä et al. 2008). Several reports present cases of project abandonment due to poor cost performance, crises in contractual relationships, infrastructure collapse due to shoddy execution of projects, cost overruns, delays in project delivery, various concerns on ethical dilemmas, as well as misplaced philosophies of drivers of value in construction project delivery. These have clearly been linked to inadequacies in processes and procedures of designing, estimation, planning and controlling construction (Gould 1998; Gruneberg and Hughes 2006; Yeoman et al. 1998; Yiu and Cheung 2005). While (Latham 1994) and (Egan 1998) argue that construction costs are rather too high, inconsistent and inefficient to create value for money; (Masidah and Khairuddin 2005) claim that some professional services offered by estimators are unnecessary and counter-productive. Moreover, (Williams 2008) and (Souza 2008) report that the industry has not witnessed major improvements in the accuracy of project cost estimation tools and competitive procedures in securing value for money. Consequently, the industry is in dire need of major systemic improvements that would facilitate accuracy in quantification, value measurement and risk assessment.

The construction industry is familiar with manual and computer-aided estimation (CAE) procedures (Oyediran and Odusami 2005). The limitations of manual estimation processes are evident in the extensive time estimators spend on certain energy-sapping procedures. Regrettably, the accuracy of estimates generated using manual processes leaves more to be desired (Endut et al. 2005). (Cheong 1991) observes the range of accuracy of manually estimated projects. Whilst comparing several estimation models, the author claims that estimates are mostly generated by Bill of Quantities (BoQ), the accuracy of which is estimated to range from 8 – 30%. Other studies have shown that estimation may be seen as the Achilles heel of construction processes as project success is at the mercy of avoidable crises, which result from variations, disputes and other effects of subjectivity in professional judgments. In Ogunsemi and Jagboro's (2006) opinion, it is yet practically impossible to determine the cost of construction until all aspects of the project has been concluded. However, Ogunlana (1989) - cited in (Lowe 1998) argues that the reliability of estimators' judgments is more likely to improve as the quality and quantity of their experience improves. Interestingly, there is limited empirical evidence to justify extensive trade-off in efficiencies of computer-aided estimation over manual estimation procedures.

Evidence from previous reports shows that quality of information, project documentation, efficiency of designs and depth of interaction between project teams are significant to the reliability, accuracy and quality of cost estimates in construction processes (Acharya et al. 2006). Interestingly, CAD and BIM applications are two successive techniques that are being deployed to redress certain inadequacies in manual drafting and design methods. However, while CAD drafting applications are limited to two-dimensional or three-dimensional (2D or 3D) drawings which are based on geometric-data only; BIM combines both geometric and non-graphic information on design components. Although, there are other capabilities promised in BIM, there are certain features in BIM processes which relate to cost estimation in construction. Such features include automated measurement of quantities contained in BIM models, simultaneous access to design database, improved framework for communication between project teams, project visualization and simulation (Aranda-M. et al. 2008; French and Fischer 2000; Gu et al. 2008 ; Lee et al. 2005 ; Tse et al. 2005). This study aims to explore the impact of embedded information in BIM on cost estimation.

2. Auto-quantification of BIM models and estimation

Several studies have provided comprehensive definitions of BIM (Lee et al. 2005 ; Maher 2008; Méndez 2006). According to (Succar 2009), the applications of BIM transcend discipline or institutional boundaries, and its definitions are being tailored to multidisciplinary concepts. It can be adapted and expressed in relation to different perspectives, stage of maturity and depth of application. Nevertheless, in the context of this study, general applications of BIM in relation to estimation will be considered. Therefore, BIM is defined as a combination of computer-aided drafting and design (CADD) techniques and allied technologies, which extend beyond rendering designs in 2D or 3D with lines, arcs, splines and other rigid "unintelligent" features, but includes procedures and frameworks for enhancing object-oriented productivity and creativity in design processes through simultaneous creation, access, management, storage, use, update and sequencing of both geometric and non-geometric data to simplify project life-cycle information management. Given this premise, BIM facilitates sharing of data between different applications between project teams such that conflicts and insufficient information could be avoided. Interestingly, collaboration and value integration had been the bane of effective estimation in manual and conventional CAD applications.

BIM provides strong platforms for collaboration and process integration both for construction and facilities management. It also applies object-oriented design processes with features like simulation, project visualization, collaboration, value intelligence, thorough integration and data sharing. Aside these, BIM's auto-quantification tools are relative to effective estimation processes as estimators require drawing-based accuracy to trigger succinct description of cost variables in relation to accurate judgments on quantities, prices and risks. However, while so much has been said about the potential of BIM regarding process integration involving design, component specification and costing databases; the current level of achievement is fragmented as those systems are still independent. Figure 1 shows the taxonomy of interactions between CAD applications, specification documentation and cost estimation rather than full integration promised in BIM. Considering BIM as a platform for project stakeholders to collaborate, share data and sort discipline-related data on projects, it is expedient to explore the capacities of BIM models to satisfy procedural expectations that are relative to estimation.

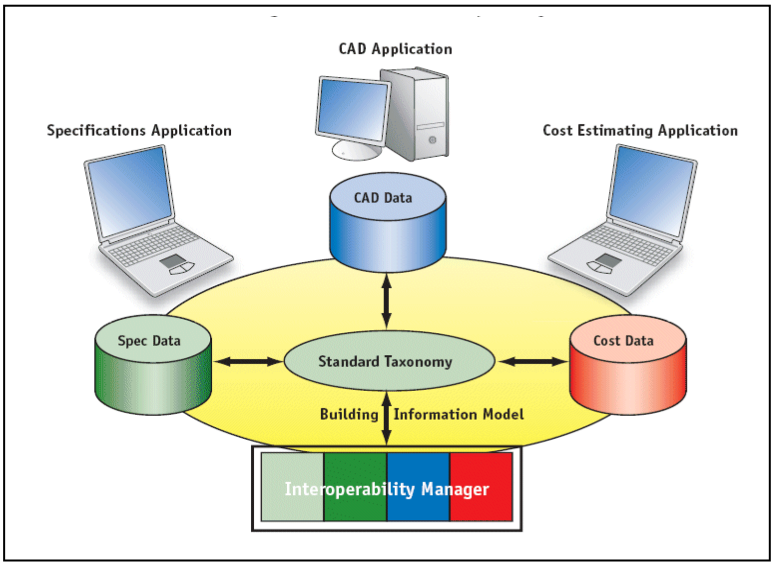

Figure 1: The Taxonomy of Interactions between CAD Applications, Specification Documentation and Cost Estimation (Dean and McClendon 2007)

Interestingly, BIM allows multi-dimensional manipulation of drawings from higher dimensions to lower dimensions, and vice versa (nD to 2D and 2D to nD). Moreover, estimators are better off when they are able to visualise and rotate designs in 3D. This does not only show details that conventional presentations in 2D CAD cannot expressly reflect; this phenomenon facilitates more accurate judgment about construction realities. In addition to this, project visualization provides platforms that eliminate design conflicts and inefficient multi-discipline integration in design and construction processes. The implications of effective collaboration promised in BIM include systemic improvement of processes, as though when project teams integrate at earliest stages, issues or opinions that bother on economic risks and limitations are better conceptualized and comprehensively mitigated than in conventional fragmented processes.

Object-orientated modelling improves spatiotemporal capability of estimators. This is because they do not just relate with design components as quasi-real objects; embedded information that underlay model objects is very value-adding. As a way of limiting limitations of calculation errors, BIM models are auto-measured. This is a major advantage, especially with complex and irregular shapes. Moreover, BIM provides platforms for individual disciplines to use discipline-specific applications such that would enhance accuracy, innovative service delivery and value integration. It will therefore be very helpful when estimators are provided with environments that permit workable relationship with information from other disciplines in the project team and vice versa.

Auto-quantification features in BIM both as Industry Foundation Classes (IFCs) formats and graphic dimensions, and those have been used to simplify control and planning of construction activities. According to (Sher 1996), the integration of procurement documentation and construction simulation has been a major challenge in the industry for decades as contractors often find it difficult to extract quantity data from tender documents. In many cases they need to confirm measured quantities in BoQs, extract information on construction risks and analyse work program digitally. Auto-quantification does not only reduce the time that contractors spent on quantity extraction, it saves them time for sourcing and management of price data as well as reduces inconsistencies of design data and measurements. (Sutrisna et al. 2005) have demonstrated how these issues often trigger crisis in civil engineering projects as working within limited time in bid-pricing frequently impel misinformation, conflicts, omissions and inaccuracy of judgments.

Conversely, a major issue in the multi-disciplinary deployment of BIM is how to distinguish between BIM models as objects and activity-based processes that conventional procedures are made of. Activity-based estimation procedures are prescribed in different forms and versions of Standard Methods of Measurement (SMMs) as though composed of several element-tasks that may be described with fixable cost implications. In currently forms of BIM models, these are made in ways that neither recognize exiting guidance which are predefined in SMMs and practice notes nor proffer a better alternative. Whilst BIM only provides platforms for all stakeholders to put in information into project database and sort whatever data they need, conventional estimation practice is activity-based wherein each element task are measured and defined, not just to standards of clients and project teams' expectations, quantities must be applied to reflect appropriate construction situations. Moreover, as BIM models superficially present auto-quantities in as-it-appear form, certain data that are vitally important to estimators might not be available in some design models. Such includes wastes, allowances for joining and lapping, in-line fittings and accessories, material contexts, treatments and other indirect inputs. Table 1 shows some examples of BIM models in auto-measured forms and the corresponding variables in estimation standards' provisions.

Table 1: Examples of BIM Models in auto-measured Forms and the Corresponding Variables in Provisions of Estimation Standards

Model Forms	*Object-based description in BIM models*	*Activities-based variables of estimation standards*
Floors	*Floors' core material, including surfaces and other contents defined as unitary*	*Floor cores must be separately measured because they imply different costs; then other ancillaries like reinforcements, formworks, treatment to surfaces, etc are measured according to different rules. Other factors include corresponding units, nominal sizes of materials and description details, application complexities, assemblage treatments required, lapping details, shrinkage values and application limitations; ditto finishing and protection.*

Walls	*Wall models are defined according to superficial area of main materials*	*Walls are measured according to types and must be separated from other ancillaries. Other variables of measurements include spot-item related measurements, type of wall materials and treatment to components' core, bedding and jointing details, rendering materials and treatment, special treatments needed on surfaces, coating materials, number of coats, manufacturers' details, etc.*
Roofs	*Roof areas measured superficially*	*Roofs are considered on the basis of materials, manufactures, application limitations, and separately detailed from other attachments. Such include carcasses, ridges, barges, eaves, flashings, etc. Carcasses are measured in relation to sizes, lapping and application details*
Frames	*Frames are as-they-appear*	*Frames are measure according to types and separately from ancillaries, according to height, size or weight and content. Ancillaries are considered on the bases of sizes and weights, lapping, application requirements, treatment to surfaces, etc*
Door and Window Units	*Measured as model units*	*They are considered in relation to different characterizations. Main units are categorized by sizes, materials and thicknesses; then accessories considered separately. This must reflect size, type, model codes and other details of each accessory*

As the level of adoption and maturity of BIM application differ in different parts of the world, there is significant empirical evidence on the need to integrate the requirements and expectations of estimators in BIM model formulation, and this will be helpful to cost-led deployment of BIM universally. It is necessary that project teams improve on their value integration skills in order to facilitate improved design and construction processes. Hence, rather than rhetoric claims on error-proof potential of auto-quantified models, BIM models should be developed to reflect value and cost-led indices in construction activities. Many studies have shown that activity-based measurement of construction works has served the industry as a lasting platform for reliable accuracy, competition, accountability, openness, generation of value for money and innovative estimation procedures in construction.

3. Conclusion

Effective estimation procedure depends on the interaction between project teams and the value of quality of information design processes could reflect. However, while manual and conventional CAD applications are delimited by certain limitations, BIM promises marked improvements through collaboration and integration. There are exceptional opinions on the impact of auto-quantification in BIM on estimation. Although, this and other capabilities promised in BIM markedly reduce errors and conflicts of judgments in estimation, it is evident that bridging the gap between estimation conventions and auto-quantification features on BIM models is a challenge. Therefore, while the adoption and level of maturity of BIM modelling techniques continue to improve; this study identifies the need for stakeholders to develop integrative codes and standards that are systemic and strategic to construction industry's fuller understanding of activity-based work measurement. Further empirical studies are needed to justify the acceptability of other options of measurement other than activity-based measurement rather than superficial claims on product-led auto-generated data. It is also recommended that BIM model development should be relative to multi-disciplinary expectations and standards as portended in the philosophy of trans-disciplinary integration it promises.

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An Assessment of Construction Labour Productivity in Malaysia

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Abstract

The construction industry is one of major strategic importance. Its level of productivity has a significant effect on national economic growth. The analysis of published census/biannual surveys of construction by the Department of Statistics of Malaysia shows that Malaysia managed to achieve construction labour productivity growth between 1996 and 2005 despite increases in cost per employee. The decrease in unit labour costs is attributed to the value added improvement per worker through the increase in capital intensity. The marginal decline in capital productivity is due to the gestation period and the overcapacity of the industry. The civil engineering sub-sector recorded the highest labour productivity and is the most labour competitive in terms of unit labour cost and added value per labour cost. The residential sub-sectors recorded greatest change in the productivity indicators between 1996 and 2005.

Keywords: productivity, construction sector, productivity-measurement, productivity-indicators, Malaysia

1. Introduction

Productivity is by far the most important determinant of the long-term health and prosperity of an economy (Baumohl, 2005). It is the engine of economic growth both for a country and for an individual organization (Hope and Hope, 1997). It is necessary to examine the situation at the industry level for causal factors for economic performance. If the causes of performance in enough industries is understood, it should then be possible to understand what causes a country's productivity to be what it is (Lewis, 2004). This is because the productivity of a country is the average productivity of all industries weighted according to size.

This paper examines the productivity performance of the construction industry in Malaysia in order to establish whether productivity change is the result of industrial composition, or a reflection of the productive capacity throughout the industry. This involves the consideration of the data available from various reports of Census/Survey of the Construction Industry published by the Department of Statistics Malaysia.

2. Productivity measurement

Productivity measures can be classified as single factor productivity measures or multi-factor productivity measures (OECD, 2001). Labour productivity and capital productivity are the two most common examples of single factor productivity measures. Labour productivity is the output per unit of labour input. Labour input is measured along two dimensions: the number of persons employed and the total number of hours worked by all persons employed. There is a possible third dimension that concerns labour quality (Goodbridge and Schreyer, 2007).

The two different measures of output are gross output and value added output. The gross output-based productivity measure provides a more complete picture of the production process by including intermediate inputs as a source of industry growth. It reflects a variety of influences including changes in efficiency, economies of scale, variations in capacity utilisation and measurement error as well as disembodied technological change (Schreyer, 2001). It is sensitive to substitution between factor inputs (including labour) and intermediate inputs, particularly through outsourcing. Outsourcing activities previously conducted in-house will cause the gross output per unit of labour input to increase even though the amount of labour used to produce the output may not have changed.

The inclusion of intra-industry flows of intermediate products would involve double counting on both the input and output side of an industry production function. The input measure would include both the intra-industry transactions and the inputs required to produce them, and output measures would include intra-industry transactions and the goods made from them. The double counting of output and intermediate inputs tends to obscure the extent of technological change or changes in efficiency taking place in the industry/sector as a whole (Schreyer, 2001).

The measurement of output poses problems in relation to changes of quality, particularly in the construction sector. Identifying and capturing changes in the quality of services is difficult in both concept and practice. Although some adjustments for quality are captured in the price data used to deflate current price estimates, the difficulties involved are such that the final measure of industry output may not have adequately captured all changes (Pink, 2007).

The value-added measure is more meaningful in the presence of outsourcing and is generally favoured for estimating labour productivity (Cobbold, 2003). Value added-based measures exclude intermediate inputs. The value-based measure which takes the role of output measure is gross output corrected for purchases of intermediate inputs (Schreyer, 2001). This is in effect a total measure of productivity, converted into a partial measure by deducting the value of raw materials, bought-out goods and services from both the numerator and the denominator to give a measure of value-addedness during the production process (Grimes, 2007). By excluding intermediate inputs, value-added based estimates of productivity growth deny the effect of attributing productivity improvements gained through the more efficient use of intermediate inputs to capital and labour.

An advantage of the value added productivity measure is its ease of aggregation across industries and the conceptual link between industry-level and aggregate productivity growth. Value added is derived directly from national accounts data and is available earlier than gross output and for a longer time series.

At the aggregate (or national) level, gross output-based and value-added based measures are close, only differing to the extent that intermediate inputs are sourced from imports. In proportional terms, this tends to be low. At the industry or sectorial level, however, intermediate usage tends to be a much higher proportion of gross output. This results in a greater variation between the two measures (Cobbold, 2003).

While productivity refers to the physical relationship between inputs and outputs, generally, this is not the way it is being measured, especially over longer periods of time. Output and the composition of input mix change over time. It is difficult to establish a rate of conversion between labour and capital in order to compare them on equal terms. The solution has been to use the price of outputs and inputs and establish the rate of change. This method works well where the value of outputs can be measured independently from the value of inputs. However, there is no obvious way of measuring the output independently of the input in the construction industry. Hence, in the construction industry, productivity increases when times are good and profit is high, and decreases when times are bad and profit is low. In the long run, there are very small changes (Runeson, 2000). In addition, costs are influenced by the level of prices in a nation's economy, the industry's efficiency and the difficulties in its operating environment as perceived by the entrepreneurs. These change with time. A high output may simply be a measure of the level of inefficiency or an indication of high prices in general (Ofori, 1990).

On the other hand, off-site production of formerly on-site activities, process changes - where capital is substituted for labour and which represents a substantial source of the reduction in labour required on-site – is not considered as productivity improvement in the building industry. They are classified as manufacturing industries because of the peculiarities of Standard Industrial Classification (SIC) (Runeson, 2000).

3. .Productivity indicators

Malaysia Productivity Corporation (2008) defines productivity indicators as follows:

(a) *Labour cost competitiveness* – competitiveness in terms of labour cost indicates the comparability of the industry in producing products or services at the lowest possible labour cost. There are three competitiveness ratios, which include *added value per labour cost*, *labour cost per employee* and *unit labour cost*.

   i. *Added value per labour cost* (Added Value/Labour Cost) indicates how competitive the activity is in terms of labour cost. A low ratio indicates high labour cost which does not match with the creation of added value.

   ii. *Labour cost per employee* (Labour cost/Number of Employee) measures the average remuneration per employee. A high ratio means high returns to individual workers and vice-versa.

   iii. *Unit labour cost* (Labour Cost/Total Output) indicates the relationship of labour cost to total output. A high ratio indicates high labour cost.

(b) *Labour productivity* – can be used as one of the ways of gauging the productivity performance of the industry. The commonly used indicator is *added value per employee* and *total output per employee*.

   i. *Added value per employee* (Added Value/Number of Employees) reflects the amount of wealth created by the company relative to its number of employees. A high ratio indicates the favourable effects of the labour factor in the wealth creation process.

   ii. *Total output per employee* (Total output/Number of Employees) measures the size of output generated by the enterprise.

(c) *Capital productivity* (Added Value/Fixed Assets) – indicates the degree of utilisation of tangible fixed assets. A high ratio indicates the efficiency of asset utilisation.

(d) *Capital intensity* (Fixed assets/Number of Employees) –the ratio measuring the amount of fixed assets allocated to each employee. This ratio is used to measure whether an industry is relatively capital-intensive or labour-intensive. A high ratio indicates high capital intensity and low ratios mean dependence on labour-intensive methods.

(e) *Added value content* (Added value x 100/Total Output) – this ratio can be used to gauge the degree of utilisation of bought-in materials and services and changes in the price differentials between products and purchases. A high ratio indicates efficient usage of purchase or favourable price differentials. A low ratio means high cost of bought-in materials and services, poor products quality and low price competition.

4. Methodology

The productivity indicators were computed from the data obtained from the three industry surveys and two industry censuses by The Department of Statistics, Malaysia (DOSM). DOSM conducts a Construction Industry Survey every two years and Census of Construction Industry every five years. The surveys/censuses cover 25 industries from the Construction Sector (based on the Malaysia Standard Industrial Classification, 2000). The respondents are the establishments primarily engaged in construction activities, with a value of construction work RM500,000 and above. The surveys collect information pertaining to growth, composition and distribution of output, value added, employment and other variables of the sector (Department of Statistics Malaysia, 2009). All the values from the surveys/censuses are deflated to 2000 prices using the Implicit Price Deflators for construction obtained from the National Accounts (DOS, 2006, 2009).

The construction sector comprises two categories namely, general construction and special trade. General construction comprises three sub-sectors which are residential construction, non-residential construction and civil engineering construction. The second category concerns special trade, which involves activities such as metal work, electrical, plumbing, sewerage and sanitary, refrigeration and air-conditioning, painting, carpentry, tiling and flooring, and glass (Malaysia Productivity Corporation, 2008).

5. Results

The added value per employee of the construction sector has increased between 1998 and 2004 and decreased between 2004 and 2007 (Figure 1). The sub-sectorial comparison shows that labour productivity is falling in the civil engineering sub-sector from 2000 onwards after recovered from a setback in 1998. It also lost its most competitive position to the special trade sub-sector in 2005. The special trade sub-sector was growing between 1996 until 2002; but subsequently falling between 2002 and 2007. The residential sector rose between 1996 and 2004 and surpassed the non-residential sector in 2002. Although there is an overall improvement in the performance of the non-residential sub-sector between 1996 and 2005, its progress is uneven.

The total output per employee follows the trend of the value-added per employee, i.e. it rises between 1998 and 2004 and falls between 2004 and 2007. There is a net expansion in total output per employee in 2007 compared with 1996. However the value added per employee is in contraction. Despite the increase in labour cost per employee, the unit labour cost declined from .22 in 1996 to .21 in 2007; however, the added value per labour cost did not improve. The capital intensity increased, but the capital productivity did not catch up. The added value content of contracts is 29.81 in 2007, compared with 38.51 in 1997.

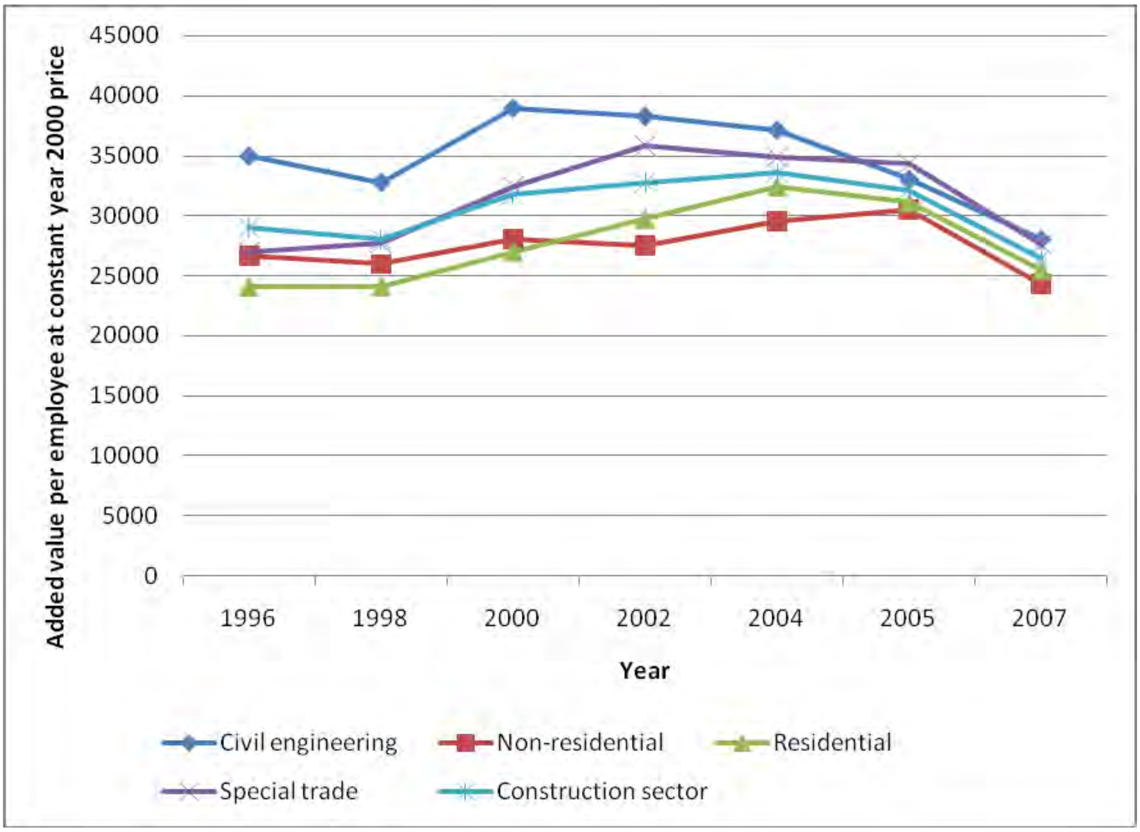

Figure 1: Value added per employee of Malaysian construction sectors (1996-2007)

Table 1: Productivity indicators of the Malaysian Construction Sector 1996-2007 at 2000 constant price

Productivity Indicators	*1996*	*1998*	*2000*	*2002*	*2004*	*2005*	*2007*
Added value per employee	*29055*	*28033*	*31820*	*32741*	*33628*	*32177*	*26444*
Total output per employee	*75439*	*72606*	*86947*	*92607*	*97823*	*91400*	*88712*
Added value per labour cost	*1.72*	*1.60*	*1.67*	*1.62*	*1.69*	*1.75*	*1.40*
Labour cost per employee	*16923*	*17467*	*19020*	*20191*	*19842*	*18408*	*18932*
Unit labour cost	*0.224*	*0.241*	*0.219*	*0.218*	*0.203*	*0.201*	*0.213*
Capital productivity	*2.65*	*2.18*	*2.18*	*2.40*	*2.38*	*2.54*	*2.16*
Capital intensity	*10976*	*12852*	*14585*	*13638*	*14155*	*12681*	*12266*
Added value content	*38.51*	*38.61*	*36.60*	*35.35*	*34.38*	*35.21*	*29.81*

The comparison of productivity indicators shows that the differences among the four sub-sectors, with the exception of value added content, are statistically significant based on the ANOVA test (Table 2). Follow-up tests were conducted to evaluate pairwise differences among the means. As Levene's test for all the productivity indicators (except the last indicator - unit labour cost) are not significant, equal variances were assumed among the four subsectors and Turkey test was selected for the post hoc comparisons. The Levene's test of the unit labour cost is significant, therefore equal variances were not assumed, Game-Howell was used for *post hoc* comparisons (Morgan *et al*, 2004).

Table 2: Mean and One-way ANOVA F Test Statistic (F Ratio) of productivity indicators of construction sub-sectors, 1996-2007 in 2000 price

Productivity Indicators	*Civil engineering works*	*Non-Residential works*	*Residential works*	*Special trades works*	*F*	*Sig.*
Added value per employee	*34747*	*27501*	*27711*	*31410*	*7.32*	*0.001*
Total output per employee	*97632*	*77041*	*78104*	*91873*	*5.97*	*0.003*
Added value per labour cost	*1.76*	*1.57*	*1.52*	*1.63*	*5.80*	*0.010*
Labour cost per employee	*19700*	*17551*	*18170*	*19300*	*3.07*	*0.047*
Unit labour cost	*0.20*	*0.23*	*0.24*	*0.21*	*580*	*0.004*
Capital productivity	*2.01*	*2.88*	*2.97*	*2.10*	*20.24*	*0.000*
Capital intensity	*17424*	*9680*	*9358*	*15182*	*28.32*	*0.000*
Added value content	*35.66*	*35.88*	*35.96*	*34.30*	*0.43*	*0.734*

Table 3: Test of homogeneity of variance of productivity indicators

Productivity Indicators	*Levene Statistic*	*df1*	*df2*	*Sig.*
Added value per employee	*1.888*	*3*	*24*	*.159*
Total output per employee	*1.338*	*3*	*24*	*.286*
Capital productivity	*.562*	*3*	*24*	*.645*
Capital Intensity	*1.901*	*3*	*24*	*.156*
Added value per labour cost	*.166*	*3*	*24*	*.919*
Wages per employee	*1.507*	*3*	*24*	*.238*
Unit labour cost	*3.968*	*3*	*24*	*.020*

The results of the selected statistically significant pairwise comparison are shown in Table 4. The civil engineering sub-sector is higher than the non-residential sub-sector and residential sub-sector for both of the labour productivity indicators, i.e. added value per employee and total output per employee. The civil engineering and special trade sub-sectors have a higher capital intensity than the residential or non-residential sub-sectors. However the residential or non-residential sub-sectors recorded higher capital productivity than the civil engineering and special trades sub-sector. The labour competitiveness indicators show that the civil engineering sub-sector has a lower unit labour cost than the residential sub-sector and higher added value per labour cost than the non-residential and residential sub-sectors.

The residential sub-sector shows the highest improvement in total output per employee (54 percent) and added value per employee (29 percent) between the construction industry censuses of 1996 and

2005. This sector also records a 33 percent increase in capital intensity, 24 percent reduction in unit labour cost and 17 percent increase in the labour cost per employee. The added value per labour cost has improved by 10 percent.

Table 4: Selected results of multiple comparisons of productivity indicators

Dependent Variable	*(I) Types of works*	*(J) Types of works*	*Mean Difference (I-J)*	*Std. Error*	*Sig.*
Added value per employee	*Civil engineering works*	*Non-Residential works*	*7245.57**	*1798.58*	*.003*
Added value per employee	*Civil engineering works*	*Residential works*	*7035.86**	*1798.58*	*.003*
Total output per employee	*Civil engineering works*	*Non-Residential works*	*20591.43**	*5905.72*	*.010*
Total output per employee	*Civil engineering works*	*Residential works*	*19528.71**	*5905.72*	*.015*
Capital productivity	*Civil engineering works*	*Non-Residential works*	*-.87**	*.16*	*.000*
Capital productivity	*Civil engineering works*	*Residential works*	*-.96**	*.16*	*.000*
Capital productivity	*Non-Residential works*	*Special trades works*	*.78**	*.16*	*.000*
Capital productivity	*Residential works*	*Special trades works*	*.87**	*.16*	*.000*
Capital Intensity	*Civil engineering works*	*Non-Residential works*	*7743.86**	*1069.53*	*.000*
Capital Intensity	*Civil engineering works*	*Residential works*	*8065.57**	*1069.53*	*.000*
Capital Intensity	*Non-Residential works*	*Special trades works*	*-5502.00**	*1069.53*	*.000*
Capital Intensity	*Residential works*	*Special trades works*	*-5823.71**	*1069.53*	*.000*
Added value per labour cost	*Civil engineering works*	*Non-Residential works*	*.20**	*.07*	*.038*
Added value per labour cost	*Civil engineering works*	*Residential works*	*.24**	*.07*	*.009*
Unit labour cost	*Civil engineering works*	*Non-Residential works*	*-.03#*	*.01*	*.005*

* The mean difference is significant at the .05 level using Turkey HSD test.

[#] The mean difference is significant at the .05 level using Games-Howell test.

The improvement is mainly due to the initiative to increase the use of the Industrial Building System (IBS) that utilises techniques, products, components, or building systems which involve prefabricated components and on-site installation (CIDB, 2005). The Construction Industry Development Board Malaysia formulated the *IBS Strategic Plan 1999* which subsequently redesigned its strategies and formulated the *IBS Roadmap 2003-2010* (CIDB, 2009). Examples of the measures taken are:

encouraging the use of alternative construction materials and technology under the IBS and designs based on the modular coordination concept in housing construction; using IBS components in the construction of affordable homes and in Government building projects and enforcing the use of modular coordination concept through Uniformed Building By Laws by the local authorities, increasing usage of IBS components in Government building projects from 30 percent to 50 percent commencing 2005 and giving accelerated capital allowance for capital expenditure on moulds to manufacture IBS components (Economic Planning Unit, 2006; Ministry of Finance, 2004, 2005). The initiative requires higher capital investment, which is reflected in the 33 percent rise in capital intensity. IBS reduces labour requirement and there is a reduction of 24 percent in the unit labour costs despite the rise of 17 percent in labour cost per employee. These changes managed to raise the added value per labour cost by 10 percent. The initiative also resulted in a 16 percent decline in value content because of a lesser dependence on in-situ processes. The modernisation of the sector through the purchase of new equipment requires a gestation period before new investments can be realised and therefore the capital productivity has contracted by 2.8 percent.

The censuses indicate there is a decline in the share of civil engineering subsector contribution to the gross output of the construction sector. Its share of the construction sector was 40.9 percent in 1996 and was reduced to 34.9 percent in 2007. Construction in the civil engineering sub-sector remained strong during 1997 underpinned by infrastructure developments. The first phase of the Kuala Lumpur International Airport is at the final stage of completion. Work on the Light Rail Transit Phase 2 is in progress for Commonwealth Games in September 1998. Several road projects are at various stages of implementation. These include the Second Link to Singapore, the Middle Ring Road II in Kuala Lumpur, the upgrading of Kuala Lumpur-Karak Highway and Simpang Pulai-Loji-Gua Musang-Kuala Brang Highway (MOF, 1997). Due to completion of major infrastructure projects such as the Kuala Lumpur International Airport and the Commonwealth Sport Complex construction activities in the civil engineering sector have slowed down significantly in 1998 (MOF, 1998). In addition, the Government had to defer the implementation of several large projects because of 1997/1998 East Asian Financial Crisis. Given the volatile nature of the international environment as well as the need to extract the economy from recession, the Government implements the National Economic Recovery Plan (NERP) to revive the economy. The Government stepped up its expenditure by RM7 billion in July 1998 which was focussed on selected projects with strong linkages to ensure maximum stimulus to economic growth, minimal leakage in terms of imports and short gestation periods as well as those with the capacity to enhance the efficiency of the economy (BNM, 1999). Subsequently, the civil engineering sub-sector has recovered because of a higher budgetary allocation for public infrastructure. Among the major on-going projects are the construction of the East-Coast Expressway, Kapar-Sabak Bernam and Klang-Banting Road, Tanjung Kidurong-Berkam Coastal Road in Sabah, Rawang-Ipoh double tracking project, the new Johor-Singapore Bridge as well as the Stormwater Management and Road Tunnelling (SMART) project in Kuala Lumpur (MOF, 1999, 2000, 2001, 2002, 2003).

The completion of several large infrastructure projects and the accelerated completion of the Eight Malaysia Plan projects, coupled with a lower number of new contracts awarded by the Government have contributed to a slower activity in civil engineering work in 2004 (MOF, 2004). Activities in the civil engineering sub-sector tapered off during 2005, partly due to the reduction in the number and value of infrastructure contracts awarded (MOF, 2005).

Table 5: Percentage change in productivity indicators of Malaysian construction sub-sectors between Construction Industry Censuses 1996 and 2005 (at 2000 constant price)

Productivity Indicators	*Civil engineering*	*Non-residential*	*Residential*	*Special trade*
Added value per employee	*-5.59*	*14.39*	*28.89*	*27.28*
Total output per employee	*3.74*	*20.10*	*54.09*	*30.41*
Added value per labour cost	*-3.81*	*1.55*	*9.83*	*8.95*
Labour cost per employee	*-1.85*	*12.64*	*17.36*	*16.82*
Unit labour cost	*-5.38*	*-6.21*	*-23.84*	*-10.42*
Capital productivity	*-7.20*	*8.47*	*-2.77*	*-20.08*
Capital intensity	*1.74*	*5.46*	*32.57*	*59.26*
Added value content	*-8.99*	*-4.75*	*-16.35*	*-2.40*

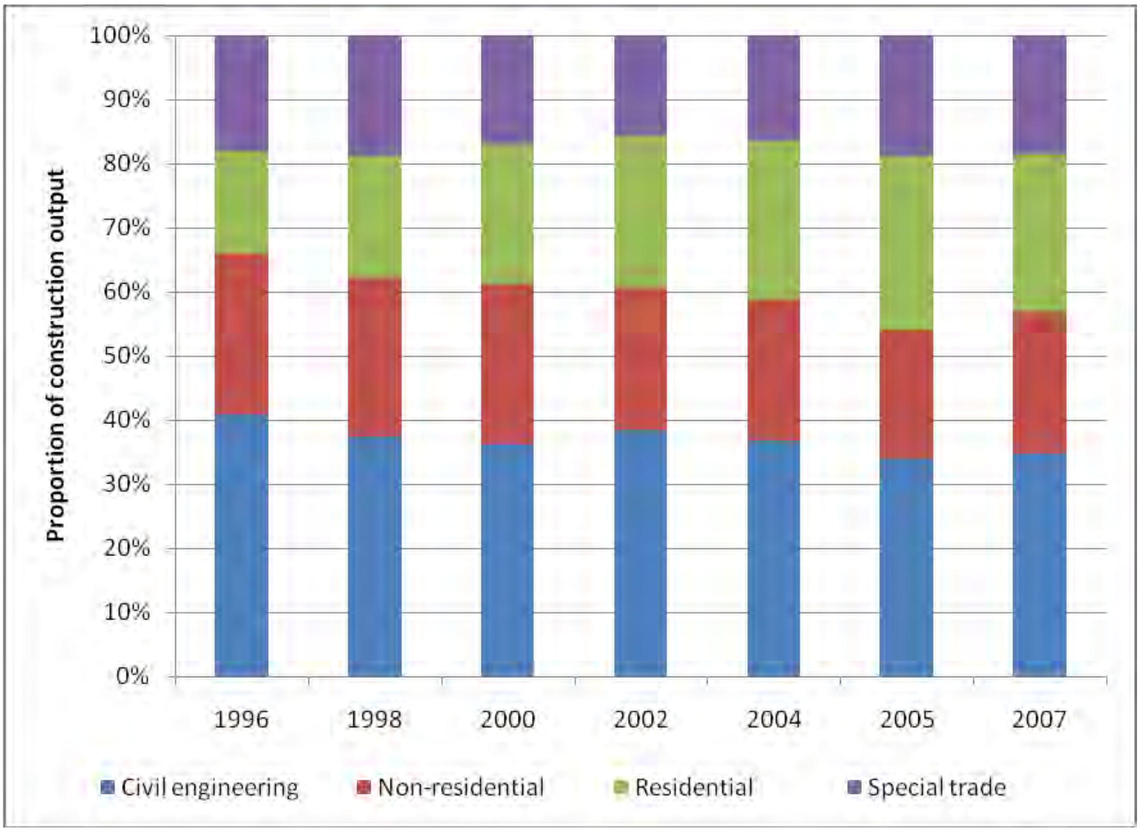

Figure 2: Distribution of construction output (1996-2007)

The civil engineering sub-sector picked up in 2006 with the production of infrastructure projects under the Ninth Malaysia Plan (9MP) and ongoing projects such as Kuala Lumpur-Putrajaya Expressway, Senai-Desaru Expressway, Duta-Ulu Kelang Expressway as well as upgrading works at the Kota Kinabalu International Airport (KKIA). Among the 9MP projects, totalling RM15 billion announced by the Government in July 2006 (MOF, 2006). The construction sector is strengthened further with the implementation of major transport-related projects, such as the Second Penang Bridge, Penang Monorail, Ipoh-Padang Besar Double Tracking Rail project and extension of Ampang and Kelana Jaya Light Rail Transit lines. Efforts to develop Southern Johor as one of the world's largest integrated petroleum logistics hubs and the ongoing NCER will further add impetus to the growth of this sector (MOF, 2007).

Finally, Bivariate correlation test shows that capital and output of industrial composition are statistically significant associated with the labour productivity (table 6). The directions of correlation were positive, which means capital deepening or rise in output tend to have higher labour productivity. Using Cohen's (1988) guidelines, the effect size is 'larger than typical' to' much larger than typical' for capital (r=.54) and 'typical' to 'larger than typical' for output (r=.39) (Cohen, 1988).

Table 6: Pearson correlation of elements of industrial composition and construction labour productivity (N=28)

Elements of Industrial composition	*Value-added per employee*		*Output per employee*	
	Pearson Correlation	*Sig.*	*Pearson Correlation*	*Sig*
Output	*.390**	*.040*	*.410**	*.030*
Input	*.356*	*.040*	*.453**	*.016*
Number of employee	*-.028*	*-.888*	*-.081*	*.683*
Wages	*.206*	*.294*	*.192*	*.328*
Capital	*.540***	*.003*	*.460**	*.014*

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

6. Conclusions

Labour productivity reflects more than just the efficiency of the productivity of workers. The output is influenced by many factors that are outside the workers' influence – including the nature and amount of capital equipment that is available, the introduction of new technologies and management practices.

The labour productivity of the Malaysian construction sector peaked in 2004 over the period between the years 1996 and 2007. The civil engineering subsector kept its highest levels of labour productivity among the four sub-sectors; however, it also has had a downwards trend from the year 2000 onwards. The special trade subsector was catching up as the next highest labour productivity sub-sector and surpassed the civil engineering subsector in 2005.

The unit labour cost of the civil engineering sub-sector is the most competitive despite it having the most expensive labour cost per employee among the four sub-sectors. While civil engineering is the most mechanised subsector and it has the highest capital intensity, it also recorded the lowest capital productivity.

Between the construction census of 1996 and 2005, the residential sub-sector recorded the highest growth in labour productivity, both in value added per employee and total output per employee. In order to improve productivity, the residential sub-sector has focused on various strategies - such as reducing in-situ processes and increasing the use of the Industrialised Building System (IBS). The changes require acquisition of new machines and equipment for new projects. These are reflected in the dramatic increase in capital intensity. However such investment requires a gestation period before the results are seen in the capital productivity. Hence, there is a marginal decline in capital productivity.

Construction productivity has a long history of being difficult to estimate because of the variety of projects and techniques in different parts of the world, even within the same region. The sectorial performance comparisons and analyses indicate that increases in the intensity with which labour uses capital are necessary for sustainable productivity growth. The study also identifies a need to deal with the issue of capacity utilisation that impinges the capital productivity growth. Finally, Malaysia is a small, open and trade dependent nation. The sustainable growth of the construction industry perhaps requires not only the ability to increase productivity but also meeting the challenge of the 'new construction industry' envisaged by Runeson and de Valence as a result of globalisation of the construction market and technological progress in communication technology (Runeson and Valence, 2009).

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The Use of Bills of Quantities for a New Tender Price Index

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Abstract

Currently the building cost index of the Stellenbosch University's Bureau for Economic Research (BER) is the only published tender price index in use in South Africa. Because of the relative age of the index, which was established in the late 1960's, the author has undertaken, as part of the research for his PhD-degree, to investigate the possibility of establishing a new tender price index (TPI) for use in the South African construction industry. One of the concerns regarding the current BER index is that the weights of the index are not longer representative of current building trends, types, etc.

This paper looks at the analysis of recent priced bills of quantities in order to arrive at a new set of weights for use in a proposed new TPI and how this compares to the current weights of the BER index

The findings of the paper is that the existing 22 weights as used by the BER can be extended to a bigger number with different items, that will be more representative and therefore should have a greater accuracy when compiling a new index

Keywords: tender price index, bills of quantities, index weights

1. Background

According to the handbook of the Steel and Engineering Industries Federation of South Africa (SEIFSA), an index is a numerical scale representing a relative level of price at a particular date compared with the price ruling at some other date (SEIFSA, 2009). Marx (2005) mentions that there are two kinds of indices that are generally used in the building industry namely indices based on the cost incurred by contractors and indices based on the purchase price of clients. Marx further states that a cost index is influenced by the purchase price of material, labour cost and the purchase price of equipment, while the second kind of index, a contract price index or a tender price index, is based on the tender prices of contracts.

Indices can be used either for updating historic cost data to current pricing levels or for predicting future trends. According to Ashworth (1991) some of the most common applications of index numbers are cost planning, forecasting, price fluctuations, comparisons of cost relationships, assessment of market conditions and pricing.

2. Purpose of the study

As will be discussed later, the building cost index of the Stellenbosch University's Bureau for Economic Research (BER) is currently the only published tender price index in use in South Africa. Because of the relative age of the index, the author has undertaken, as part of the research for his PhD-degree, to investigate the possibility of establishing a new tender price index (TPI) for use in the South African building industry. One of the concerns regarding the current BER index is that the weighting of the index is not representative of current building trends, types, etc. This paper attempts to establish whether recently priced bills of quantities can be used in order to arrive at a new set of weights for use in a new TPI and how this compares to the current weights of the BER index.

3. Choice of weights for an index

All commodities that are used for an index are not necessarily of equal importance. Akintoya (1991) states that the choice of weights therefore becomes very important when items are being considered for an index and that the weights assigned to the various items must be carefully chosen to measure their relative importance within the index.

There are a number of indices available, but according to Marx (2005), the Laspeyeres index is one of the most popular. This index, which is also used to compile the BER index, is a combined base-weight index and can be represented as follows:

$$\frac{\text{Total cost of base-year quantities at current prices}}{\text{Total cost of base-year quantities at base-year prices}} \times 100$$

Seeley (1996) states that the major items incorporating the largest price extensions in each work section of bills of quantities should be included in the index. Marx (2005) quotes Mitchell (1971) who has shown that because a relatively small number of bill items account for a high proportion of the total cost, a high level of reliability can be achieved by using as little as a 25% sample of the total bill value.

4. History of the BER index

The original index was developed in 1966 by Brook, a quantity surveyor who was at the time responsible for research and development in the quantity surveying division of the Department of Public Works in Pretoria. The original Brook index was based on the variation of the cost items of a single storey, 100m^2 quasi-house (Segalla, 1991). According to Marx (2005) the cost of a suspended concrete slab "was somehow also included in the index". Killian (1980) mentions that, in search of a deflator for prices of buildings, the BER discovered a building cost index at the Department of Public Works in Pretoria. Permission was granted to the BER to publish this index. It subsequently became necessary for the BER to develop its own index. The BER set up a team consisting of Brook, the author of the original index, together with an economist, a statistician and engineer to re-assess the compilation of the Brook index. This resulted in the BER building cost index.

Brook (1974) describes the background to the development of the index as follows:

"The basic logic involves the assumption that the total building cost will move in correspondence with the cost of the specific items selected for the purpose. The accuracy of the index will, accordingly, depend on the degree to which the items are representative of the most common, and therefore the most widely used, construction and finishing materials. To this end the items have been selected in such a manner that the resulting index will be indicative of relative cost levels not only for various types of buildings but also for various regions in the Republic of South Africa and also South West Africa (now Namibia).

Twenty-two cost components were selected and expressed as quantities. The latter are weighted in proportions to the role played by each in the total cost, in which consideration had been given to the incorporation of basic design criteria which vary from the simplest one of the fundamental ratio of light or window area to the more complicated criterion of a predetermined floor loading in respect of the ratio of formwork, steel and concrete in the selected floor slab component"

The description of the 22 items used to compile the BER index, together with their units and quantities are given in Table 1. Also included in this table is the percentage weight of each item (column 4). This was calculated by Marx (2005) by using the average item rates published for the 73 quarters between 1985 and 2003.

Table 1: BER index: items, quantities and percentage weights

No	Item	Uni	Quantity	% Weight
1	Excavation for footings	M3	77	2.1
2	Mass concrete in footings	M3	15	4.9
3	Reinforced concrete in slabs	M3	23	8.2
4	Centering to slabs less than 4,5m high	M2	93	5.4
5	Reinforcement	Kg	907	3.1
6	Vinyl or similar flooring	M2	84	4.2
7	Half brick wall	M2	84	4.8
8	One brick wall	M2	84	9.3
9	280mm Hollow wall	M2	84	9.9
10	Facings	M2	84	4.2
11	Asbestos or galvanised iron roof covering	M2	279	15.7
12	38x114mm Sawn softwood roof trusses	M	305	3.1
13	6mm Gypsum/asbestos ceiling (no brandering)	M2	185	6.1
14	44x813x2032mm Semi-solid core door	No	10	2.2
15	76mm Mortice lock (4-lever) external quality	No	10	1.5
16	Steel frame for 813x2032mm door (HB)	No	10	1.4
17	Steel or wooden window (stock)	M2	9	2.1
18	25mm Cement screed	M2	42	0.8
19	Internal plaster (one coat)	M2	334	5.9
20	152x152mm White glazed tiles	M2	8	0.7
21	3 Coats PVA on plastered walls	M2	334	3.7
22	Glass in steel or wooden frame	M2	9	0.7
	Total			100.00

By using the quantities (or weights) as indicated in Table 1, an index is calculated for each specific project by multiplying the applicable weights with a rate supplied on a quarterly basis by quantity surveying firms, who submit BER calculation sheets for completed projects. The total amount obtained for each project is then expressed as a percentage of the amount obtained in the base month (currently April 1990). These project indices are then used to calculate the overall building cost index.

According to Brook (1974) it was also necessary to include an adjustment in respect of the Preliminary and General (P&G) component of bills of quantities. Segalla (1991) confirms this when he states that to ensure that correct comparisons are made, the index allows a 5% P&G amount per project. This 5% was derived from norms established during previous analyses.

The BER calculation sheets also make provision for allowances for contingencies and amounts for electrical work, lifts and air conditioning which are calculated as a percentage of the contract amount (Brook, 1985). The averages for all projects in a specific quarter are given in the final analyses. There are also a rate per sanitary fittings and an all-in rate for reinforced concrete given, but the above are not included in the calculation of the index.

5. Reasons for a new index

The question can be asked why it would be necessary to change or replace the existing BER index if it had been in use for more than 40 years. Segalla (1991), states that although the fundamental formula for generating the index has remained unchanged since its initial development in 1966, the index has undergone continuous enhancement through the years. Some of those changes, according to Segalla (1991) and Brook (1985) are:

- Changes in regional divisions. The information obtained from quantity surveying firms are categorised according to nine different regions throughout South Africa. Through the years the borders of these regions have been changed occasionally either according to magisterial districts or provincial borders. The fact is however that during some quarters no or very few projects are submitted for some of these regions. The index is seldom used on a regional basis and therefore the average index figure for all projects is much more reliable.

- Project specific indices. In 1987 the calculation of project specific indices for 28 categories of projects (housing, flats, offices, shops, education, factories, churches, hospitals, police stations, etc) were calculated. As with regional indices however, the number of completed projects are not sufficient to separate them into these categories.

- The changing of the base date. The base date, which was originally 1970, was first changed to 1975 and later to 1990, which is still the current base date.

- A rate per sanitary fitting was introduced (but does not form part of the index).

- Whereas the base rates for the quarter immediately preceding that of the index to be computed were previously used in the calculations, it was later decided to use the base rates relating to two quarters prior to those of the specific index being computed. This was done because it was found that the base rates for quarter t-2 are more stable than for quarter t-1 as the former are usually based on a larger number of analysed projects.

From the above it can be seen that the index has changed very little since its inception. An indication that the BER is also worried about the correctness of the index is the fact that the Department of Quantity Surveying and Construction Management at the University of the Free State was appointed in 2005 by the BER to investigate whether the index measures changes in the cost of construction in South Africa correctly (Marx, 2005). Although this study was completed and submitted to the BER, very few of the suggested changes were implemented. The PhD-degree study as indicated earlier emanated from discussions between the author and Dr. Charles Martin, senior economist at the BER, who expressed concern about the age of the index and that "best practice" is not followed any more in compiling the index (Martin, 2006).

Some of the major items of concern regarding the BER index according to Marx (2005) and from personal observation are as follows:

- The current item descriptions as well as the order of the items are not in line with the latest version of the Standard System for Measuring Building Work (6^{th} edition – revised, 1999) as published by the Association of South African Quantity Surveyors. An example is item 4 of the 22 items used which reads "Centering to slabs less than 4,5m high". A more appropriate description would be "Rough formwork to soffits of slabs not exceeding 3,5m high". Another example is the reference to "Preliminary and General" which should be changed to "Preliminaries"

- Some of the material that are being referred to in the descriptions are outdated, such as item 11, "Asbestos roof covering", item 13, "Asbestos ceilings" and item 20, "White glazed tiles"

- The relative low number of active participation. According to Yu and Ive (2008) the Building Cost Information Services (BCIS) in Britain, who publishes a fix-based match-item index, aim at sampling 80 projects each quarter. In the period between 1990 and 2005 the BCIS TPI has an average quarterly sample size of 67. In comparison the projects sampled for the BER index for the period 2004, term 4, to 2005, term 3, were much less, as indicated in (Table 2) (BER, 2005):

Table 2: Projects sampled: BER Index (2004, 2005)

Year	*Term*	*Number of projects*
2004	*4*	*31*
2005	*1*	*28*
2005	*2*	*28*
2005	*3*	*18*

- The items as well as the weights should be changed (see following section)

6. Methodology

In order to determine weights for a possible new TPI, 20 bills of quantities were analysed for this purpose. These bills were sourced on a random basis from various quantity surveying offices throughout South Africa. In an attempt to have as great a variety of projects as possible, purposive sampling was done among the projects received so that different types of projects with varying tender amounts were used in the analysis. The different types of projects that were analysed are the following:

Motor dealerships (2 off), house, office building, health centre, retail and office park, factory, administration block with lecture rooms, value centre, library, university residence, animal enclosures, magistrate's court, block of flats, laboratories, retirement village, training facilities, hall and resource centre, holiday chalets, primary school.

Most of these projects were in the private sector, but there were also some government projects. The contract value ranged from ZAR2,7m to ZAR200m with an average value of approximately ZAR41m.

Firstly, the adjusted contract value of all projects were calculated by omitting amounts allowed for contingencies, value added tax as well as external works from the original contract value. Although external works is a trade listed in the standard system of measurement, Van der Walt (1992) mentions that it is a function of the nature of every individual site and is therefore not dependant on the building itself. For this reason it should not form part of the trades considered to be part of the weights of a TPI. Secondly, all trades of a project were expressed as a percentage of the adjusted contract value. After all 20 projects were analysed in this way, the arithmetical mean of all trades were calculated. The result of this analysis is given in Table 3. Also indicated in this table (column 3), is the percentage weights of the BER index as previously shown in Table 1, expressed as trades. For example the percentages for half-brick wall, one brick wall, 280mm hollow wall and facings were added and the total inserted as Masonry. It should also be noted that two trades, namely Pre-cast concrete and Paperhanging, were omitted from Table 3 because these trades occurred in only a small number of the projects and therefore were not of significant value (less than 0.1% each of the average contract value).

Table 3. Average percentage of trades

Trades	*% Analysed*	*% BER*
Preliminaries	*8,5*	-
Earthworks	*2,2*	*2,1*
Concrete, formwork and reinforcement	*16,8*	*21,6*
Masonry	*9,2*	*28,2*
Waterproofing	*0,9*	-
Roof coverings	*3,3*	*15,7*
Carpentry and joinery	*3,9*	*5,3*
Ceilings, partitions and access flooring	*2,5*	*6,1*
Floor coverings, wall linings, etc	*1,0*	*4,2*
Ironmongery	*0,9*	*1,5*
Structural steelwork	*2,6*	-

Metalwork	*4,0*	*3,5*
Plastering	*3,4*	*6,7*
Tiling	*2,7*	*0,7*
Plumbing and drainage	*5,7*	*-*
Glazing	*0,3*	*0.7*
Paintwork	*1,9*	*3,7*
Provisional amounts	*30,2*	*-*
Total	*100*	*100*

The following observations can be made from Table 3:

- The absence of some of the trades from the BER index, notably Structural steelwork and Plumbing and drainage. As these trades constitute 2,5% and 5,7% respectively of the analysed projects, it serves as an indication that it should form part of the TPI.

- The average percentage for preliminaries in the analysed projects is 8,5%, compared to the 5% allowance in the BER index. Even if it is not a huge difference, the fact that Preliminaries fluctuates a lot, depending on the economic climate, indicates that weights of a TPI should be re-evaluated on a regular basis. Another noticeable omission is that of Provisional amounts, with a contribution of more than 30% of the analysed projects. Marx (2005) mentions that "The BER building index is compiled from items that represent the most common and widely used construction and finishing materials", and therefore these items represent the basic elements of construction together with their standard finishes. Marx's argument is that for this reason, non-standard finishes and work carried out by specialist sub-contractors (allowed for under Provisional amounts), should be excluded from a TPI. Van der Walt (1992) on the other hand, who did research on tender price indices in the 1970's, argued that provisional amounts form an integral part of construction projects and therefore had to be included in some form (either as a fixed percentage or as a proper trade) in a TPI. Yu and Ive (2008), in evaluating the BCIS's TPI, observed that in some non-residential buildings, mechanical and electrical services represents a significant portion (approximately 40%) of the total cost of the building and leaving this out "could result in large measurement errors".

- The trades where the biggest differences occur are Concrete, formwork and reinforcement, Masonry, Roof coverings, Ceilings, Floor coverings, Plastering, Tiling and Paintwork. The difference in Concrete, formwork and reinforcement can be attributed to the fact that the concrete slab that was added into the weights of the BER index bears no resemblance to the quasi-house that the rest of the index is based on. Most of the other differences among the trades are factors of the BER index being based on a single storey quasi-house opposed to the analysed projects which represents a number of different buildings, both single- and multi-storey with different designs and finishes. Especially in the Masonry trade the difference is high (28,2% against 9,2%). The reason for this is that the quasi-house is quite full on plan with a number of half-brick dividing walls internally, both one-brick and hollow walls allowed externally (although only one-brick walls are indicated on the original plan) and face-brick finish externally. Similarly the roof covering of a single-storey building constitutes a much larger percentage of building cost compared with multi-storey buildings, which may also have a concrete slab as a roof.

- Floor coverings (BER more than the analysed projects) and tiling (BER less than analysed projects) can be considered together because the complete floor covering in the BER index is vinyl flooring, whereas in the analysed projects floor tiling comprises the majority of floor finishes.

Thirdly, the priced bills of quantities of each project was analysed in detail. This was done by taking each trade and extracting all measured items with a value of more than 5% of the trade value, expressing it as a percentage of the trade as well as of the total contract value. The 5% is an arbitrary value, decided upon after different values from 1% to 10% of the trade value were tested in order to see which value gave a reliable sample of the total bill value without using too many items. (According to Yu and Ive (2008) the BCIS re-price all bill items with a value greater than 1% of total measured value). The result of using 5% in the analysis was that an average of 19, 3% of bill items were used which represented an average of 77, 2% of contract values.

Next a matrix was drawn up of all trades listing all items that were used in the 20 projects, listing each item’s percentage of the contract value, frequency of occurrence, average percentage per project as well as the average percentage of all 20 projects. From this matrix items were identified that could possibly be used as weights for a new TPI. The selection criteria were frequency of occurrence, i.e. whether it occurred in 15 or more of the analysed projects, as well as what percentage of the trade value it represents.

When weights for a new TPI were considered, the principles that are used when compiling the South African Consumer Price index (CPI) were studied. In a report on new weights for the CPI, Statistics South Africa (2007) states that they have adopted the Classification of Individual Consumption by Purpose as the basis for defining the categories of items in the CPI basket. This international classification provide for a number of categories such as food and non-alcoholic beverages, clothing and footwear, health, transport, communication, education, etc. Each category is in turn sub-divided into different classes, and for each class there are a number of indicator products for which prices are collected on a monthly basis. An example of this is the category Clothing and footwear, indicated with the allocated weighting for each, given in Table 4:

Table 4. Example of CPI weighting

3.Clothing and footwear		*4,42*
3.1 Clothing		*3,13*
	Clothes for men	*0,99*
	Clothes for women	*1,03*

	Clothes for children and infants	*1,11*
3.1 Footwear		*1,29*
	Footwear for men	*0,56*
	Footwear for women	*0,36*
	Footwear for children and infants	*0,37*

Although a TPI is not as complex as a CPI, the same principles regarding the allocation of weights can be used. In the instance of a TPI, the trades as in the bills of quantities can be used as categories with representative measured items serving as the indicator items for which prices will be collected on a quarterly basis.

7. Findings

Based on the above principles new weights were determined from the analysed bills of quantities. These weights are indicated in Table 5.

Table 5. Proposed weights for a new TPI

Category/indicator item	*% weight*	*% weight*
1.PRELIMINARIES		*8,5*
2.EARTHWORKS		*2,2*
2.1 Excavate for trenches, holes	*0,77*	
2.2 Backfilling to trenches, under floors	*1,43*	
3. CONCRETE, FORMWORK & REINFORCING		*16,8*
3.1 Reinforced/un-reinforced concrete in surface beds	*3,41*	
3.2 Reinforced concrete in slabs/beams	*4,68*	
3.3 Rough/smooth formwork to soffits of slabs	*1,80*	
3.4 High tensile steel reinforcement	*6,91*	
4. MASONRY		*9,20*
4.1 Half-brick walls	*0,81*	
4.2 One-brick walls	*6,29*	
4.3 Extra over for facings	*2,10*	
5.WATERPROOFING		*0,90*
5.1 Dpc under surface beds	*0,90*	
6. ROOF COVERINGS		*3,30*
6.1 Galvanised sheet steel roof coverings	*3,30*	
7. CARPENTRY & JOINERY		*3,90*
7.1 Timber roof trusses	*3,55*	
7.2 Single semi-solid/solid door	*0,35*	

8. <u>CEILINGS, PARTITIONS & ACCESS FLOORING</u>		*2,50*
8.1 Vinyl suspended ceilings	*1,18*	
8.2 Plasterboard nailed-up ceilings	*1,32*	
9. <u>FLOOR COVERINGS, WALL LININGS, ETC</u>		*1,00*
9.1 Carpets on floors	*1,00*	
10. <u>IRONMONGERY</u>		*0,90*
10.1 Door lock	*0,90*	
11. <u>STRUCTURAL STEELWORK</u>		*2,60*
11.1 Welded roof trusses	*1,99*	
11.2 Steel purlins and bracing	*0,61*	
12. <u>METALWORK</u>		*4,00*
12.1 Single steel door frame	*0,23*	
12.2 Standard steel windows	*0,58*	
12.3 Aluminium windows	*3,19*	
13. <u>PLASTERING</u>		*3,40*
13.1 Screed on concrete	*0,86*	
13.2 Internal plaster	*1,97*	
13.3 External plaster	*0,57*	
14. <u>TILING</u>		*2,70*
14.1 Wall tiling	*0.74*	
14.2 Floor tiling	*1,96*	
15. <u>PLUMBING AND DRAINAGE</u>		*5,70*
15.1 110mm Soil pipes	*1,71*	
15.2 WC suite	*1,81*	
15.3 Electric water heater	*2,18*	
16.<u>GLAZING</u>		*0,30*
16.1 6mm Mirror	*0,30*	
17 <u>PAINTWORK</u>		*1,90*
17.1 Paint on internal plaster	*1,75*	
17.2 Paint on timber doors	*0,15*	
18. <u>PROVISIONAL AMOUNTS</u>		*30,20*
18.1 Electrical installation	*20,72*	
18.2 Air-conditioning installation	*9,48*	
TOTAL	*100,00*	*100,00*

As space does not allow a detailed discussion of how all items for the different trades were selected, it is sufficient to say that in some trades the selection was fairly easy, where some items occurred on a regular basis and also had the biggest numerical value, such as Masonry, Concrete, Ceilings, Plasterwork and Tiling. On the other hand, some trades such as Metalwork, Ironmongery and Plumbing and drainage were more difficult with a vast range of items that occurred in the different projects on an irregular basis.

8. Conclusion

From the above investigation the following conclusions can be made:

- It is necessary to look into either replacing the current BER index, or at least provide an alternative TPI for comparing purposes

- It is possible to use current priced bills of quantities to derive weights for a new TPI

- The 36 indicator items as listed in Table 5 can be used as a starting point for such a new TPI as, compared to the 22 items in the current BER index, these items can be considered to be more representative of current building trends.

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Understanding Internal Real Estate Provision Using a Marketing Approach

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Abstract

Real estate-based service provision inside organisations can be provided by Corporate Real Estate Management (CREM) or Facility Management (FM) branded service providers. While these can be shown to have significant contributions to an organisation's growth there is a credibility gap between them and their customers. This paper presents early results from a study into the positioning of internal real estate providers using a marketing-based theoretical framework to bridge the credibility gap. The framework has four main elements – Positioning the brand, Communicating the brand message, Delivering the brand performance, and Leveraging the brand equity (the PCDL model). Early results show that the framework provides a useful way to understand how internal service providers relate to their organisational customers and offers potential for these providers to market their contributions to the organisation through an improved organisational position.

Keywords: corporate real estate management, internal branding, marketing, positioning strategy, service provision

1. Introduction

In the new millennium, the creation of internal awareness about internal service providers to the internal customers is part of necessary changes by senior management to ensure employee deliver required levels of service to external customers. Global competitors have shifted good-based product strategy to a new customer-driven strategy to develop and maintain long-term relationships with their customers (Beckett-Camarata et al., 1998). Empirical evidence suggests that service transaction interface between firm's employee and its customer is a major contribution to the long-term performance, profitability and the survival of the company (Bitner, 1995, Sheth and Parvatiyar, 1995). Quality internal service helps employee to feel more respected and remain longer with the organisation(Cannon, 2002). This lower staff turnover, in turn, can positively impact consumer confidence as well as lower hiring and training costs. Therefore, quality-focused organisations realised that consistent internal service maintained the high levels of external service.

Besides of the high expectation, sometimes, internal service provider must respond with competitive proposal when company open to outside vendor of outsourcing proposal. A drastic cost reduction is something the company expects from the internal service provider. Given that an internal service provider does not necessarily earn profit, the financial comparisons are favourable in spite of inefficiencies. Generally, it is difficult to compare an internal service provider's budget to vendor's outsourcing proposal. Primary reasons for this to happen are an internal service provider is not presented in a business like fashion and internal staff are generally funded to do corporate-good activities which vendor do not have to do.

Corporate real estate management (CREM) as part of internal service provider faces challenge to prove their worth to its internal customers and business units. CREM executives face people from other department who do not want to give up control, cope with flexibility in real estate market to meet rapidly changing needs, managing assets for maximum efficiency and facing the e-commerce wave (O'Mara et al., 2002). In addition CREM has to cope with changes in the business environment that more concerned with competitive advantage due to global market competition and the information communication technology (ICT) revolution changes the lifestyle and business operations that influenced the CREM role to be more creative and proactive (Fryrear et al., 2001, Dennis, 2002, Roberts and Daker, 2004). This paper provides an overview on how to understand CREM service provision inside organisation using marketing approach.

2. CREM dilemma

CREM provides valuable contributions to the business by addressing its objectives. CREM adds value by increasing efficiency, increasing customer satisfaction and improving productivity by incorporating real estate strategy into broader corporate planning (Lambert and Poteete, 1997, Scheffer et al., 2006). There are several ways for how CREM demonstrates its value. These can be classified in physical, financial, human, functionality, and capital market terms, as in Table 1.

Table 1: CREM"s demonstrated value

CREM"s demonstrated value	*Contributions*
Physical	*Provide and manage workspace (Venezia and Allee, 2007, Morgan and Anthony, 2008)* *Data storage and tools to manage physical objects (Roberts and Daker, 2004)* *Corporate site selection (Rabianski et al., 2001, Gibler, 2006)*
Financial	*Financial flexibility in rapid changing environment (Lasfer, 2007, Liow and Ingrid, 2008)* *Cost reduction (Roberts and Daker, 2004, Haynes, 2007)*
Human	*Boost employee satisfaction (Martin and Black, 2006)* *Shifting „cost reduction paradigm" to „value added paradigm" (Weatherhead, 1997, Haynes, 2007)*
Functionality	*Provide conducive workplace design (Gibson, 2003, Schriefer, 2005)* *Owning or leasing (Brounen and Eichholtz, 2005, Tipping and Bullard, 2007)*
Capital Market	*Increase shareholder wealth (Lindholm et al., 2006, Liow and Ingrid, 2008)* *Liquidise capital for uncertainty (Scott, 2004, Tipping and Bullard, 2007)*

Despite all these demonstrations of technical performance, corporations still do not have sufficient insight into the impact of CREM decisions on corporate performance (Scheffer et al., 2006, Warren et al., 2007). It is not that CREM does not provide enough value but it is more towards relationship issue.

There are at least two reasons that contribute to this situation. The first comes from CREM customers' side lacking understanding and interest in CREM and failing to see CREM opportunities beyond cost savings. The second reason comes from CREM executives who fail to position themselves well and have poor communication strategies to uplift themselves to a better position. This means the positioning problem come from both sides underlie by performance and relationship dimensions. Therefore, in dealing with performance and relationship elements, CREM needs some guide in unpacking their problem.

Implementation branding body of knowledge is a relatively new concept to CREM practices, but it has been practiced with success by some organisations for example in the health-care field to reposition themselves (Bak et al., 1994). Internal service provider can maintain a customer-focused culture through branding especially in organisation where employees are aware of their impact in delivering good service (Stershic, 1994). Besides, my making the internal customer central element to the way employees perceive themselves, senior management can aim to achieve external customer satisfaction.

3. PCDL model as exploration tools

Proposition applied in this research that internal branding theory useful in understanding CREM positioning strategies and providing a body of knowledge applicable to its credibility problem underpinning by performance and relationship issues. A model named PCDL model developed by Ghodeswar (2008) was used as guided framework. It is a simplified version of building strong brand concept used by Aaker (1996) and Duncan and Moriarty (1997). The PCDL model contains four elements beginning with Positioning the brand (P), Communicating the brand message (C), Delivering the brand performance (D), and Leveraging the brand equity (L).

The elements from the PCDL model are supported by branding theory and could be used in empirical case studies into CREM's internal organisational positioning (Omar and Heywood, 2009). The PCDL model could provide a solution to the performance and relationship dimensions of CREM's problem of being unrecognised by its customers and trying to be accepted as a source of competitive advantage to an organisation as it also has the same dimensions (Table 2). There are other models for understanding branding theory but the PCDL model is one that encapsulates the required elements in a concise yet comprehensive model.

Table 2: The PCDL Model's framework and its elements

Dimensions	*PCDL elements*	
Relationship dimension	*Positioning the brand (P)* • *Trust* • *Brand identity* • *Value proposition*	*Communicating the brand message (C)* • *Consistency* • *Accessibility* • *Responsiveness*
Performance dimension	*Delivering the brand performance (D)* • *Brand scorecard* • *Brand metrics*	*Leveraging the brand equity (L)* • *Affinity* • *Liking* • *Investing in the brand*

Source: Omar and Heywood (2009) and after Godeswar (2008)

4. Methodology

This study uses a qualitative paradigm because the main aim is to develop theory about CREM's positioning phenomenon inside organisation. This parallels qualitative research's aim to discover meaning and understanding rather than verify truth or predict outcomes (Myers, 2000). A qualitative approach has the strength to address questions and goals derived primarily from specific situations and contribute knowledge to the community in its own perspective.

Strauss and Corbin (1990) asserted that qualitative approach is suitable and highly recommended when little is yet known about the investigated phenomena and the research issues cannot be expressed quantitatively. Given the limited access to data, a qualitative approach is a more useful way of gaining deep and clear experiences from CREM executives and CREM's customers involved with this phenomenon than a positivist approach provides. Hence, the chosen qualitative paradigm closely matched those requirements that need in-depth understanding of data rich in meaning of the CREM positioning situation inside organisations.

Eight cases were selected from different countries as representation of various industry sections - retail, telecommunications, logistics and educations. This paper does not analyse the differences between the two countries but looks at how the PCDL applies to CREM's positioning situation. These organisations are the leading organisation in their industry with significant market share in their respective countries. Multiple-case studies were applied to this study as it is considered more compelling and therefore regarded as being more robust (Yin, 2003). A single case study or country of study appears fragile in the environment where data is accessible and contradictory, which is the nature of comparison research. Each case in the study provided two types of data – semi-structured interviews and document analysis. This paper concentrates on the interview data only.

Interview works as an essential source of case study information because most case studies are about human affairs (Yin, 2003). These human affairs should be reported and interpreted through the eyes of specific interviewees, and well-informed respondents can provide significant insights into a situation. Experience and history of interviewee can lead the researcher on paths to locate other substantial sources of evidence (Yin, 1994). In fact, qualitative interviewing allows the researcher to develop a holistic description of the situation, as well as learn how different respondents interpret events. It allows the researcher to look insight into perceptions and attitudes that were known only to the people that had experienced the phenomenon.

Respondents in this study were derived from two groups of people, one is from the CREM executive's side and other one is from the CREM customer's as branding theory highlighted the needs for service provider and targeted audience in building a strong brand. The same PCDL model framework was used as a guide for semi-structured interviews of both sides. The number of respondents was chosen for its practicality and also to provide corroboration of responses from both sides. At least two interviews were conducted for each case.

This study uses two market conditions – Malaysia and Australia. These two countries represent a developing country with an emerging real estate market and a developed country with a mature real estate market. Either country would be useful in doing research but focusing on one country only is inappropriate because it is not broad enough to give a general understanding from research findings. In addition, Australia is a good place to represent mature markets and comparable to other mature markets – the US and UK.

In this paper, data from all the interviews was used to identify CREM positioning strategies. Each market provides a separate analysis through single-case analysis before being analysed in a cross-case analysis (Table 3). This comparison will be examined in future papers as this paper presents early results from the overall study.

Table 3: Coding for Cross-case Analysis between Australia and Malaysia

Country	*Australia*		*Malaysia*	
Company\respondents	*CREM executives*	*CREM customers*	*CREM executives*	*CREM customers*
Retail	*AusRCe*	*AusRCc*	*MalRCe*	*MalRCc*
Telecommunication	*AusTCe*	*AusTCc*	*MalTCe*	*MalTCc*
Logistic	*AusLCe*	*AusLCc*	*MalLCe*	*MalLCc*
University	*AusUCe*	*AusUCc*	*MalUCe*	*MalUCc*

5. Findings

Organisations' management tend to be dominated by accountancy-based thinking because most organisations are profit oriented. Frequently in the case study organisations, CREM exists as a support unit or cost-oriented department reporting to the Chief Financial Officer (CFO) being two or three layer below the Chief Executive Officer (CEO). CREM customers presume CREM's purpose is to maximise business objectives from occupying space while minimising cost and risk. These create a big challenge to CREM executives as reducing cost contributes little to financial statements compared to providing conducive working environments which give greater impact to the business. Moreover, cost-cutting activities through reducing spaces and relocation of physical buildings to a certain degree have their own limitation.

Positioning the brand

Most CREM executives defined their customers as business units. CREM customers find that CREM function is a specialised area requiring its own qualified person. One customer (AusLCc) mentioned *"my first impression that it is a highly complex area. You need people with skill and experience in that background. It is an area that I have no skills at all"*. With the expertise, CREM adding value by looking after the working environment and helps in the organisation's marketing strategy. As stated by MalUCc *"we will show off our physical environment and the advanced facilities that we have as marketing tools to attract prospective students to come in"*.

Australia has better acceptance from senior management compared to Malaysia, but the trend seems to be moving towards a same direction towards more acceptance of CREM. Organisations in both countries have started to realise the impact that CREM brings to them, in setting their long-term goals, especially during an economic crisis. The statement that CREM is often ignored at board level is slowly changing in both countries. CREM is welcome to help as long as the CREM objective tallies and is accountable with the organisation's goals. A CREM executive from telecommunication industry (AusTCe) stated "t*he primary accountability is to match the shareholder funds invested in real estate and effectively minimise the cost base of the property while meeting the business unit's needs"*.

CREM's value proposition and brand identity can be derived in the following ways:

1. Accountability – by getting the best out of shareholder funds invested in real estate in terms of return on investment, meeting the business needs, minimising real estate costs, and charging users for space usage;
2. Working for the business, not for itself;
3. Applying specific skills in CREM; and
4. Creating positioning for the organisation as a whole by creating certain images or impression from CRE meeting specific organisation needs through real estate development activities.

Organisations are taking bolder steps in utilising CRE more than just providing space for employee activities. A few organisations are venturing into real estate investment activities with support from their senior management. A CREM customer (MalUCc) responded *"at the moment, the university is short of space to house postgraduate students. We are trying to move into property investment. Most likely is to build apartments for postgraduate students through a staff cooperative"*.

Organisations in Australia are practising a trade in the use of space by business units. Majority of business units are responsible of budgeting their own use of space before request it from CREM unit. AusUCe stated *"we are a service provider. We instituted new budget model last year. So we charge everybody for use of space – every faculty or administrative unit, - and that funds the capital plan. And for the operation of the space, utilities, cleaning and maintenance and our property management's costs we charge the university's facilities and common services. We run the space like we are the landlord"*. This is one way of highlighting the CREM function and its contribution to financial measurement. By utilising space budgeting, this helps the organisation to save cost in regards to space planning and company overheads. Organisations in Malaysia are moving toward the same practice where a few of the studied organisations are proposing to senior management to charge business units for the amount of space being used.

Communicating the brand message

CREM executives were expected to communicate in business language rather than cost per square foot language (McCarty et al., 2006). However, one way to impress customers is to show them that CREM executives understand and responsive to their business first. A CREM executive (AusLCe) stated that *"I not only talk all about property related stuff. It is also about the standard of business. You've got to understand how the business works. I cannot just come and doing my job as a property person who did not know what the business is actually doing. It is all coming back to the core business of the company"*. However, communication between CREM executives to senior management is not always abundant. A few studied organisations mentioned that there are cases where real estate issues were not being considered in major company decisions because CREM executives not part of the decision-making process. Clearly, this is an area where CRE industry needs to improve.

In order to gain trust from customers, the CREM executive was expected to be proactive in communication to all direction within organisation; bottom-up and top-down (Figure 1). The strategy was to build up rapport with the customer by identifying their problems earlier and to solve it very quickly. Project based activities like moving, relocation, and a newly-built site which is involved with change in the environment provided an excellent opportunity to built good rapport. This sort of project involves people with various backgrounds. A respondent (AusLCe) affirmed how he has done it, *"we present the whole paper on what we have been doing, how we were doing it, and how much more value we can add if we create the project. It is just generating additional revenue by being smart without really doing anything more from what we are doing. Just do it differently"*. Therefore, project management skill is important for CREM executives to handle all the projects and add value to the organisation.

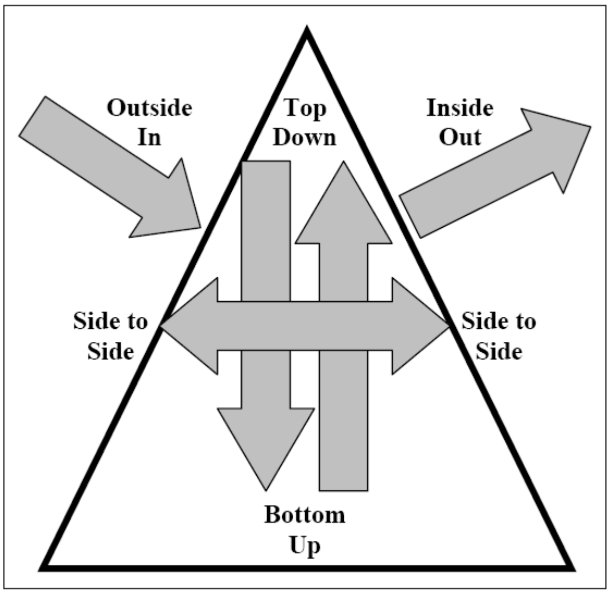

Figure 1: Flow of communication in organisation

The studied Australian companies have more systematic customer relationship management (CRM) compared to Malaysian companies. These companies set up a client account for every business unit managed by a CREM executive. The appointed executive is responsible to monitor what is happening in the business unit related to CREM functions. A reason for this arrangement is because of the number of business units and the ongoing projects CREM have to deal with at the same time. Meanwhile, the information gathered also useful for corporate planning and budgeting.

It was found that not all customers find that the CREM function is important to their business because they think CREM services are replaceable by outside service providers, such as estate agents or property management companies. Probably, this is more specific for site relocation and property maintenance purposes. One CREM customer (AusLCc) mentioned CREM function as "*it just fulfilling the functions that need to be fulfilled. In one way they are supporting our business. There are only a few transactions a year. So we still can outsource it because it is not all the time.* As long as the business units have access to these services they do not need a department with CREM functions. This reinforces the need for CREM positioning strategies.

Delivering the brand performance

The CREM function within an organisation is being accepted as important to the business. A CREM customer from a telecommunication case (AusTCc) stated *"property is major enabler. You've got to have a property function as to fit with the culture and company guidelines. I look overall of what they are doing with the company portfolio is just amazing, like - reducing footprint, reducing costs, and great fit out, and all sorts of stuff"*. In this case, the CREM unit as a single point of contact is crucial for the business because this gives time and resource for business units to focus on their core business.

A changing paradigm from a cost centre towards a unit that adds value to the organisation can be a daunting task. It is always easy for the company to blame CREM if it continues being seen as cost-centred. But the blame is something that they have to live with and the challenge is to increase its value. A head of CREM unit from Australian retailer (AusRCe) voiced how he feels with that role as CREM function inside their retail organisation with *"it is comes with the role. It is just a bad luck. You must be ready and prepare. You know they always catch you out somewhere"*. But he suggested a few ways to add value to the company. CREM executives perform by highlighting the benefits from CREM compared to an outside provider, secondly by continuing to educate their senior management and customers, and continue fixing any problems that arise. He added *"while I am here I will explain what we do. Whenever there is problem or loop hole I will fix it so it does not happen again. It is never about promoting myself. If the company do not want their property function managed by me",I am happy with that. Give me a retrenchment and I will find something else to do"*.

One useful thing to do is to focus more on strategic activities than just doing routine operational activities. Dealing too much with operational activities makes CREM executives lose focus of their contribution in strategic level where the most important parts of performance can be achieved. This happened especially in the retail industry cases. A respondent (AusRCe) mentioned that *"it is difficult because with 700 sites you are constantly drawn back to day-to-day activities. But, what I do is set a little piece of my day after the monthly meeting to discuss what we are going to do in future"*. This scenario happened to both Malaysian and Australian retail cases. However, a prerequisite for CREM before jumping into strategic activities is that every CREM operational activities must be smoothly managed. It is unacceptable to CREM customers if CREM executives forget their role as a supporting unit and left undone important operational activities that need to be done.

Leveraging the brand equity

When the issue of leveraging the CREM function is being raised, CREM executives from both countries preferred to stick to what they know rather than stepping on others' feet. However, one CREM customer (AusUCe) responded that there is room for leveraging for CREM in the area of green issues. He does part of this through green strategies by *"looking after new buildings with a five star rating. We are looking on how we can fit into new buildings to ensure we maintain a high sustainability"*. With the increase of awareness in this area and lack of sole authority in this area, CREM has the opportunity to venture into this area because it involves a lot of physical assets. Australian cases were more aware of this issue compared to Malaysian cases. As one CREM customer (AusTCc) mentioned *"property people are pretty good now because if we do a new fit out, we have to do it based on company guidelines. They have all the information because they do all the research"*.

There is an idea of leveraging CREM's value by incorporating CREM with the IT department along the lines of the corporate infrastructure resource (CIR) model as sometimes these two units share information together and meet common organisational objectives (Materna and Parker, 1998). But a respondent (AusUCe) did not agree with that idea as *"there are quite different parameters between these two. There are overlaps in terms of what you are trying to achieve sometimes. But there are quite different drivers for the two different businesses. So, in many ways it is a matter of time for these two to work together rather than being one department"*.

Even though many CREM executives prefer to stick to their current roles, there is room for leveraging that could be taken up, especially in big corporations. As one customer (AusLCc) mentioned *"there should be some property function across business units. Sometime it could be better in terms of property and corporate outcomes if there were shared facilities"*.

6. Conclusion

This research aims to give useful understanding of CREM's positioning and credibility problem from the perspective of performance and relationship dimensions. This work shows that those dimensions exist in the PCDL model which provides a holistic view with a multi-dimensional approach. The model's four elements help to understand CREM's complex operating world empirically by providing a different way of seeing CREM's situation. To this end, this empirical study shows evidence of the PCDL model in practitioners' understanding of CREM practice. The findings show that the PCDL model provides a useful contribution in understanding CREM's positioning status inside organisations and provides a basis for future CREM's study on how to be aligned towards supporting a competitive organisation.

As this paper is from early analysis of the empirical data future research will involve more detailed analysis of the model's various elements through cross-case analysis and cross-market comparisons.

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A Critical Review on Application of Activity-Based Costing In the Construction Industry

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Abstract

Activity-Based Costing (ABC) has been around for more than two decades and challenges the relevance of simplistic traditional-costing practice. Academics and practitioners together in institutions such as the Consortium for Advanced Management-International (CAM-I), the Chartered Institute of Management Accountants (CIMA), and so on are playing an important role in popularising the ABC system worldwide. The fundamental concept underpinning philosophy of the ABC method highlights that organisations to produce products and services require performing activities, and those activities cause the organisations in incurring costs. The Royal Institution of Chartered Surveyors (RICS) indicated that overhead and profit is added on percentage basis of main contractor's building work and preliminary estimates. It appeared from the literature study that this percentage basis may not provide reliable baseline for planning and controlling overhead in the construction stages. This paper aims to explore and critically discusses the drivers, barriers, challenges, benefits, and further research possibilities on application of the ABC system in the construction industry. Through a thorough literature review, it highlights the potential of the system in implementing sophisticated cost drivers and proves its excellences in assigning accurate overheads to increase project cost control by showing insight to cost cause-and-effect relationships between overheads, project activities, jobs, products and services.

Keywords: activity-based costing, cost planning and controlling, overhead, construction industry

1. Introduction

Construction industry has generally been regarded as playing an important role behind the economic development of any country (Alarcón *et al.*, 2009). It is typically constructing multiplayer effect in the economy worldwide. Previous studies have indicated that construction business has a high dependency on the quality of human resources rather than on fully automated machines. However, business' cyclical and intricate nature of the construction industry unavoidably consume a lot of time (Sears *et al.*, 2008). Therefore, those construction business sectors may have rather higher risk of losses, and even some of them may be liberated out of the global competitive market (Gould and Joyce, 2009).

Construction project today is increasingly sophisticated and the complexity of client's needs for the best value principles rather than lowest cost (CIOB, 2009). It makes construction management operations to involve project participants on the planning, coordinating, and controlling of the project for client's objectives in terms of utility, function, time, quality, and cost (Walker, 2007). Project process issues such as construction methods, value additions, minimum duration, costs saving, and so on can be considered critical to project control. The project control process usually begins with the identification of the client's objectives and likely finishes when those objectives may have been fulfilled. The client's wish is to obtain project within time agreed, at a necessary quality designed, which meet the budget estimated (Potts, 2008). The time, quality, and cost are triangular typical constraints of project parameters that require special attentions due to the unique characteristic of construction project (Aretoulis *et al.*, 2006). Enshassi *et al* (2008) highlighted the importance of having strong periodic controls in managing overhead costs to avoid problems. However, there are emerging important issues of cost planning and controlling in the construction project related business. It is quite challenging that further greater attention needs to be taken for how the cost teams plan project costs to meet contractor's requirement and available resources, how the project itself is controlled and successfully absorbs the project costs as have been arranged, and more specifically how the cost planners accurately predict overheads, then correctly assigning them to the projects in order to improve cost certainty or project margins.

General contractors' perspective approaches on the project level, cost overrun must be prevented to help an affordability of project margins. Primary components of the project price include direct costs, indirect costs, overheads, profits, and contingency (Aretoulis *et al.*, 2006; Giammalvo, 2007). However, the overhead is becoming increasingly important because the clients demand for the projects more sophisticated, complicated and fragmented under competitive budgets. On such changing environments caused general contractor's overhead is increasing comparable to project direct costs (Kim and Ballard, 2002 and 2005). Assaf *et al* (2001) revealed clear evidence that majority contractors thought and experienced overhead expenses have been increasing during the previous years. The trend of overhead is very significantly increased as indicated by 77% of surveyed companies, 9.8% unchanged, and only 13.2% is decreased. Its' portion constitutes an important part in the construction costs, i.e., 13% ratios to project direct cost in Saudi Arabia (Assaf *et al*., 2001), and 11.1% in Palestine (Enshassi *et al.*, 2008), whilst most literature ranged within 8 to 15 percent depending on the project characteristics. The term overhead in the construction company is made up of two groups: home-office and site-project overheads (Kim and Ballard, 2001; Aretoulis *et al*., 2006). It should be considered as the fundamental costs to the construction projects. To determine which overhead is belonged to which activity, it appears to be quite difficult to accurately predict, because overheads are generated by indirect activities which are not clearly defined (Assaf *et al*., 2001), the lack of practical knowledge of the construction process (Akintoye and Fitzgerald, 2000), incorrect initial belief with historical data memory (Heitger, 2007), additional percentage role (RICS, 2009), and the fact that traditional system is still widely used in the UK and overseas (Sutrisna *et al.*, 2004) with it may continue to be conventionally pricing bills of quantities (BoQ). So, the overheads would seem to be brought to the wide variability of project costs with poor transparencies of cost causal relationships. In order to overcome project costing problems, it is suggested that additional strand of future research will help to ensure project budget formulation tools are used more effectively in practice (Fortune, 2006). In light of the ongoing discussion, a research project has been set to gather inventive issues emerged in the construction industry, attractive challenges faced by construction business, potential barriers to implement ABC system, important of post contract cost planning and controlling, and additional benefit of management of construction overheads. This paper intends to provide a review on the ABC system and its applications so far in the construction industry, through a thorough literature review and critical discussion on ABC method.

2. Activity-based costing system

Traditional costing system was initially developed in England between the middle part of the 18th century and early of the 20th century when the industrial engineers and cost accountants such as Josiah Wedgwood in 1754 developed a primary concept of costing system to avoid bankruptcy during recession (Giroux, 1999). It arbitrarily allocates costs and traditionally shares all indirect costs among all products (Daly, 2002). In traditional costing, overhead cost allocations is applied excessively broad-brush average cost rates, it usually rely on a sales-related and volume-based factor, such as direct labour hours or departmental expenses (Cokins, 2001). This system then appears to be common senses distributes prorate overhead costs to every unit of the products. A familiarity and convenience of employing traditional costing system has been utilised for many years and is very rarely used nowadays (Innes *et al*., 1994). A complexity of assigning organisation resources especially fixed-indirect overheads to the wide array of different jobs, products or services in different proportions can undergo many difficulties and radical changes of resource costs (Beaulieu and Mikulecky, 2008). The complexities and difficulties challenge academic scientists and professional experts in critically thinking to change the costing practice methodology from simplistic-traditional system to become sophisticated-contemporary system. This effort of changing is supported with arguments that simplistic-traditional costing system relied on arbitrary allocation bases and discovered fragmental information for planning, coordinating, controlling and decision making (Glynn *et al.,* 2003). A fundamental change established the evolutions of ABC concept. Underpinning philosophy of ABC system defined by Hicks (1999) is used to underline further thinking on application of it in the construction industry, as:

> "The jobs, products, and services an organisation provides require it to perform activities, and those activities cause it to incur costs" (Hicks, 1999, p.50).

In that way the opinion of some literatures and Hicks (1992) is in line with the underpinning philosophy of the ABC system that, cost is caused, the cause of the cost is activity, the reason of the cost can therefore be managed, and trigger of the cost should be controlled.

The sophisticated ABC system differs from simplistic traditional cost accounting. The ABC system employs reliable hierarchical process and diverse activity cost drivers assignment bases in assigning organisation resource costs to greater variety of cost objects, while simplistic traditional system uses volume-based allocation (Kim and Ballard, 2005). Major differences between simplistic traditional system and sophisticated ABC system can be summarised in table 1, based on work done by Cooper and Kaplan (1988); Innes and Mitchell (1998); Hicks (1999); Grannof, *et al.* (2000); Cokins (2001); Daly (2002); Kaplan and Anderson (2007); and Drury (2008).

Table 1: Major Differences between Simplistic Traditional System and Sophisticated ABC System

Criterion	*Simplistic Traditional System*	*Sophisticated ABC System*
Interpretation of resource consumptions	*Resource costs are directly consumed by cost objects*	*Resource costs are consumed by activities, then those activity costs are consumed by cost objects*
Orientation of cost accounting	*The basis of cost accounting is orientated on departmental structure*	*The basis of cost accounting is orientated on hierarchical process of activities*
Utilisation of cost drivers	*Cost accounting mostly employs volume-base allocations at single rate of unit costs*	*Cost accounting use activity hierarchy levels at multiple rates of cost drivers*
Concern on cost objects	*It focuses on estimating single type of cost objects by the unit levels for the products and services*	*It interests on estimating multiple types of cost objects by the unit, batch, product, and facility levels for sustaining the jobs, products, and services*
Specific distribution of overheads (advantages / disadvantages)	*It allocates prorate overheads and brings a problem of cost distortions, because of its inability to highlight the visibility degree of cost cause-and-effect relationships*	*It assigns overheads per activity to avoid a problem of cost distortions, because its ability to highlight the visibility degree of cost cause-and-effect relationships*
Relative monetary value of accounting systems (potential benefits / losses)	*It is financially cheaper to implement and maintain because is familiar system to available human resources, but provides simplistic cost accounting, hiding unknown benefit or potential to lose.*	*It is relatively rather expensive to implement and maintain, required qualified human resources, but provides higher cost accounting accuracy, potential to engineer clear benefits or profits.*

ABC System identifies complexity and diverse cost drivers that related to various types of resource costs, such as direct-variable (e.g. material, labour, setup, inspection), direct-fixed (e.g. design, resource planning, estimating, budgeting), and indirect-fixed (e.g. office rent, general administration) (Beaulieu and Mikulecky, 2008). In order to enable separate measurement to specific jobs, products or services, an organisation is required to perform activities, and those activities need an organisation to incur resource costs (Hicks, 1999). In this way the ABC system demonstrate its excellence drivers in assigning resource costs to cost objects. Activity cost drivers is used to measure the quantity of each activity that is required for each project (Mansuy 2000). Various cost drivers may have been set to serve manufacturing production systems, while specific adjustment is required to adapt in construction process. Table 2 conceived practical hierarchy level of activities in order to visualise the applicability of cost drivers in construction projects, namely:

- Unit level is activity driver that assigns costs by the units of output bases, where costs are traced for every unit of outputs. A good example for unit level includes direct materials, direct labours, and equipment depreciations (Kim and Ballard, 2001). Direct labour costs will increase in proportional with each additional-unit of products (see: the table 2). This driver is used on the basis of resource-volume related activities. So, the ABC method in this context employs resource driver in similar ways to the traditional allocations.

Table 2: Activity hierarchy level and cost driver

Activity hierarchy	*Cost driver*
Unit-level activities	
Material	*volume units*
Labour	*labour hours*
Batch-level activities	
Mobilisation	*number of mobilisations*
Quality inspection	*number of inspections*
Product-sustaining activities	
General plan	*number of engineering hrs*
Resource planning	*number of resource plans*
Facility-sustaining activities	
Rental office	*square feet*

- Batch level is activity driver that assigns costs by the batches of output group bases, where costs are traced for every batch of outputs, regardless the rank of process-batch. Selected example for this category includes procurement batch (e.g. purchase order, material received, suppliers payment), delivery batch (e.g. material delivery to site), process/task batch (e.g. setup, mobilisation, quality inspection), and hand-off batch (e.g. external quality inspection) (Kim and Ballard, 2001). Internal and external quality inspections are executed on group of the batches to sub projects, work groups, or process units. So, for this type of batch level, the number of inspections may become a proper driver.

- Product-sustaining is activity driver that assigns costs by the particular occurrence of output bases, where costs are traced for every output of products, regardless the number of unit and batch. A proper example for this driver including general planning, resource planning, cost planning, estimating, budgeting, and cost control that are occurred at both home-office and site-project (Kim and Ballard, 2001). The more resource planning numbers are occurred for sustaining the projects, the more resource planning costs should be assigned to that project. The number of resource plans may become an excellent driver.

- Facility-sustaining is activity driver that assigns costs by the facility employed for output bases, where facility cost support whole project and entire organisation. A fine example for this category is rental offices and general administration costs (Kim and Ballard, 2001). Those resources are not directly related to the project, but the costs that are assigned by facility-sustaining activity driver will therefore seem to be traceable square-footed (Beaulieu and Mickulecky, 2008). However, the projects cannot avoid those inevitable costs.

The ABC system is initiated by the CAM-I institution to improve simplistic traditional accounting system for manufacturing company, but nowadays has extended to serve cost management concerns for trading, healthcares, banking, insurances, and other service companies including construction industry sectors.

3. ABC system in the construction industry

Construction industry demands large resource that supplies from other prospective producers (Alarcón *et al.*, 2009). It has built a wide opportunity in construction business with significant expenditures. The total output of the construction industry in Great Britain was estimated at £123.24 billion in 2008, an increase of 20.5% on the figure for 2004 (Construction Industry Market Review, 2009). The UK economy is vitally linked with the construction industry, which accounted for 8% of the gross domestic product (GDP) in 2005 (RocSearch Ltd., 2006). In the US construction industry, this sector has spent approximately by US$1.155 trillion that represented 9% of its GDP in 2006 (Sears *et al*., 2008; Gould and Joyce, 2009). Construction industry is inherently complex and may involve intricate projects which required lots of resource. In general terms construction resources included human, funds, equipment, and materials (Walker, 2007). Those resources should be measured in term of monetary value to more visible in engineering cost control baseline. Within construction projects, the impact of cost planning and controlling for profit is meaningful because for many contractors the assurance of profit is a top priority (Ostwald, 2001). However, traditional cost accounting system may still continue to price the BoQ and add percentage overheads and profits base on main contractor building costs and preliminaries (RICS, 2009). Unfortunately, percentage addition of overhead and profit has poor visibility cause-and effect relationships with project activities. Staub-French and Fischer (2002) developed activity-based cost estimate (ACE) model based on the preferences and particular features in a given product design to help estimators customise resources, project activities, and resource productivity rates, but this model excluded an importance of external factors like site characteristics and availability of resource skills. The ACE model has not specifically included explicit overheads and profits. However, this literature review focuses on application of ABC system to predict accurate overheads and engineering benefits or profits in the construction industry.

The ABC system is not new in construction industry and other organisations. Innes and Mitchell (1995; 1997) declared that the CIMA administered postal questionnaires to survey the Time-1000 largest companies in the UK and achieved 439 total responses which involved 21 cross-sector organisations. The survey found that, 9.5% of “construction and building” companies have been implementing ABC system into the main core of cost accounting, large numbers of companies are still considering whether to adopt it, and another 9.5% has declined to use ABC system (Innes and Mitchell, 1995). It would appear some beliefs that the adoption and application of ABC system may improves business performances in both corporate management levels and technical operations. Kennedy and Affleck-Graves (2001) provide empirical evidence that performance of the ABC’s implication in competitive market within the first three years adoption is significantly increased in both economically and statistically at about 27 percent above the achievement of non-ABC companies. These positive figures of previous ABC applications have performed an insight belief that the adoption of ABC system in the construction industry may provide an opportunity on engineering benefits in terms of both competitive market and accounting measurement. Furthermore, the ABC system may become a leading contender method to cost management and production control, that encourage managers to effectively manage construction process, to identify construction cost inefficiencies, and to undertake corrective actions (Marchesan and Formoso, 2001). On the other hand, traditional costing techniques continue to be employed on the lack of practical knowledge of construction process. It was inaccurately estimating project costs (Akintoye and Fitzgerald, 2000).

The accuracy of cost estimation should not be damaged with reliance on neglecting the important change of personnel improvements and individual adjustments from representation of historical data memory and incorrect initial belief for costing project activities (Heitger, 2007). A corporate culture of construction organisation in practice would seem to be changed due to progress of cost accounting and management development. It can therefore be assumed that the requirement of cost accounting reports to satisfy third party, nowadays, may be extended to cover construction activities, services, project lines, and even anything that becomes the need of the decision maker. The application of the ABC concept and development of the ABC system in the construction industry may provide powerful cause-and-effect relationships to change the role of how personnel "think and act" (SAP AG, 2000).

Regarding the application of ABC system, various research findings have been revealed, numerous ABC literatures are established in many areas of construction industry. Those conditions indicate that the logic of ABC concept seems to be successfully adapted in respect of better management and cost accounting. However, there is always a need of more extensive research and continuous improvement in developing methods, tools and techniques regarding the suitability of the application of ABC system in the construction industry.

4. Methodology

Literature review enables to synthesise and summarises some other authors' ideas on a specific topic. According to Cooper (1988), the literature review is described as:

> "......a literature review uses as its database reports of primary or original scholarship, and does not report new primary scholarship itself. The primary reports used in the literature may be verbal, but in the vast majority of case reports are written documents. The types of scholarship may be empirical, theoretical, critical/analytic, or methodological in nature.......a literature review seeks to describe, summarise, evaluate, clarify and/or integrate the content of primary reports." (Cooper, 1988, pp.104-126)

General issues of some areas which complement the study such as the recent condition of economy, industry, project jobs, and employment are considered. The main literature review included some research areas like: construction industry, construction management, ABC system, and ABC application in the construction industry. Further, certain specific areas are explored to gather information to collect inventive issues and to identify methods on cost planning and controlling. An addition of this literature review is focused on how to predict accurate construction overheads and engineering project benefits with ABC method, tools and techniques. Following part of this paper has analysed the challenges faced by construction industry/business in the current economic conditions, e.g., economic and industrial downturn; potential barriers of the ABC application, e.g., relatively rather expensive to implement and maintain and inappropriate knowledge of human resources; post contract cost planning and controlling practice; additional benefit of management of the construction overheads, e.g., enable predicting accurate overheads for engineering profits; and possibility of further research.

5. Finding and discussion

5.1 Construction business

Industrial downturns and economic conditions are still ongoing problem nowadays that depress the UK's construction industry sector hardly. According to the UK's national statistics (2009), construction workforce represents substantial quotas at 7% of 30.997 million overall employment, and has fallen significantly as much as 3.3% (all jobs: 1.6%) from 2.245 million to 2.170 million within two years period (June, 2007 to June, 2009). It is further feared with project related "job cuts" that the issue of employment downturn is quite challenging for the construction industry business. Therefore, it is necessary to further tighten up in predicting every single part of cost elements of competitive plans because there is no clear idea yet, when the recession will end (Pitcher, 2009). Construction industry must survive whenever market conditions remain tough which squeeze profit margins significantly (Atkinson, 2009). The snapshot survey conducted by Pitcher (2009) polled more than 1,100 respondents of construction news' readers (CN's readers). It was revealed that staff members of the company employed recently; almost a quarter (23%) expected to be "a lot fewer" by the end of the year 2009, more than one-third (36%) declared that has redundancies, while only less than one-tenth (8%) predicted growth in headcount, and another one-third (33%) survived at "about the same" employment (Pitcher, 2009). From the survey reports based on the industrial information of CN's readers show an identical figure to the construction sector itself. Project employments have decreased and expressed unstable economy of future uncertainty of the construction industry. On the other hand, construction project is increasingly diversified, and complicated in satisfying the requirements for client's demand. As those quality characteristics of projects will inevitably consume lots of time and funds. It seems some things must be sacrificed that construction companies should reconsider a deployment of extensive staff redundancies (e.g. project management teams, supervisors, engineers, officers, securities, helpers, etc.), over capacity of facility (e.g. site offices, labour camps, warehouses, batching plants, heavy equipments, etc.), and wasteful utilities; (e.g. power, phone, software, internet, television, video-audio, security system, etc.). Those situations challenge major contractors to perform adequate cost predictions in order to financially cope with business operations in construction project. Main contractor should continue to improve its expertise and professionalism to plan real project costs. It must be tightened up the ceiling budgets with intensive cost control, and more importantly spreading costs with proper assignment methods, tools and techniques. Whenever the phases of project are successfully completed within the time scheduled and conformance of quality, then all of these have to be paid for by the client as much as contractor's price initially and mutually agreed, no-more no-less (Giammalvo, 2007). In order to visibly meet requirement of the profit for contractor's business principles, the project's real prices and cost expenses have to be properly planned and suitably controlled as accurately as possible.

5.2 Post contract cost planning and controlling practice

A shortcoming of current cost management methods, tools and techniques may be unable to satisfy an importance of construction cost planning and controlling practice. It could distort an accuracy of cost predictions for the contractor's preferences. Poor practical knowledge in construction process may still continue to be the weaknesses of the UK's construction estimators (Akintoye and Fitzgerald, 2000). Traditional cost systems still widely use in the UK and overseas (Sutrisna *et al.*, 2004), while overhead and profit simply mark up on the BoQ (RICS, 2009). It therefore can bring cost planning into biased baseline of cost controlling in project practice. This may be caused from the absence to use an availability of adequate methods, tools, and techniques. Heitger (2007) underlined an improvement of individuals' adjustment from incorrect initial belief of activity cost data and historical memory should not be damaging the accuracy of cost estimations. If those beliefs and memories simply adopt for future planning of activity costs and as baseline for further controlling costs would seem to suffer critical cost distortions. The past standard rates might be differed to current market price. It is influenced and determined by longer period of unstable economy. Projective cost planning and controlling baseline may differ since the market condition is changed. Furthermore, most construction companies may typically still continue to predict costs using traditional approach to accumulate costs together in the single cost pool, then spread across the estimated number of direct labour hour bases in assigning it to the project (Mansuy, 2000). Similar approach is found by Kim and Ballard (2001) that resource-based costing is adapted to assign cost accumulation to the sub-projects. Absorbing resource costs directly to the projects would seem to change depending on project-volume allocations (Kim and Ballard, 2005). The lack of accuracy of project costing should be unnecessarily happened as today's improvement on cost accounting and management systems, since the methods, tools and techniques were available for planning and controlling project operations. In the case of construction projects, the ABC methods may provide visible cost cause-and-effect relationships and would be able to perform proper cost plans and suitable cost controls.

Construction cost planning and controlling importantly serve to satisfy project practice during execution stages, which is provided by responsible consultants often beyond the real cost of project operations. There are some common reasons such as unavailable adequate data, design or requirement changes, time limits, unpredictable market prices, and so on. During the project executions, cost planning may become cost baseline to control a tendency of the cost expenditures, whether the project trend inclines to cost overrun. However, cost planning and controlling very much dependent on availability of the robust methods, tools and techniques. Fortune (2006) suggested that additional investigation in real project is required to ensure budgeting formulation tools are effective, such as neural network, neuro-fuzzy network, sustainability and whole life cost models. So, implementing ABC approach may have given major advantages of being able to plan resources for cost planning and controlling baseline, especially the resources that associated to project overheads.

5.3 Construction overhead

Predicting overheads of the construction projects would seem to be quite difficult due the unique characteristic of buildings with poorly defined brief (Potts, 2008), the requirement of large quantity and variety of resources and supplies from other productive sectors (Alarcón, et al., 2009), the complexity and predictability of the constructability buildings (Winch, 2009), the diversity and fragmental of project targets (Cooper and Kaplan, 1988), and the basic issues summarised by Gould and Joyce (2009) such as project size, quality, location, construction duration, general market condition, and so on. More specifically, the significant portion of overheads constituted in the constructions must be accurately predicted and correctly distributed for the real projects. However, Kim and Ballard (2001) found that each individual resource of overheads directly distributed to the sub-project on traditional resource-based allocations.

The role of measurement of the RICS (2009) which comprises simplistic mark-up of overhead and profit on percentage-based addition to main contractor building works and preliminaries remained the lack of details. Therefore, construction cost planners may have no specific baseline to allocate overheads more systematically to the projects. Simplistic traditional cost accounting system distributes overheads variably on volume-based allocation to project activities (Kim and Ballard, 2005). In this approach, the percentage-based addition of overhead costs (RICS, 2009), which is accumulated in the single cost pool (Kim and Ballard, 2002), then is spread across estimated-volume of direct labours (Mansuy, 2000). The basis of direct labour hours may be used in allocating overheads to the projects. Unfortunately, direct labour has poor causal relationships between percentage of mark-up overheads and activities within the projects. Even though overheads are directly supplied from support department, it however may vary with rank-ordered of volume of products or services, and wide complexity of the project-line, but not by the number of unit produced (Cooper and Kaplan, 1988). The lowest complexity of the products that traditionally consume prorate overheads may lead to over-costing, while the reminders with the highest complexity will undergo to under-costing (Cokins, 2001). Similar meaning has given by Mansuy (2000) that simplistically allocated average overheads to the project process can be either over-costing or under-costing. So, the conventional costing methods can influence the true cause-and effect relationships along the project process, which in turn can widely distort possible profit (Cooper and Kaplan, 1988). Figure 1, illustrates that simplistic traditional costing approach use prorate overhead allocations which serves the least complexity of the products or services, provides over-costing by 200% with hiding unknown profits, while the most complexity becomes under-costing by 1,000% with hiding potential losses (Cokins, 2001). Construction projects are often most complex and produced in low volume of units, i.e. the right side of figure 1. The characteristic of construction project mostly featuring approximately

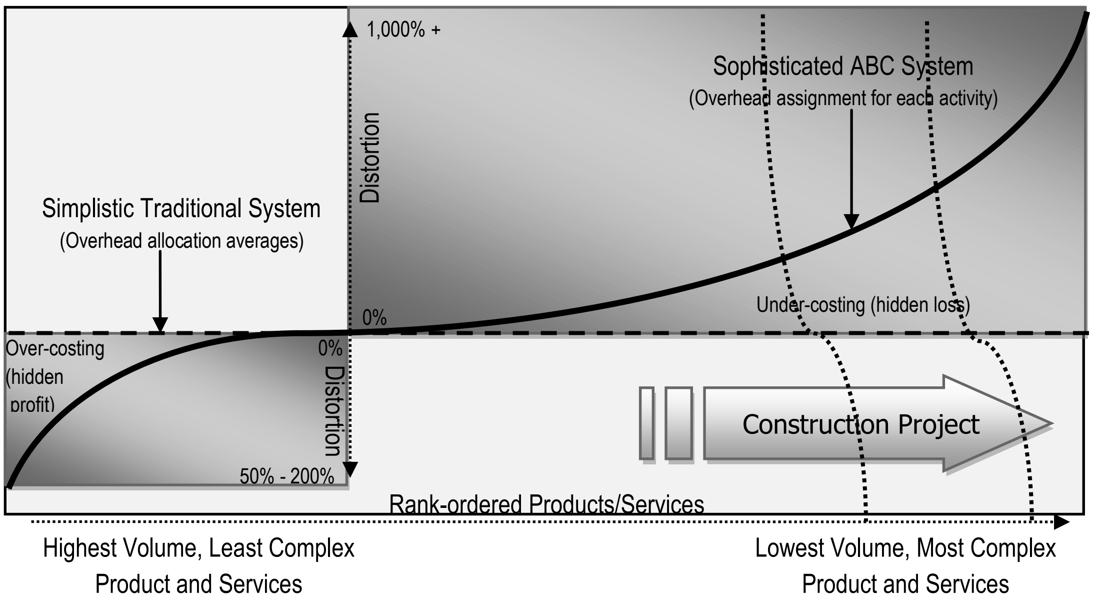

Figure 1: Overhead for construction project.
Source: Adapted from Cokins (2001).

to higher complexity and lower quantity of project packages compare to manufacturing mass productions with usually provide higher rank of volume and similar type of products. On the other hand, when direct cost of materials and labours are quoted quite tightly, then, a contribution for the business principle in construction is acquiring opportunity of profits by optimising overhead expenses from the part of contracted project prices. Giammalvo (2007) suggested that ABC approach distributes overhead for every activity. So, sophisticated ABC system may become better method than simplistic traditional system to implement in construction project to avoid overhead cost distortions from averaged allocation baselines. Moreover, the reliance on traditionally prorated overheads will affects substantially under-costing in real project process and hiding potential to lose and sacrifice the profit margins (Cokins, 2001). The project overheads would seem to be perceived that something could be fairly predicted (Sutrisna et al., 2004). In this way the role cause-and effect relationships of ABC system could provide cost accounting accuracy with activity hierarchy level and sophisticated cost drivers to enable engineering benefits or profits.

The illustrations cover discussions focusing on ideas for further study that the ABC system is perceived to be better application methods which provide tools and techniques to adapt in projecting cost planning and controlling practice, specifically in predicting overheads to increase profits when executing project in the construction industry.

New cost management practice may be developed and identify generic to specific factors that influence the accuracy of predicting overhead through cost planning and controlling methods to increase project profits during construction stages. The components of factors include: the causal relationships between overheads and construction projects; the diversity of jobs, products or services within construction projects; the dependence of resources from other product sectors and suppliers; the availability of robust method, tool and technique; the availability of adequate resources; the characteristic of project site; the complexity of projects; the build-ability of project design; the constructability of unique buildings; the predictability of possible costs; the size of project; the quality of project; the location of project; the duration of construction; the condition of general market, and so on. Akintoye (2000) used the main factors analysis technique to study relevant project cost estimating practice, with the most important order is grouped into: project complexity; technological requirement; project information; project team requirement; contract requirement; project duration; and market requirement. Compared to the study by Akintoye (2000), there are specific factors may be proposed to complement previous study, namely the importance of contemporary costing methods, tools and techniques in predicting overheads accurately to save cost expenses for engineering benefits, i.e., the ABC system.

6. Conclusion and further research

The literature review on application of ABC system in the construction industry highlighted some important findings such as: construction industry sectors continue to be survived under squeeze unstable economy, industrial downturns, project related job cuts, and decreasing employments. Construction business is pessimistically expected about uncertainty of the future construction industry. It is quite challenging to create complementary contribution for the cost planning and controlling practice. The project cost management remains to rely on the shortcoming of practical knowledge of construction process with conventional BoQ pricing techniques. Percentage addition of overhead and profit has poor cause-and-effect relationships to construction process. Incorrect initial belief and historical data memory without specific adjustments may lead to biased cost planning and controlling baseline. Financial limitations and the lack of accounting knowledge of human resources are becoming the barriers on implementing ABC system, but the logic of ABC concept has proved it excellences and it may be suggested to complement the simplistic traditional cost accounting systems. Furthermore, the ABC system could provide more robust methods, tools and techniques to enable cost planning and controlling practice manage more accurately, and specifically in predicting overheads to improve profit margins when executing construction project.

The development of ACE model excluded the factor of technical practice such as site characteristics and available resources. So, the previous study could be extended to new cost management model by analysing additional factors that influence the management of project overheads to generate profits.

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Security of Final Account Payments: The Case of New Zealand

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Abstract

Little is known about final account disputes. In this exposure study, 20 cases out of a total of 57 have been studied in order to seek a first time understanding of the nature of final account payments, causes that hinder settlement, and to unearth possible improvement strategies. It is found that the number of court cases on final accounts have increased significantly since the introduction of the Construction Contracts Act (CCA) in 2003. These cases have been mainly with private clients with most judgements in favour of contractors and subcontractors. Whilst the monetary values of most disputes are not exceedingly high, the time delays are, suggesting the need to examine alternative dispute resolution methods currently not available through standard form contracts such as conciliation. Workmanship issues and cross claims feature more frequently as the main reasons for disputes. Issues connected with a lack of understanding of CCA also featured prominently. In an attempt to understand the root causes, initial investigations revealed the presence of generic causes such as ‘contractual incompetence’ and ‘opportunistic behaviour’ which seems to substantially hinder the resolution of these disputes not least ‘technical incompetence’ and ‘managerial incompetence’. It is expected that understanding the relevance of such generic categories coupled with broad trends on court decisions including reasons hindering early settlement would help ease problems connected with final accounts. Industry initiatives through client and contractors’ federations may be useful too. Further studies are necessary to gain a greater understanding of the issues impacting on final accounts in order to minimise the incidence of final account problems in courts.

Keywords: commercial settlement, final accounts, payment disputes, security of payment

1. Introduction

Security of payment is a major concern of contractors, subcontractors, and suppliers alike in an industry that is widely perceived to be risky (Abeysekera, 2008). One of the earliest initiatives to provide some form of protection was the Housing Grants Construction and Regeneration Act in the UK in 1996 despite similar but different initiatives in the US. Since then, a number of countries have introduced legislation to facilitate cash flow and provide a quick dispute resolution processes on payment related matters with the latest being the Securitization Act in Germany which came into effect on 1 January 2009 with the aim of remedying (amongst other things) losses suffered by contractors as result of client's insolvency.

In a breakthrough piece of legislation in New Zealand (in 2002), contractors (including subcontractors) and some suppliers can now seek the protection of an Act of Parliament known as the Construction Contracts Act (CCA). The main intention of the Act is to facilitate progress payments and to set in place a mechanism by which related disputes could be resolved speedily. In particular, a major relief for the subcontracting community was the abolition of pay-if-paid and pay-when-paid contractual provisions making it illegal to use even if the parties agreed to. Yet there is anecdotal evidence that all is not well particularly relating to settlement of final account payments.

Many standard forms of contract in New Zealand such as NZS3910:2003 or for that matter the Master Builders Contract impose procedures for the settlement of final accounts. As such, if the final account is well prepared, it is reasonable to expect that there should not be any problems of settling the account (Kennedy-Grant, 1999). Moreover, the CCA was also expected to have a substantial influence on reducing associated problems. Nevertheless, the problems with final account payments have not disappeared let alone problems with interim payments. According to Bayley (2007), adjudication applications have increased substantially since the enactment of CCA. In fact, he points out that many of the disputes now being referred to adjudication are final account disputes spanning several months involving millions of dollars. According to Cheung and Yu (2008), the situation does not seem to be too different elsewhere. Indeed, the National Specialist Contractors Council in the UK (2003) has stated that their biggest problem related to payments is the final payment (cited in Odeyinka and Kaka, 2005).

Preliminary investigations in New Zealand by the first author (a Master Builder involved in residential construction for over a decade) with discussions with construction professionals confirmed that final payment has always been a problem for contractors in spite of the provisions of statutory legislations like the Construction Contracts Act 2002 (CCA). It was also found that the settlement of final payment in reality takes longer than the timeframes stated in standard form contracts and that there is much reluctance to agree and settle final accounts especially by private corporate clients including property developers. Although it was expected that such problems would disappear after the introduction of the CCA, strengthening of contractual awareness of the need for prompt payment, the unreasonableness of delayed payments etc., according to the findings of preliminary survey referred to above, problems have not disappeared. In fact, it was clear that there is much concern on delays connected with the settlement of final accounts; indeed, an unsatisfactory situation despite the introduction of the CCA in New Zealand in 2002.

2. Aims and objectives

Given this background, the aim of this study is to find suitable solution(s) to mitigate late and/or non-payment problems connected with final accounts. In order to achieve this objective, the following objectives were set up.

- Understand the nature of final account payment problems
- Understand the causes that hinder the settlement of final account payments
- Suggest possible solutions to improve the situation

3. Methodology

As a first step (as mentioned before), a pilot study was carried out among the industry practitioners in order to understand the significance of the research problem, i.e. the seriousness of the final account payment problem. Thereafter, in order to research the objectives, it was thought appropriate to study relevant court cases related to final account payments which were sourced through Brookers Online, Lexisnexis.com, and also through the Ministry of Justice's website focussing on New Zealand court cases. A few court cases were retrieved initially from these websites and the preliminary study that followed re-confirmed the need for this study as there was evidence of the problem being researched (see Laywood & Ree v Holmes Construction Wellington Ltd, Willis Trust Co Ltd v Green and the five appeals). Moreover, unlike adjudication proceedings, it was a better resource to examine the profile of the final payment issues in New Zealand as matters ending up in courts were seen as the critical ones. The online search offered 57 cases on final payments covering the period from 1984 to 2009 of which 20 cases were studied in-depth. The statistics available from Building Dispute Tribunal (the Tribunal) which is the authorised nominating authority under the CCA was used as another source to review and verify the court cases.

Due to the limitation of further in-depth information from these court cases, the following closely related and collateral matters were not discussed in detail in relation to legal issues (a) in other sectors of the construction industry like civil engineering, marine engineering etc. (b) civil procedures relating to summary judgment, winding up petition, injunction etc. (c) sub-contracting, and (d) issues in relation to liquidated damages, variations, direct losses and expenses.

4. Research findings

4.1 Nature of final account payments in New Zealand

According to commonly used standard forms of contract in New Zealand, the submission of the final payment claim by the contractor is considered as the conclusive evidence that the contractor has no outstanding claim against the client except as contained therein, and except for any item which has been referred to arbitration or adjudication. The client is not liable to the contractor for any matter in connection with the contract unless contained within the final payment claim but it doesn't preclude the later correction of any clerical or accounting errors. Thus, it is acknowledged by most in the construction industry that it is extremely difficult for the employer to adequately and meaningfully prepare a payment response to the contractor's final payment claim within 21 days from the date of service of the claim.

Usually, the final payment claim is submitted by the contractor not later than two months after the expiry of defects liability or within such further time allowed by the Engineer. And then the final payment schedule should be issued within one month after the receipt of contractor's payment claim. If it is delayed more than one month, the Engineer issues a statement with the reasons for the delay. The scheduled amount as shown in the final payment schedule is paid to the contractor within 10 days of the date of final payment schedule.

According to CCA, if the client fails to pay the claimed amount, the client has not provided a payment schedule or the scheduled amount, and the client has given a payment schedule by the due date for payment, the contractor has the following two remedies: In the case of either a residential or a commercial construction contract, the contractor can recover the unpaid portion of the claimed amount or scheduled amount as a debt due to the contractor in any court. In addition, the contractor can recover the actual and reasonable costs of recovery ordered by that court. However, in the case of commercial contracts, the contractor can only serve a notice to the client about the intention to suspend the work under the construction contract.

Whilst the position is as such in relation to legal and contractual situation in New Zealand, it is now opportune to present details of the 57 cases that were sourced.

4.1.1 The number of court cases in New Zealand high court and district court

The distribution of the 57 court cases sourced from 1984 – 2009 in relation to the final payment disputes is shown in Table 1. There is an increase of cases being judged in court since 2003. In 2003 there was no cases finalised, and there were less cases before 2003.

Table 1: Number of court cases from 1984 – 2009

Year	*1991 or before*	*1991-2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009 (up to Aug)*
No. of cases	*2*	*5*	*0*	*6*	*9*	*9*	*8*	*10*	*8*

The actual number of relevant court cases are expected to be more than on this list, as those cases of district court and Building Dispute Tribunal cannot be accurately retrieved from the Brookers Online search engine. However, what it shows is that the number of court cases has increased rapidly since the introduction of the CCA in 2002 (operational in 2003).

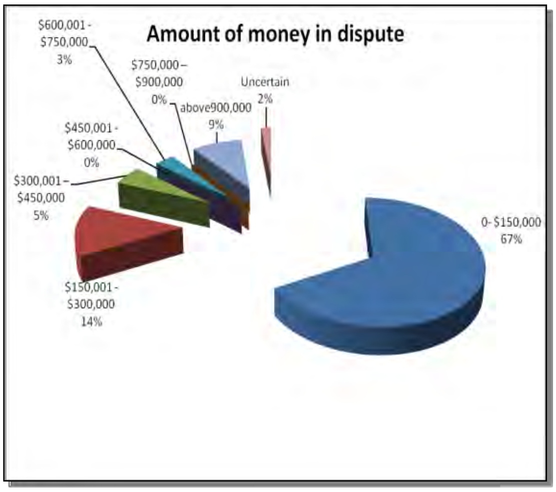
4.1.2 Parties in dispute

Detailed analysis of the above cases revealed that contractors and principals (in 47 out of 57) were the main parties amounting to 91% of the cases connected with final accounts. Contractors were the main claimants (amounting to 53%). Interestingly, sub-contractors were relatively small in proportion (amounting to only 9%) perhaps due to prohibitive costs of litigation or due to the lack of resources and time; moreover, court cases would endanger relationships and the opportunity to secure new work.

It is further observed that almost no government or public organisation was involved in such court cases. Most of the big name head contractors were also not found either but for just two major construction companies. This seems to imply that work with public bodies and reputed contractors seem to be more secure than private clients. Perhaps, it may be that other contracting parties may be eager to resolve their dispute without litigation; a matter that has not been investigated under this study.

4.1.3 Monetary value of disputes

In most of the cases (38 out of 57 cases), the amount of money in disputes was less than NZ $150,000 with majority below NZ$60,000 (38 cases). However, there were 5 cases with values over one million. Nevertheless, the monetary values of the disputes do not seem to be too large as 58% of the cases are for amounts less than 60,000. It needs to be pointed out that in some cases, claims have been brought even after the parties had gone into liquidation with the aim of recovering debts from the guarantors (see Downer Construction Ltd v One Hobson St Ltd). The pie charts shown in Fig. 1 give a more informed picture of the distribution.



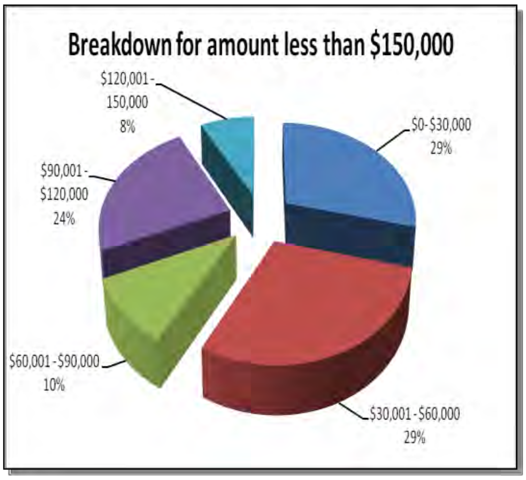


Fig. 1: Breakdown of monetary value in dispute

4.1.4 Successful parties in court decision

By far contractors and subcontractors were the successful parties in relation to the court cases studied with almost 70% of the cases won by contractors when in litigation with principals (clients). Interestingly, in cases filed by subcontractors against contractors, all cases have been won by subcontractors. The statistics are interesting as they seem to suggest opportunistic behaviours by clients.

4.1.4.1 Time taken to solve the dispute

For the purpose of this analysis, duration to resolve a dispute is taken from the day the dispute has been raised up until the date of the judgment. The breakdown is shown in Fig. 2 which shows that in almost over half the cases took more than 11 months to settle. This is a considerable delay, given the adverse impact on cash flow. It is interesting to note that before the introduction of CCA in 2003, the delay was higher with more than 75% of the cases taking over 15 months to resolve. In contrast, with cases in the Building Disputes Tribunal (2009), 50% of the cases were completed within 20 working days (from the date of receipt of the response as provided by the Act) with 8% completed by their adjudicators in less than 15 working days with just one case taking longer than 30 days.

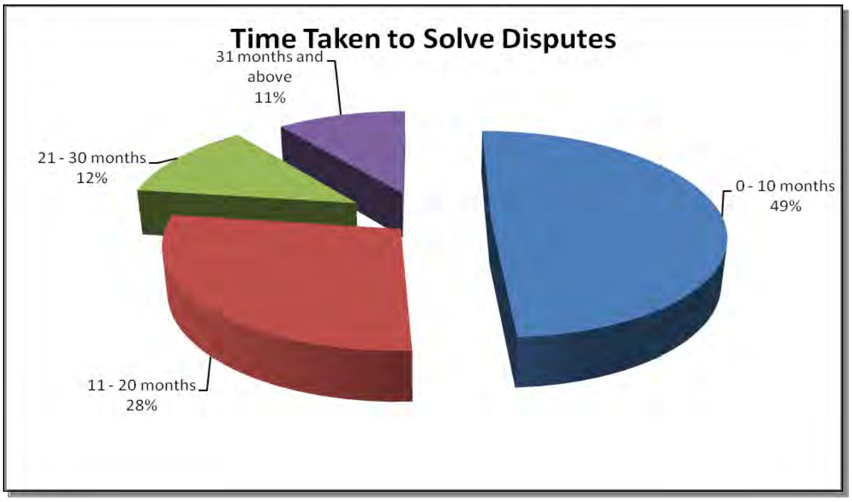


Fig. 2: Breakdown of time taken to resolve disputes

Interestingly, given that monetary values are not too high (as noted in 4.1.3) there does not seem to be much purpose in attempting to resolve these disputes through lengthy court cases.

4.1.6 CCA and cases

This study shows that all cases filed after the introduction of CCA were connected with the CCA. It implies that the Act has dominated proceedings and is a tool that parties were keen to use for the settlement of disputes. Thus, it goes without saying that understanding the underlying philosophy of the Act and how various provisions have been interpreted by the courts is fundamental.

4.2 Factors hindering settlement of disputes

Disputes in construction occur due to many reasons. Many authors have elaborated on possible reasons but without particular relevance to final accounts. The attempt in this section therefore is to present these reasons by focussing on the 20 court cases as referred to earlier. Accordingly, 13 reasons were discovered and are presented in the first three columns of Table 2.

The first column shows the reasons with the second column showing the number of times the causes are discerned from the 20 cases with the last column showing the numbers as a percentage (of the 20 cases). Accordingly, it is observed that the three most pressing reasons for the disputes were withholding payments, workmanship issues, and inadequate understanding of CCA provisions. As to why these arose in the first place was difficult to discern from court cases; in other words, it is difficult to understand the root causes by resorting only to the study of court cases. It is worth noting that cross-claims is a different kind of a reason which often aggravates opportunities for settling early and is not a reason that is connected with the work itself.

Disagreement with adjudicators, unreasonable termination of contract, and incompetent project management teams came next. Interestingly, improper forms contracts or no formal contracts though less common, is a matter for much concern and must be addressed to overcome problems with final accounts. It will be useful to understand whether these reasons result in disputes of high monetary value. So would be the case with variations and also with 'allegations re certification'.

Table 2: Reasons for final account problems

Direct reasons	*No.*	*% occurrence*	*Contractual incompleteness*	*Opportunistic behaviour*
Withholding payments/refusal to pay	*18*	*90*		
Workmanship of contractor	*17*	*85*	-	*x*
Misunderstanding CCA requirements	*12*	*60*	-	-
Incompetent project management team	*8*	*40*	-	-
Unreasonable termination of contract	*8*	*40*	-	*x*
Disagreement with adjudicators	*8*	*40*	-	-
Improper form of contract/no formal contract	*7*	*35*	*x*	*x*
Unreasonable variation claims	*7*	*35*	*x*	*x*
Incomplete project information	*6*	*30*	*x*	*x*
Selection of incompetent contractors	*6*	*30*	-	-
Allegations re (over) certification	*5*	*25*	*x*	*x*
Inadequate records of documentations	*5*	*25*	*x*	-
In-direct reasons				
Cross claims	*19*	*95%*	-	*x*
Total number of cases	*20*			

5. Root causes and possible solutions

The discussions hitherto have provided insights on the nature of final account problems including a first time understanding possible reasons. However, what is of greater importance is to understand the root causes for these problems with the hope of minimising the occurrence of such problems in the future. As mentioned before, it is difficult to unearth these reasons without further study without discussions with the parties involved which may be quite restrictive. Nevertheless, it is interesting to reflect on Yates (2003) analogy of ‘root causes’ for contractual conflicts (claims and disputes) for which purpose, he utilised the Transaction Cost Economics Theory to draw conclusions. He argued that ‘contractual incompleteness’, ‘opportunistic behaviour’, and ‘asset specificity’ are the three root causes for conflicts, claims and disputes. Interestingly, it can be shown that number of reasons discovered under this study could be classed under ‘contractual incompleteness’ or ‘opportunistic behaviour’ (of the parties) as shown in Table 2 (see columns 4 and 5). Moreover, as pointed out by Yates (2003), contractual incompetence provides incentives to behave opportunistically. For example, ‘incomplete project information’ (see Table 2, first column) can promote opportunistic behaviours from the contractor resulting in variations which may be declined by the client. As such, steps need to be taken to ensure that contracts are as complete (as much as possible) before award or use appropriate procurement options to avoid opportunistic behaviour.

It must also be pointed out that there are other root causes for problems associated with final accounts. For example, it is clear from Table 2 that ‘legal incompetence’ (misunderstanding CCA, disagreement with adjudicators) is also a root cause. Yet another is ‘technical incompetence’ (workmanship issues) along with ‘managerial incompetence’ (incompetent project management team, selection of incompetent contractors). However, based on the cases studied thus far, ‘contractual incompetence’ and ‘opportunistic behaviour’ seem to be the more frequent root causes. Clearly, cross claims by either party would only prolong the resolution of the dispute. Paradoxically, dollar values of most disputes do not seem to be too excessive although durations for settlement are. This begs the question whether parties should resolve to ‘commercial settlement’ using an alternative dispute resolution process such as conciliation wherein the goal would be to seek concessions to settle disputes. For example, Gatley (2004) has advocated its use in construction contracts noting that it does not appear in standard form contracts used in New Zealand. Moreover, disputes need to be managed just as much as a construction projects need to be managed as well utilising strategic frameworks and decision points as noted by Fenn and Gameson (1992).

6. Concluding remarks

Delays in settling final accounts are no doubt unsettling. Yet, at times, parties seem to choose litigation with protracted outcomes. This study has for the first time established a long known problem as evidenced by number of court cases on final accounts. There has been an increase in number of court cases since the introduction of CCA in 2003 with most judgements in favour of contractors and subcontractors. These disputes have been mainly with private clients. Generally, the amount of money tied up in disputes has not been too excessive but the time durations for settlement have been considerable. Further studies may be necessary to understand the relative proportion of such sums of moneys with respect to contract size and interim payments and associated delays.

The main reasons for delay have been connected with workmanship issues coupled with refusal to pay. Cross claims by various parties have impacted adversely towards early settlement. A good understanding of CCA provisions would clearly assist in resolving these disputes as most cases have been connected with this Act. In this regard, it is unknown whether a third party has been involved in the management of these disputes (contractually) and whether standard form contracts have been used as the information could not be easily ascertained. Perhaps, this is a useful piece of information which may assist in getting a deeper understanding of the issues as delays are considerable with over half the cases taking almost a year to settle. Moreover, given that monetary value of the disputes are not too high, it may be prudent to settle some of these disputes faster using alternative dispute resolution option such as conciliation as mentioned before.

An attempt was made to understand root causes. This is not an easy task and need further study. Initial investigations reveal the presence of generic root causes such as 'contractual incompetence' and 'opportunistic behaviour' which substantially hinder early settlement not least 'technical and managerial incompetence'. It is expected that understanding the relevance of such generic root causes along with broad trends in court decisions including specific reasons for delay would help ease current and future problems connected with final accounts. Industry initiatives through clients' and contractors' federations may be useful too. Clearly, there is a need for a deeper study to progress further understanding in order to minimise the incidence of problems connected with final accounts.

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International Comparisons of Malaysian Construction Labour Productivity

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Abstract

Productivity is basic statistical information for many international comparisons and country performance assessments. This study estimates the construction labour productivity of 79 selected economies. The real (purchasing power parities converted) and nominal construction expenditure from the Report of 2005 International Comparison Programme published by the World Bank and construction employment from the database of labour statistics (LABORSTA) operated by the Bureau of Statistics of International Labour Organization were used in the estimation. The inference statistics indicate that the descending order of nominal construction labour productivity from high income economies to low income economies is not established. The average construction labour productivity of low income economies is higher than middle income economies when the productivity calculation uses purchasing power parities converted data. Malaysia ranked 50th and 63rd position among the 79 selected economies on real and nominal measurement respectively.

Keywords: international-comparison, purchasing-power-parities, construction-labour-productivity, Malaysia

1. Introduction

One way of assessing the productivity performance of a nation is to benchmark it against appropriate comparator countries. At its simplest, the level of productivity is a measured as the ratio of output to one or more inputs. It can be expressed as a physical measure, a monetary measure or an index. The choice between them depends on the purpose of productivity measurement and the availability of data. Physical measures become rather meaningless in construction where each building or project is unique. The monetary value of output is used instead as it is necessary to find a common measure in order to establish the total output in a given period of time or make comparisons (G. J. Ive & Grunberg, 2000). International productivity-level comparisons for construction are harder to do because of the exceptional difficulties involved in both output and input measurement. Further complicating factors include differences in climate, taxation, industrial relations, safety standards, environmental standards, labour/capital intensity (Best & Langston, 2006). In addition, the problems in finding appropriate rates of conversion to common purchasing-power units are increased by the heterogeneity of construction output and complexity of national differences in output mix and quality (G. Ive, Grunberg, Meikle, & Crosthwaite, 2002).

Equally important for international comparisons of productivity levels are comparable measures of labour input. In most comparisons of productivity levels, labour input is measured along two dimensions: the number of persons employed and the total number of hours worked by all persons employed. A possible third dimension concerns labour composition (quality) (Goodbridge & Schreyer, 2007). This third dimension is not considered here and the „number of persons employed" as labour input is adopted instead.

Any field of inquiry with as many variables as international construction comparisons cannot be an exact science. However, comparisons can produce some useful insights in spite of the difficulties associated with them (Best & Langston, 2006).

The following comparative analysis is conducted with construction expenditure and construction employment data obtained from the World Bank"s International Comparison Program 2005 and the database maintained by LABORSTA, an International Labour Office database on labour statistics operated by the ILO Department of Statistics.

2. Purchasing Power Parities (PPPs) of construction productivity

A monetary measure of output has the basic weakness common to all such financial data (Ofori, 1990). Market exchange rates are determined by the demand for, and supply of, currencies used in international transactions. They reflect a wide range of things including: interest rate differentials, capital flows, speculation on currency and international prices of goods that are traded internationally (Goodbridge & Schreyer, 2007). They may under or overstate the real value of an economy's output and the standard of living of its residents (World Bank, 2008). One of the methods of comparing levels of productivity between countries is using Purchasing Power Parities (PPPs).

A PPP is a ratio of prices created by taking the prices of goods that make up GDP in one country and expressing them relative to another country‟s currency (Goodbridge & Schreyer, 2007). PPPs between any pair of countries change slowly whereas market exchange rates can change quickly (World-Bank, 2008).

The International Comparison Program (ICP) initiated by the World Bank is a worldwide statistical initiative to collect comparative price data and estimate PPPs of the world's economies. PPPs enable cross-country comparisons of the sizes of economies, average consumption levels, poverty rates, productivity, and the use of resources (World-Bank, 2008).

The 2005 ICP report produced estimates of the relative price levels of GDP and its principal aggregates for 146 economies, which account for more than 95 percent of the world's population and 98 percent of the world's nominal GDP. The price data were used to estimate PPPs benchmarked to the year 2005. The PPPs express the values in local currencies in relation to a common currency i.e. U.S. Dollar in 2005 (World Bank, 2008).

When applied to the value of GDP or any component of GDP, the resulting dollar values reflect the real value of GDP in each economy, corrected for differences in price levels and unaffected by transitory movements of exchange rates (World-Bank, 2009). PPPs provide a better measure of economic volumes or real economic values, in contrast to nominal values (World-Bank, 2009).

PPP is a recommended use for partial comparisons of relative price levels but it is not recommended as a precision tool to establish ranking between countries or as a measure to generate output and productivity comparisons by industry (unless there are industry-specific PPP) (Stapel, 2004).

The two approaches available for the international comparison of PPPs are current or constant PPPs. The current PPPs are the best indication of the most recent and relevant price structure as they are constructed using current GDP expenditure data. These provide snapshots for specific years. However, they should be avoided for inferring productivity growth rates as year-on-year comparisons also include changes in the price structure. The constant PPP approach allows users to compare productivity growth as it captures only volume changes. However, over longer periods these constant PPPs fail to reflect changes in price structure (Dey-Chowdhury, 2007; HM Treasury, 2007).

Because of measurement difficulties that exist when making international comparisons, it is not possible to identify significant difference in the productivity levels of two countries if their ICP estimates differ by a few percentage points only. This difference could be caused by measurement error rather than any real differences in country productivity performance (Dey-Chowdhury, 2007).

PPPs are statistical estimates which fall within some margin of error of the unknown, true values. The error margins for the PPPs depend on the reliability of the expenditure weights and the price data as well as to the extent to which particular goods and services selected for pricing by participating countries truly represent the price levels in each country. PPPs may not reflect the expenditure patterns of the poor. The need to measure prices for internationally comparable goods and services means that they are more likely to reflect consumption patterns of urban areas (Stapel, 2004; World Bank, 2008).

The data used for the current study were obtained from the 2005 ICP Report using current PPPs. This snapshot approach, while not allowing a precise quantitative-based analysis to be made of how much the productivity gap has differenced, does allow a qualitative assessment of the ranking comparison.

Because of the difficulties of measuring construction investment due to the wide variety of projects and techniques in different parts of the world, three different methods were used to compute PPPs for construction goods in the 2005 ICP Report:

- The "Standard Project Method" (SPM) used by the OECD-Eurostat group mimics the costing procedures that construction companies use when they make a competitive bid for construction project. The countries price a "Bill of Quantity" (BOQ) for each of the 16 projects which include residential construction, non-residential buildings and civil construction works (World Bank, 2005).

- The "Method of Technical Resource Models" (MTRM) used by the CIS[1] countries requires countries to collect statistics on wages and salaries in the construction industry and the average prices of just over 100 types of building materials and energy products. These prices, which cover around 85 percent of the material and energy costs of construction projects, are used in a number of "technical resource models" in order to calculate the costs of 100 different residential and non-residential building and civil engineering works (World Bank, 2005).

- The "Basket of Construction Components Method" (BOCC) is used by all other countries. The BOCC approach involves pricing identifiable, complete, installed components (including material and labour), plus the cost of hiring any capital equipment used. PPPs were first computed within each system using cost data for each component within it, as if they were product prices. These were then weighted separately according to the three construction basic categories of residential and non-residential building and civil engineering works (World Bank, 2005).

3. Methodology

Real construction expenditure from the 2005 ICP report and total employment in construction obtained from LABORSTA are used as 'output' and „input" respectively for the labour productivity estimation. Matching employment statistics are particularly lacking, with only 79 out of the 146 economies reported by the ICP having corresponding employment data for 2005 (LABORSTA Table 2B, which summarises total employment by economic activity). This shows that the 79 economies

[1] Commonwealth of Independent States; members of the former Soviet Union.

comprise 36 high-income, 25 upper-middle income, 14 lower-middle income and 4 low-income economies - accounting for more than 63 percent of the world's population and 94 percent of the world's nominal GDP. The classification of economies is according to the World Bank Analytical Classifications for the calendar year 2005, where per capita GNI of U$875 or less is low-income, per capita GNI of between U$876 and U$3,465 is classified as lower-middle income, per capita GNI of between U$3,466 and U$10,725 is classified as upper-middle income and per capita GNI of U$10,725 and above is high-income.

4. Results

Table 1 shows the mean of the construction labour productivity group according to the World Bank Analytical Classifications. An one-way analysis of variance (ANOVA) indicates that the differences in real and nominal construction labour productivity among the economic development groupings are statistically significant (i.e. $\rho < .05$). The means of nominal construction labour productivity are in ascending order when arranged from low income economies to high income economies, i.e. $P_{NLI} < P_{NLMI} < P_{NUMI} < P_{NHI}$ (P_{NLI} = nominal construction labour productivity of low income economies, P_{NLMI} = nominal construction labour productivity of lower-middle income economies, P_{NUMI} = nominal construction labour productivity of upper-middle income economies and P_{NHI}= nominal construction labour productivity of high income economies). However, the PPP-converted construction labour productivities are not in the same ascending order. Although the high income economies are sill associated with the highest productivity levels, real construction labour productivity is in descending order from low income economies to upper-middle income economies i.e. i.e. $P_{RLI} > P_{RLMI} > P_{RUMI}$ and $P_{RHI} > P_{RLI,}$ $P_{RHI} > P_{RLMI}$ and $P_{RHI} > P_{UMI}$ (P_{RLI} = real construction labour productivity of low income economies, P_{RLMI} = real construction labour productivity of lower-middle income economies, P_{RUMI} = real construction labour productivity of upper-middle income economies and P_{RHI}= real construction labour productivity of high income economies).

Table 1: Mean and one-way ANOVA F test statistic (F Ratio) of construction labour productivity of 79 economies

Development Category	*Number*	*Mean of nominal construction labour productivity in US Dollars*	*Mean of real construction labour productivity in International Dollars*
Low income economies	*4*	*14,416*	*55,415*
Low-middle income economies	*14*	*15,177*	*53,583*
Upper-middle income economies	*25*	*22,346*	*49,275*
High income economies	*36*	*99,298*	*102,898*
Total	*79*	*55,741*	*74,785*
F		*34.775*	*8.390*
Sig.		*.000*	*.000*

Post Hoc Multiple Comparison Tests were conducted to verify if the pairwise differences among the economies are significant. The observed ascending order of nominal construction labour productivity needs to be supported by the hypothesis that $P_{NLI} < P_{NLMI}$, $P_{NLMI} < P_{NUMI}$ and $P_{NUMI} < P_{NHI}$.

Since the Levene's test for homogeneity of variance is significant ($\rho < .05$), an equal variance of nominal productivity was not assumed (Table 2). Hence, the Games Howell test was conducted to determine the significant pairwise comparisons. Table 3 confirmed the statistically significance on $P_{NLI} < P_{NHI}$, $P_{NLMI} < P_{NHI}$ and $P_{NUMI} < P_{NHI}$, however, $P_{NLI} < P_{NLMI}$ and $P_{NLMI} < P_{NUMI}$ are not proven statistically significant. Because of the missing links on $P_{NLI} < P_{NLMI}$ and $P_{NLMI} < P_{NUMI}$, the ascending order of nominal labour construction productivity from low income economies to high income economies is not sustained.

Table 2: Test of homogeneity of variance of construction labour productivity of 79 economies

	Levene Statistic	*df1*	*Df2*	*Sig.*
Nominal Construction Productivity	*11.745*	*3*	*75*	*.000*
Real Construction Productivity	*2.080*	*3*	*75*	*.110*

Table 3: Multiple comparisons of nominal of construction labour productivity of 79 economies

(I) Classification	*(J) Classification*	*Mean Difference (I-J)*	*Std. Error*	*Sig.*
Low income economies	*Lower-middle income economies*	*-761.036*	*11,334.238*	*1.000*
Low income economies	*Upper-middle income economies*	*-7,929.550*	*10,650.196*	*.874*
Low income economies	*High-income economies*	*-84,881.861**	*13,091.363*	*.001*
Lower-middle income economies	*Low income economies*	*761.036*	*11,334.238*	*1.000*
Lower-middle income economies	*Upper-middle income economies*	*-7,168.514*	*5,322.744*	*.545*
Lower-middle income economies	*High-income economies*	*-84,120.825**	*9,289.173*	*.000*
Upper-middle income economies	*Low income economies*	*7,929.550*	*10,650.196*	*.874*
Upper-middle income economies	*Lower-middle income economies*	*7,168.514*	*5,322.744*	*.545*
Upper-middle income economies	*High-income economies*	*-76,952.311**	*8,440.998*	*.000*
High-income economies	*Low income economies*	*84,881.861**	*13,091.363*	*.001*
High-income economies	*Lower-middle income economies*	*84,120.825**	*9,289.173*	*.000*
High-income economies	*Upper-middle income economies*	*76,952.311**	*8,440.998*	*.000*

* The mean difference is significant at the .05 level using Games-Howell Test

The population variances for each group of real construction productivity are approximately equal because the Levene's test for homogeneity of variance is not significant (ρ > .05) (Table 2). The subsequent Turkey‟s HSD test confirmed that only $P_{RLMI} < P_{RHI}$ and $P_{RUMI} < P_{RHI}$ are statistically significant (Table 4). The descending real construction productivity from low income to upper-middle income economies is also not sustained.

Table 4: Multiple comparisons of real construction labour productivity of 79 economies

(I) Classification	*(J) Classification*	*Mean Difference (I-J)*	*Std. Error*	*Sig.*
Low income economies	*Lower-middle income economies*	*1,831.643*	*25,896.848*	*1.000*
Low income economies	*Upper-middle income economies*	*6,139.940*	*24,598.219*	*.994*
Low income economies	*High-income economies*	*-47,483.083*	*24,074.286*	*.208*
Lower-middle income economies	*Low income economies*	*-1,831.643*	*25,896.848*	*1.000*
Lower-middle income economies	*Upper-middle income economies*	*4,308.297*	*15,247.651*	*.992*
Lower-middle income economies	*High-income economies*	*-49,314.726**	*14,387.138*	*.005*
Upper-middle income economies	*Low income economies*	*-6,139.940*	*24,598.219*	*.994*
Upper-middle income economies	*Lower-middle income economies*	*-4,308.297*	*15,247.651*	*.992*
Upper-middle income economies	*High-income economies*	*-53,623.023**	*11,891.820*	*.000*
High-income economies	*Low income economies*	*47,483.083*	*24,074.286*	*.208*
High-income economies	*Lower-middle income economies*	*49,314.726**	*14,387.138*	*.005*
High-income economies	*Upper-middle income economies*	*53,623.023**	*11,891.820*	*.000*

* The mean difference is significant at the .05 level using Turkey's HSD test.

Although this fails to prove that nominal construction labour productivity is ordinally related to the level of economic development, the difference in productivity level between high and low income economies is confirmed. An earlier study by Ganesan had revealed that the major factors related to significant productivity increases in fast-developing construction intensive countries are mechanisation of construction operations, industrialised buildings, the development of labour saving components technology continuous efforts to rationalise the construction process (Ganesan, 1984).

The higher level of real construction labour productivity of low income economies is likely to be because the prices of many goods and services within economies, such as construction work, are determined in partial or complete isolation from the rest of the world. Developing economies tend to have relatively lower wages leading to lower prices of non-traded goods and services - a unit of local currency has greater purchasing power within a developing economy than it does in the global market (World-Bank, 2008). Therefore relatively lesser developed nations show higher PPP-converted construction labour productivity.

Table 5: A summary of selected economic indicators and construction labour productivity of Malaysia

Items	*Real (PPP-converted) Expenditure in International Dollars*	*Nominal Expenditure in US Dollars*
GDP	*27*	*36*
GNI	*29*	*36*
GNI per capita	*43*	*44*
Construction expenditure	*27*	*45*
Construction expenditure per capita	*41*	*54*
Construction expenditure share on GDP	*31*	*74*
Construction labour productivity	*50*	*63*

The nominal construction labour productivity of Malaysia is U$11,140 per employee, which is equivalent to only 20 percent of the average of the 79 economies at U$55,741 per employee. The real construction labour productivity (PPPs converted) of Malaysia is 46,365 International Dollars per employee, which is 62 percent of the average of 79 economies at 74,785 International Dollars per employee.

In additional to the use of PPPs, there is a range of measurement issues that need to be considered to ensure such comparisons are valid; one of them concerns the point of the countries‟ economic cycles. Malaysia is classified as an upper-middle income economy - comparisons within the economies grouping shows that Malaysia achieves 49.9 percent and 94.1 percent of nominal (U$22,346 per employee) and real (49,275 International Dollars per employee) respectively (Table 1).

Malaysia spends relatively high on construction within the 79 economies, being ranked in 27th and 31st place in the proportion GDP spent on construction but is only in 50th place in terms of construction labour productivity when adopting the purchasing power parities method of comparison. However, Malaysia is ahead of the majority of similarly developed economies (i.e. real GNI per capita between 12,000 and 13,000 International Dollars) namely, Romania (51st position), Bulgaria (54th position), Mexico (59th position) and the Russian Federation (64th position) – but behind Argentina (35th position) (Table 6).

Table 6: Summary of construction labour productivity in real (PPP-converted) international dollars and nominal US dollars

Country Name	*Real (PPP-converted) construction labour productivity*		*Nominal construction labour productivity*	
	International $/ Employee	*Ranking*	*US $/ Employee*	*Ranking*
Iceland	*188,440.26*	*3*	*229,185*	*1*
Norway	*123,139.59*	*14*	*175,657*	*2*
Ireland	*114,328.69*	*17*	*164,954*	*3*
France	*132,262.89*	*12*	*159,337*	*4*
Luxembourg	*140,468.49*	*8*	*152,920*	*5*
Canada	*155,497.51*	*7*	*151,113*	*6*
Finland	*126,774.61*	*13*	*145,653*	*7*
Netherlands	*103,708.41*	*20*	*144,123*	*8*
Switzerland	*85,469.51*	*27*	*140,957*	*9*
Belgium	*118,825.99*	*16*	*129,192*	*10*
Denmark	*83,528.75*	*30*	*127,742*	*11*
United States	*119,808.88*	*15*	*119,809*	*12*
Australia	*110,703.43*	*19*	*117,781*	*13*
Austria	*88,891.75*	*22*	*110,663*	*14*
Sweden	*60,400.53*	*39*	*106,246*	*15*
Germany	*88,722.03*	*23*	*105,392*	*16*
Macao, China	*188,934.34*	*2*	*101,283*	*17*
Japan	*87,551.91*	*25*	*94,540*	*18*
Italy	*98,789.40*	*21*	*89,922*	*19*
New Zealand	*69,210.93*	*36*	*87,510*	*20*
United Kingdom	*62,561.58*	*37*	*87,168*	*21*
Greece	*110,842.93*	*18*	*86,868*	*22*
Slovenia	*139,302.76*	*10*	*84,249*	*23*
Israel	*132,448.83*	*11*	*83,512*	*24*
Spain	*81,336.14*	*32*	*82,209*	*25*
Korea, Rep.	*140,014.44*	*9*	*78,785*	*26*
China	*283,160.01*	*1*	*66,794*	*27*
Kuwait	*179,348.12*	*4*	*60,161*	*28*
Cyprus	*76,766.07*	*33*	*56,729*	*29*
Estonia	*74,660.20*	*34*	*54,013*	*30*

Table 6: Summary of construction labour productivity in real (PPP-converted) international dollars and nominal US dollars (Continue)

Country Name	*Real (PPP-converted) construction labour productivity*		*Nominal construction labour productivity*	
	International $/ Employee	*Ranking*	*US $/ Employee*	*Ranking*
Peru	*176,037.06*	*5*	*53,555*	*31*
Malta	*83,856.28*	*29*	*53,449*	*32*
Croatia	*82,480.21*	*31*	*52,130*	*33*
Madagascar	*164,344.34*	*6*	*45,204*	*34*
Hungary	*58,167.90*	*41*	*43,340*	*35*
Montenegro	*87,907.33*	*24*	*40,192*	*36*
Portugal	*57,878.77*	*43*	*38,282*	*37*
Taiwan, China	*83,987.16*	*28*	*37,283*	*38*
Armenia	*86,553.76*	*26*	*36,432*	*39*
Czech Republic	*57,906.17*	*42*	*35,256*	*40*
Poland	*61,719.63*	*38*	*33,032*	*41*
Albania	*58,190.52*	*40*	*32,830*	*42*
Turkey	*46,485.87*	*49*	*28,231*	*43*
Lithuania	*39,252.91*	*56*	*28,043*	*44*
Argentina	*72,397.35*	*35*	*27,305*	*45*
Slovak Republic	*44,232.60*	*53*	*26,538*	*46*
Mexico	*36,790.95*	*59*	*26,045*	*47*
Latvia	*40,414.76*	*55*	*25,760*	*48*
Georgia	*54,403.69*	*45*	*22,564*	*49*
Romania	*45,823.61*	*51*	*21,583*	*50*
Kazakhstan	*47,628.87*	*48*	*21,479*	*51*
South Africa	*28,498.32*	*66*	*18,286*	*52*
Colombia	*50,304.08*	*46*	*16,634*	*53*
Macedonia, FYR	*50,232.09*	*47*	*16,443*	*54*
Russian Federation	*32,001.74*	*64*	*16,147*	*55*
Mauritius	*34,603.74*	*63*	*15,584*	*56*
Bulgaria	*41,624.39*	*54*	*15,075*	*57*
Hong Kong, China	*27,724.31*	*68*	*14,794*	*58*
Uruguay	*34,942.23*	*62*	*14,399*	*59*
Chile	*29,636.64*	*65*	*13,294*	*60*
Serbia	*36,319.90*	*60*	*12,755*	*61*

Table 6: Summary of construction labour productivity in real (PPP-converted) international dollars and nominal US dollars (Continue)

Country Name	*Real (PPP-converted) construction labour productivity*		*Nominal construction labour productivity*	
	International $/ Employee	*Ranking*	*US $/ Employee*	*Ranking*
Indonesia	*44,524.47*	*52*	*11,706*	*62*
Malaysia	*46,365.44*	*50*	*11,140*	*63*
Brazil	*25,614.13*	*72*	*11,058*	*64*
Moldova	*26,795.96*	*70*	*11,057*	*65*
Bhutan	*57,009.94*	*44*	*10,500*	*66*
Ukraine	*28,206.74*	*67*	*9,811*	*67*
Thailand	*39,088.05*	*57*	*8,465*	*68*
Iran, Islamic Rep.	*36,215.22*	*61*	*7,956*	*69*
Bangladesh	*37,905.62*	*58*	*7,398*	*70*
Azerbaijan	*19,209.88*	*74*	*7,340*	*71*
Venezuela, RB	*9,340.78*	*78*	*5,784*	*72*
Egypt, Arab Rep.	*25,754.70*	*71*	*5,147*	*73*
Pakistan	*20,132.84*	*73*	*4,449*	*74*
Mongolia	*26,982.98*	*69*	*4,196*	*75*
Philippines	*17,217.15*	*75*	*3,889*	*76*
Ethiopia	*14,827.21*	*76*	*3,460*	*77*
Bolivia	*9,974.70*	*77*	*2,154*	*78*
Kyrgyz Republic	*4,581.21*	*79*	*1,603*	*79*

Among selected Asian economies, Malaysia has a higher construction labour productivity than Indonesia (52nd position), Thailand (57th position), Hong Kong (68th position), Pakistan (73rd position), and Philippines (75th position). However, China (1st position), Macao (2nd position), Korea (9th position), Japan (25th position), Taiwan (28th position) attained higher construction labour productivity (Table 6).

5. Conclusions

Comparing levels of productivity between countries requires converting output to a common unit. A monetary measure of output has weaknesses, especially those relating to fluctuations in the rate of exchange - they may not necessarily reflect differences in price levels. An alternative is to use PPPs for international comparisons.

PPP is neither recommended as a precision tool to establish ranking between countries nor as a measure to generate output and productivity comparisons by industry. However it is recommended use for spatial comparisons of relative price level. PPPs used in the ICP reports are industry-specific generated.

The construction labour productivity of 79 economies was estimated from the PPPs of construction expenditure from 2005 ICP reports and construction employment of LABORSTA. Malaysian construction labour productivity ranks 50th among the 79 selected economies. It generally performed satisfactory, however, when compared with ASEAN countries and other similar economies. However, it has only 49 percent of the average nominal productivity level of upper-middle income economies and is marginally below the average real productivity level achieved by upper-middle income economies. In addition, the ranking comparison also shows that Malaysia has invested relatively higher in construction than the productivity it achieved.

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Traditional Cost Management vs. Lean Cost Management

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Abstract

Despite the environmental, managerial and technologies changes that have occurred in the last few decades, existing cost management systems tend to be very similar to the ones that have been used since the mid Twenties. Hence, this paper, which is an initial outcome from a doctoral study, systematically reviews the literature on traditional cost management and emerging issues dating back to 1977 with the aim to identify the historical evolution of cost management and its shortcomings. Some solutions to overcome the drawbacks in traditional cost management are then proposed. Possible gaps and claims without sufficient justification and future direction for the research development are discussed. The study is based on the analysis of a large number of publications on cost management (books, journal articles, and conference papers) using Google Scholar search engine and relevant databases.

Keywords: Activity-based costing (ABC), balance scorecard, lean cost management, theory of constraints (TOC), traditional cost management

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1. Introduction

This paper is a „thought paper" and an initial outcome from a doctoral study. It arises from the discussions about the natural history of the academic study of traditional cost management. The primary concern was with the current situation of the traditional cost management and more specifically with what exactly would represent its shortcomings, which in deed has been an on going conversation for a number of years. From these discussions and findings, this paper developed in order to present a basis for the debate and research development around the field of cost management by attempting to consolidate the current situation of traditional cost management, pinpointing gaps and paving the way to pose for possible future directions for the research development.

This paper reviews the literature on cost management that has been available to date in academic journals and books. It should be noted that textbooks will explain the basics concept of cost management within the scope of a textbook, but do not present new research and findings. The academic papers included in the review are not limited to any one discipline, since cost management has been studied from various perspectives. The term cost management was used as a search key in the Google Scholar search engine and relevant databases. Apart, from including those papers listed in the system, references in papers found were checked for further references. Ultimately, this generated a list of 36 references which include books, journal articles, and conference papers covering more than 45 years of research activities. Those findings are used as an input to further research on the re rediscovery of cost management.

This paper presents the results of a literature survey in the field of cost management and the main purposes of the survey are as follows:

- To look at some major issues in cost management along its history and identifying its shortcomings.
- To propose some solutions in order to overcome the drawbacks in traditional cost management.

The term of „cost management" is not a well defined term. It builds on both cost accounting and management accounting, but goes beyond the two (P.Agrawal and mehra 1998). (Brinker 1996) defines it as a set of techniques and methods for controlling and improving a company"s activities and processes, its products and services. In addition, Maskel (2009) described that cost and management accounting is used internally to help the company"s manager control and improve the business. Although there is an accounting standards associated with these tasks, there is no legal requirement to perform these tasks in any particular way or to perform them at all. A company can do as much or as little cost and management accounting as it wishes and it can be done in any way it wants. Furthermore, cost accounting practices are seldom exactly similar in different companies (P.Agrawal and mehra 1998).

Whereas, Anthony (1989) mentioned that management accounting is different from cost accounting as the latter was then taught in two fundamental ways. Cost accounting texts dealt entirely with numbers, while management accounting recognizes that human beings use the numbers (accounting information) and the objectives are to assist managers and to influence their behaviour. One criterion is "goal congruence" – inducing managers to act in such a way that while achieving their personal goals they also help to achieve the goals of the organization. Management accounting teaches the behavioural factors in the budget process, i.e. participative budgeting, personal responsibility, controllability, engineered costs versus discretionary costs, the approved budget as a bilateral commitment, tight and loose budgets, and acting on variances under various circumstances. Its theme is "different cost construction for different purposes" and it deals with nonmonetary information as well as dollar amounts, and future estimates as well as historical data (Anthony 1989).

All these definitions from these four research papers have given a basis and a guideline in terms of the subject area when searching for relevant sources of references for this paper. There is a confusing of overlapping terminology and meanings within the cost management literature. The lack of a universal area and definition of cost management is in part due to the way the concept of cost management has been practiced and the multidisciplinary origin and evolution of the concept. In effect, as it will be explained in the following section, the concept of cost management has been considered from different points of view in different bodies of literature. All the relevant sources of references in the subject area of cost management, cost accounting and management accounting have been used to further develop this literature review paper. As a consequence, many labels can be found in the literature review referring to cost management as a result of some of the contrasting approaches to cost management existing in the literature.

This paper provides an overview of the state of research in the fields of cost management over the period of 1965 until 2009 based on an output published in journal papers and conferences. It builds, and expands, upon the subject overview report. By way of introduction and context-setting this paper is organised in 6 sections. In Section 1 an introductory to this paper is presented and some definition of cost management are examined where underlining differences and common aspects are highlighted in order to better trace the boundaries of the concept and to show up the difficulties of its definition. Section 2 considers the bodies of literature associated with the historical evolution of cost management and portrays the evolution of the concept reported by various authors dating back to 1977. Section 3 discusses the weaknesses found in traditional cost management. Section 4 outline some of the proposed solution to the shortcomings originate in an old system of cost management and demonstrates the use of those systems. Section 5 discusses gaps and claims which without sufficient justification. Section 6 concludes the paper.

2. The cost management landscape

In providing the topology of cost management, the issues discussed in this section started with the most primitive issues about cost management moving on to the current issues in 2009. In 1984, the present era of intense global competition is leading U.S. companies toward a renewed commitment to excellence in manufacturing. Attention to the quality of products and processes, the level of inventories, and the improvement of work-force policies has made manufacturing once again a key element in the strategies of companies intending to be world-class competitors. However, there remains, a major-and largely unnoticed obstacle to the lasting success of this revolution in the organization and technology of manufacturing operations. As noticed by Kaplan (1984), most companies are still using the same cost accounting and management control systems that were developed decades ago for a competitive environment drastically different from that of today. He added further, poorly designed or outdated accounting and control systems can distort the manufacturing performance.

Furthermore, Kaplan (1984) highlighted that it is unlikely that any cost accounting system can adequately summarize a company"s manufacturing operations. He added that today"s accounting systems evolved from the scientific management movement in the early part of the twentieth century where they were instrumental in promoting the efficiency of mass production enterprises, particularly those producing relatively few standard products with high direct labor content. Reliance on these systems in today"s competitive environment, which is characterized by products with much lower direct labor content, will provide an inadequate picture of manufacturing efficiency and effectiveness (Kaplan 1984). Kaplan (1984) stated that measurement systems for today"s manufacturing operations must consider quality, inventory, productivity, innovation and work force. In summary, the financial measures generated by traditional cost accounting systems provide an inadequate summary of a company"s manufacturing operations. Today"s global competition requires that nonfinancial measures such as mentioned before to be used in the evaluation of a company"s manufacturing performance. Companies that achieve satisfactory financial performance but show stagnant or deteriorating performance on nonfinancial indicators are unlikely to become or long remain world-class competitors.

Present cost accounting and management control systems rest on concepts developed almost a century ago when the nature of competition and the demands for internal information were very different from what they are today. When companies now make arbitrary allocations of corporate expenses to divisions and products, accounting systems may provide even less valid cost data than did the cost accumulation systems in use 50 yeas ago. In general, though, an accounting model derived for the efficient production of a few standardized products with high direct labor content, it will not be appropriate for an automated production environment where the critical success factors are quality, flexibility and the efficient use of expensive information workers and capital (Kaplan 1984).

In addition, Kaplan (1984) mentioned that it is doubtful whether any company can be successfully run by the numbers, but certainly the numbers being generated by today"s systems provide little basis for managerial decisions and control. Managers require both improved financial numbers and nonfinancial indicators of manufacturing performance because no measurement system, however well designed, can capture all the relevant information, any operational system must be supplemented by direct observation in the field. Accounting and financial executives must redirect their energies, and their thinking, from external reporting to the more effective management of their companies"" tangible and intangible assets. Yesterday"s internal costing and control practices cannot be allowed to exist in isolation from a company"s manufacturing environment if the company wishes to flourish as a world-class competitor.

In 1987, (Kaplan and Johnson 1987)emphasize that management accountants have been criticized for their inability to innovate and these perceptions continue to persist in light of the relatively low success rate in implementing „new" management accounting innovations such as ABC and the balanced scorecard (Cobb, Innes et al. 1992). In 1988, it is testified that back then, the costs of direct labor and materials which is the most important production factors could be traced easily to individual products. Distortions from allocating factory and corporate overhead by burden rates on direct labor were minor and the expense of collecting and processing data made it hard to justify more sophisticated allocation of these and other indirect costs. Today, product lines and marketing channels have proliferated. Direct labor now represents a small fraction of corporate costs, while expenses covering factory support operations, marketing, distribution, engineering, and other overhead functions have exploded, but most companies still allocate these rising overhead and support cost by their diminishing direct labor base or, as with marketing and distribution costs, not at all. These simplistic approaches are no longer justifiable, especially given the plummeting costs of information technology. They can also be dangerous. Intensified global competition and radically new production technologies have made accurate product cost information crucial to competitive success (Cooper and Kaplan 1988).

Practices that we now associate with management accounting existed during the nineteenth century in textile companies, steel and other heavy manufacturing companies, petroleum companies, railroads and retailers (Anthony 1989). Based on Anthony (1989), the closest approximation to management accounting was in the 1940s business curriculum was cost accounting. Its terminology is not much different from that used today, but the emphasis is definitely different. He also claimed that the first text material on management accounting was written by Bill Vatter in his paperback entitled Managerial Accounting, published by Prentice-Hall in 1950. In the 1930s and 1940s, Professor Ross G. Walker who taught an elective course called Budgetary Control at Harvard Business School, contained the main ingredients of today"s course – an emphasis on management uses of information and on behavioural consideration in the management control function (Anthony 1989). It was also mentioned that the system which had been installed in Ford Motor Company in 1950s by Bob McNamara, who was a controller at that time, was learned from Professor Ross G. Walker. The subject of management accounting became a required course at Harvard Business School during the major curriculum revision that occurred immediately after World War II and Anthony (1989) believed that this was the beginning of management accounting.

Until recently little was known about the current state of management accounting practice, where (Anthony 1989) stated that information about management accounting practices is abysmally poor and that almost all information is anecdotal. However, much progress has been made in research and the teaching of management accounting during the past 20 years (Horngren 1989). Although the foundation was laid in the nineteenth century, management accounting as a formal subject in the curriculum dates only back to the 1950s. Thereafter, new ways of thinking about the topic and new techniques for applying the basic ideas have been developed (Anthony 1989). Although changes are taking place, firms to a large extent, continue to rely on outmoded accounting methods (Bright, Davies et al. 1992). Similar findings were also reported in other surveys in the United Kingdom where it is reported that a significant lag still exists between innovations in manufacturing and innovations in management accounting. This lack of innovation was also described by (Kaplan 1986) as „accounting lag" that needs to be minimized in order to keep management accounting relevant to the changing information needs of managers.

After all the shortcomings of traditional of cost management being reported between the year 1984 until 1992, (Spicer 1992) has claimed that there has been a remarkable resurgence of interest in both the practice and theory of cost and management accounting in recent years. Two factors seem to account for this resurgence, i.e. 1) arises from the considerable changes which have taken place in the business environment as global competition has increased the accelerated pace of technological change, and the economic deregulation of industry in many countries. These changes have resulted in many pressures and strains on the organization and management of business organizations and their cost and management accounting systems; and 2) the recent writings of Robert S. Kaplan on the direction of management accounting research (Spicer 1992)

However, the Druly et al (1993) survey reported that apart from the implementation of activity based costing by 4% of organizations and the greater use of non-financial measures suggested, most of the organizations have not made any significant changes. Furthermore, (Garg, Ghosh et al. 2003) claimed that in today"s economic environment, new initiatives aren"t high on companies" priority lists and in fact, nearly 80% agreed that implementing new management accounting initiatives is of low to medium priority. The current article about cost management was written by Mark Freebairn in the year 2009 describing that the finance started its life as a reactive function and the main focus at that time was on checking, accounting, paying bills and having wonderful penmanship. Gradually, over time, the role developed, and businesses started to see the value in analysis of historical data. This lived in the world of finance and so the function began to split and creating the management and financial accounting function. The very best management accountants started to play with the numbers and to see if the trends they could spot would help them predict what would happen next (Freebairn 2009).

3. Shortcomings or drawbacks of traditional cost management

Cost management have become subjects of increasing interest in recent years to academics and practitioners and shortcomings of traditional cost management has received attention since the early 1980s"based on a number of research works on this subject matters.

The first set of criticisms of managerial cost accounting is aimed at methods used to derive product costs. The main case against current product costing practices is that they provide inaccurate estimates of product cost, thereby failing in their function of helping management make product-related decisions. The principal arguments are: 1) costing systems in job order production require excessive tracing of costs to individual jobs, 2) overhead apportionment rates are too broad, covering wide bands of the operating cost spectrum, 3) costs that are driven by variables other than production volume are apportioned to products by volume-based rates, 4) the numerator of the apportionment rate is almost always direct labor hours or direct labor cost, even though direct labor is the driver of few overhead costs, 5) apportionment rates generally reflect the assumption that all productive resources are expected to operate at the same level of intensity (percentage of peak operating capacity), 6) costs of product-related activities outside the main manufacturing or service-providing centers – mainly

R&D, marketing, selling, distribution, and warranty costs – are not identified with the products they support. 7) Accounting textbooks have focused too strongly on short-term variable costs, overlooking the impact of capacity costs on strategically-oriented product decisions.

(Kaplan 1984) mentioned that yesterday‟s accounting undermines production and (Geri and Ronen 2005) believed that his paper was one of the first among many publications to depict the faults of traditional cost accounting and the time was ripe for the rise of the new methodology which is activity-based costing which was developed by (Cooper and Kaplan 1988). Cost accounting offers very important knowledge for management both at strategic and operational level. In a world of non-sustainable competitive advantage, costs have to be managed both aggressively and intelligently. A firm that fails to reduce costs as rapidly as its competitors will find its profit margins squeezed and its existence threatened. The competitive environment demands the development of sophisticated cost management practices to keeps costs down.

However, traditional managerial cost accounting is at a crucial stage in its development and traditional cost account information has become mostly irrelevant and even dangerous for managerial purposes (Plossl 1990). Furthermore, set of rules & regulation are increasing over the past two decades which lead to a more complicated and more complex application of traditional managerial cost accounting. It is reported that generally accepted accounting principles (GAAP) have mushroomed from less than 2,000 pages to more than 12,000 pages, with many thousands more pages of supplements. Not only has GAAP grown in size, but its complexity has accelerated as well (Sharman 2007). Besides that, a traditionalist believes that more was better and producing more irrespective of demand was rewarded with positive variances and greater apparent profit(Bicheno and Holweg 2009). A traditionalist might automate a warehouse or favour speeding up a machine and also believe that parts are separated and that improving the parts will lead to improving the whole system.

Furthermore, some of its conceptual foundations are being scrutinized as never before, and operating managers are complaining that existing systems fail to meet their needs in today‟s economic and technological environment (Shillinglaw 1989). Shillinglaw (1989) also added that he isn‟t clear where this lead to but what is clear to him is that managerial cost accounting must change if it is to be a vital force in the future. The information produced by traditional cost management are irrelevant and harmful to a business (Maskell 2009). According to Bicheno and Holweg (2009), traditionally accounting systems were essentially backward looking, i.e. only reporting on past performance, but giving few (if any) real pointers how to improve in the future and are not able to reflect accurately the improvements made through lean.

Professors Kaplan and Johnson have stated that cost accounting is the number one enemy of productivity (Kaplan and Johnson 1987). There are three principal shortcomings of traditional accounting systems, i.e., 1) irrelevant and harmful to a business; 2) expensive to maintain; and 3) divert the accountant‟s attention from more important matters (Maskell 2009). Furthermore, (Ostrenga, Ozan et al. 1998) mentioned that there are three important consequences to the drawbacks of the traditional cost management systems, i.e. 1) These systems cannot provide accurate product cost: where cost are distributed to products in a simplistic and arbitrary way that usually does not represent the real demand imposed by each product on the company‟s resources; 2) Such systems fail to stimulate decisions that can affect the overall production result. Managers are sometimes encouraged to accomplish short-term goals by reducing expenses with training and investments, or even by increasing the level of inventory. Although effective in the short term, these decisions can seriously affect future results (Goldratt and Cox 1989); and 3) Cost management information provided by traditional systems is of little help to managers in their effort to improve production performance. Poor transparency allied with the lack of timeliness makes cost information ineffective to help in the identification and elimination of waste.

Talking about the roles of an accountant, it is reported that the average accountant in an American manufacturing company spends up to 75% of his or her time on bookkeeping activities and less than 10% on analysis and process improvement (Maskell 2009). The job has been reduced to a backward-looking, reactive recording and dissemination of data that, if it could be done by a machine, would make the accountant entirely unnecessary. (Horngren 1991) argue that cost management must not be isolated from other managerial functions, and should play a key role in the implementation of the company strategies. It is reported that less than 10% out of nearly five million finance function professionals in the United States are involved in audit, tax, and external financial reporting (Sharman 2007). It takes more people to do the work than to check the work. Most people are believed that what an "accountant" does are taxes or working at a CPA firm. The cause of this imbalance is the proliferation of accounting laws and regulation themselves.

Looking at the role plays by cost management in construction industry, it is reported that in the case of cost estimating in construction industry, the information produced has the additional drawback that it is remotely related to the way costs are incurred. Most cost methods adopted in the industry are strongly based on the standard cost method, and tend to associate each cost item to a finished element, e.g. walls (m2), reinforced concrete components (m3), windows (units), obtained from design drawings (Koskela 2000). This makes it difficult to examine accurately the effect of design changes in production costs. Moreover, although time is a factor of major importance in construction costs, traditional cost estimating methods do not offer any reliable guidance for assessing the impact of production duration on project costs (Kaka and Price 1991; Turner 1993; Navon 1995). (Kim 2002) suggests that cost management systems should involve a set of processes required to ensure that a construction project is completed within the approved budget, including cost estimating, cost control and cost projection. (Navon 1995) points out that the proper consideration of the interaction between cost and time in construction projects depends on the integration of cost management systems to production management. Therefore, cost management systems in construction must be dynamic, proactive and able to support different decision-making processes, in order to protect the business from the harmful effects of uncertainty. Their main objective should be to generate information to support decision- making, mainly concerned with cost reduction, value improvement and financial management.

Whereas, (Maskell 2009) has categorized the problem with management accounting under five major headings, i.e.: 1) lack of relevance, 2) cost reduction 3) inflexibility 4) Incompatibility with lean thinking and 5) inappropriate links to financial accounts.

Therefore, we can conclude that cost management accounting system needs renovation and hence, a few solutions to the shortcoming encounter in traditional cost management are proposed in the next section.

4. Suggested solution

An attempt to improve traditional cost management has started in 1965. The idea of using an operational approach for cost estimating is not new. In the Sixties, Skoyles (1965) discussed a radical change in traditional cost estimating methods that had been proposed in the U.K., in which a very detailed estimate of the project was produced based on the early definition of construction methods. This approach was not successful because it was considered to be too time consuming and also due to the lack of knowledge on production methods by cost estimating professionals. It seems that the main difficulty for implementing such an approach was that the high level of uncertainty and variability that exist in construction at the early project stages was neglected. (Barnes 1977) proposed a less radical approach to operational cost estimating for construction projects, suggesting the use of different cost drivers for estimating the cost of resources, which were classified into fixed, quantity based, time-based, and price-based.

Furthermore,(Garg, Ghosh et al. 2003) reported that companies have been slow to implement new tools and there is broad agreement that current cost systems aren"t providing accurate-enough information. Organizations are loath to adopt new tools and techniques in management accounting to help them resolve these problems because it is hindered by economic realities and internal resource constraints as well as the difficulties involved with changing familiar practices. In practice, most firms are still using traditional accounting system even though their faults are well known (Innes, Mitchell et al. 2000; Garg, Ghosh et al. 2003). The problems that prevented the costing system from adding value to the company were the "cost world" and the "cost per unit" attitude that prevailed.

(Glad and Becker 1996) described modern cost accounting systems and information should incorporate these criteria, i.e. 1) provide a multi-dimensional focus on a multiplicity of cost objects such as customers, products, services, functions, processes and activities, 2) focus less on cost tracking and reporting and more on cost planning and control, and 3) support every key business decision, including sourcing, pricing, investment justification, efficiency and productivity measures, product elimination and new product introduction. Therefore, the proposed solution was aimed at eliminating the root problems and thereby all the unfavorable phenomena that stemmed from them can be resolved.

4.1 Activity based costing

Activity-based management (ABM) is a modern cost accounting and management model that is consistent with the concepts of strategic management and reengineering. ABM is both an accurate cost accounting system and a performance improvement tool (Turney, 1991). Like reengineering, ABM focuses on business processes, which are collections of activities or work that result in valuable output. Activity-Based Costing (ABC) is a cost method that has been recently adopted in many industrial and service firms as a method to improve cost management in complex production systems.

It is basically a two-stage approach for allocating indirect costs to products based on cost drivers of various levels (Kaplan and Cooper, 1998). In the first stage, resource costs (labour, equipment and power) are assigned to those activities performed in the organisation. During the second stage, activities costs are assigned to the cost objects based on selected cost drivers (e.g., machine set-up, quality inspection and material handling activities), which express a causal relation between the activity demand and the cost object considered (Ostrenga et al 1998). Notwithstanding the benefits of its application, ABC presents some drawbacks when compared to traditional cost systems. Perhaps, the most important one is the large amount of data usually needed in ABC systems.

4.2 Lean cost management

Alignment the value stream in accordance to lean principles is the key important thing that should be done first before implementing the lean cost management in a company. Based on(Maskell and Kennedy 2007), the objectives of lean accounting are simple and have 4 objectives, i.e. 1) provide accurate, timely, and understandable information to motivate lean transformation throughout the organization, and for decision making leading to increased customer value, growth, profitability, and cash flow; 2) use lean tools to eliminate waste from the accounting processes while maintaining thorough financial control; 3) fully comply with GAAP, external reporting regulations, and internal reporting requirements; and 4) support the lean culture by motivating investment in people, providing information that is relevant and actionable and that empowers continuous improvement at every level of the organization. There is nothing within the body of knowledge called "lean accounting" that is new. In order to achieve these objectives, lean accounting adapts familiar financial and management accounting methods to the needs of lean organizations.

4.3 Theory of constraint (TOC)

The TOC offers a seven-step Constraint-Management-Cycle (CMC) methodology for the identification of organizational constraints and their elevation. The methodology is verbalized with 7 steps starting with defining the system"s goal, determine measures of performance, identifying the system"s constraints, deciding how to exploit the constraints, subordinate everything else to the above decision, elevate the system constraints, and if in the previous steps, the constraint was violated, go back to step three, but do not let inertia become the system"s constraint.

4.4 Balance scorecard

There"s considerable variability in what management accounting tools companies use. Most popular management accounting tools where these are the top tools that more than 50% of the respondents use are 1) panning and budgeting tools (operational budgeting, ABM/standard budgeting and capital budgeting), 2) decision-support tools (quantitative techniques, breakeven analysis and internal transfer pricing), 3) product costing analysis tools (traditional costing and overhead allocations) 4) performance evaluation tools (benchmarking) (Garg, Ghosh et al. 2003). (Garg, Ghosh et al. 2003), 40% of the respondents say they are considering value-chain analysis, supply-chain costing, theory of constraints, target costing, value-based management and the balance scorecard.

4.5 Target costing

Target costing is also known as target value design, where the client include in their project business plan an allowable cost, what they are able and wiling to pay to get what they want. What is wanted and the corresponding allowable cost are then shared with key members of the team that will deliver the project if funded. Together, client, designers and constructors validate and improve the business plan. The validation process involves evaluating the allowable cost against an expected cost (Ballard 2008). Target costing is a feed-forward cost management technique that focuses on the design stage of a product‟s life. Its objective is to determine the cost at which a proposed product with specified functionality and quality must be produced to generate the desired level of profitability over its life cycle when sold at its anticipated selling price.

5. Discussion

Based on the findings from the literature review much has been reported about the shortcomings of the existing traditional cost management. Most of the research findings reported was on the drawbacks existed in manufacturing industry and a few others in construction industry. These outcome give the indication the cost management in other sector are still relevant to be used and not all industries and traditional cost management system are still relevant to be used to other sector at this point of time.

Even though most of the research findings reported about the bad side of the traditional cost management, there are three research finding that indicate about the remarkable resurgence of interest in both the practice and theory of cost and management accounting in recent years. This indicate that further development to the existing traditional cost management still taken place and being practised currently.

Based on the literature review, the subject matters of the drawbacks that have catch attention most of the researcher has been classified as follows: 1) in terms of the irrelevancy of the information provided by the current traditional cost management; 2) the irrelevancy of the traditional cost management system with today‟s economic and technological environment; 3) method used currently; 4) the product value stream; 5) the role of an accountant; and 6) new set of rules & regulation.

Even though, a few method of a new set of cost management has been introduced, not many company has participate to this initiatives of implementing a new set of management accounting in their company and their effort towards improving the cost management system in their company is of low to medium priority.

6. Conclusion

Based on the literature review it can be concluded that the current traditional cost management practices are in need of improvement. This statement is true for the practise of cost management in manufacturing industry and construction industry. Therefore it is suggested that further research direction be undertaken with a view to improving cost management in construction projects.

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CIB Publication 341