

# Managing Resources in a Sustainable Building Process



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## Extended Abstract

### Introduction

Managing resources efficiently in a building process is of great importance in a sustainable development. The framework in a building process contains legislations and rules from a societal perspective combined with demands of a more efficient way of working within the companies involved. The knowledge of all actors involved must be used in order to solve this complex task.

The quality of new buildings does not always match the expectations from the clients today so efforts must be done to improve the process. Another urgent issue is to deal with existing buildings. Participatory governance can describe the citizens' democratic right to participate in decision-making concerning building or renovation processes. The public sector in Sweden discusses the possibilities of working more systematically with the ambition to use all the resources in a better way and with an end-user perspective.

Today different processes seem to be parallel and do not always support one another. How can we achieve the best quality in the integrated process and in the end-product? Can a genuine dialogue and integrated processes be one way to achieve a better result? The case study evidence suggests that the primary focus of the logistics concept in construction is to improve coordination and communication between project participants during the design and construction phases, particularly in the materials flow control process.

### Problem

The Building Industry faces challenges both in new building projects as well as when dealing with existing housing areas. The economical resources are limited and the regulations and restrictions are many.

Examples from the Swedish building industry show severe problems with quality and how to manage the financing of the damages. The knowledge and awareness ought to be within all actors involved in the process but the question is if there are obstacles for using it?

Where and when shall the resources be adopted to the process and which are the effect of a more integrated way of working? A gap can often be indentified between different processes and actors involved in this complex industry dealing with governing the built environment:

### Theoretical framework

In the planning- and building process several kinds of flows are managed simultaneously. The flows are governed within and between the companies involved, the residents and the governmental framework of regulations and laws. If using a combination of theories from transport logistics, design methods and quality management maybe some of the existing gaps in the

process could be avoided. The challenge is to see the possibilities in new demands in services and products. New skills, competences and attitudes are required when working with processes. It is also of great importance to create an understanding and acceptance for the changes.

Starting with defining and focusing on the end-user in the process can be an important unifying force. Customer driven processes and a modern perspective on quality puts the end-users needs, expectations and requirements in focus.

Using theories from the design area one could start with looking into Architectural design where decisions influence the artificial environment in our every day life. The act of designing is a complex activity undertaken a close cooperation with many other actors. There is a growing recognition of the importance to think more creative and dynamic by adding values and culture into the process

If implementing the lean thinking philosophy and tools into construction industry one must include lean ideals and tools into the participating organisations. Eliminating waste and maximising value must be applied into the processes within the organisations as well as on site-based construction.

Logistics activities commonly involve movement and storage for the purpose of having the desired object of at the right place at the right time. Transport, storage and distribution are cornerstones of logistics and its most visible manifestations.

For the construction industry, logistics comprise planning, organization, coordination, and control of the materials flow from the extraction of raw materials to the incorporation into the finished building. Several Swedish laws emphasize the importance of the involvement of residents and end-users in the planning- and building process. Communication and knowledge transfer can be used as a tool for combining parallel processes. Digital communication networks offer the possibility of better links between clients, designers, construction organizations and suppliers

## Case study results

Three case studies are used to exemplify different levels of collaboration and integration between parallel processes. Case I and II was part of a doctoral thesis and the third case is an ongoing research project not yet documented.

## Case study analysis

Case studies on large scale projects in Sweden shows that working with the end-users needs and requirements in focus can support the complex building process. Working in a more integrated way can support the complex mix of technology, people and decisions involved.

Recourse logistics models and customer driven process methods can support the integration of parallel levels and phases in the process. The dialogue between the actors involved where experiences are shared can also give new and useful knowledge if it can be developed in a generous atmosphere.

## Conclusions

Some experiences from three different case studies in Sweden shows that it could be possible to use more of logistic models and "Considerate Lean" models in the building and planning process. There is an opportunity to get long term sustainable housing by involving the residents and end-users and by using their knowledge in the process.

Logistics require that all involved processes are communicating with each other. If not, the lean model will be hard to apply. Lean is about taking away all waste that is not used in the value added process. It concerns time, products, costs, etc. If this is done in a proper way it is possible to make a shift to a more value added process i.e. storing activities can be used for more productive and value adding work.

**Keywords:** integrated processes, logistics, service logistics, lean renovation, sustainable process, communication, co-operation

# Managing Resources in a Sustainable Building Process

## Summary

Managing resources efficiently in a building process is of great importance in a sustainable development. How can we achieve the best quality in the process and in the end-product?

The framework in a building process contains legislations and rules from a societal perspective combined with demands of a more efficient way of working within the companies involved. The public sector in Sweden discusses the possibilities of working more systematically with the ambition to use all the resources in a better way and with an end-user perspective. A traditional building project contains different parts added in a chain of time like competence, time, money, and building materials. Traditionally the process is more like a parallel relay with a high risk of a communication gap between the actors involved. Involving the tenants supports the democratic right to be part of societal development and can also be used as a source of knowledge. Working in a more integrated way can support the complex mix of technology, people and decisions involved. Recourse logistics models and customer driven process methods can support the integration of parallel levels and phases in the process. The dialogue between the actors involved where experiences are shared can also give new and useful knowledge if it can be developed in a generous atmosphere. Where and when shall the resources be adopted to the process and which are the effect of a more integrated way of working?

## 1. Introduction

Managing resources efficiently in a building process is of great importance in a sustainable development. The framework in a building process contains legislations and rules from a societal perspective combined with demands of a more efficient way of working within the companies involved. All parts involved must be active and creative to develop new strategies and working processes. The knowledge of all actors involved must be used in order to solve this complex task.

Governance can be used as a term in industry to describe the processes needed for a successful project. New laws and regulations demands a more efficient way of using energy and a better availability in concern of people with difficulties in their mobility. These demands require large scale investments and urge a change of attitude and behaviour. New demands combined with the fact that many of the existing old houses need to be renovated due to poor building material that was used in the past, stresses the economy for the Real Estate owners in a bad way.

The quality of new buildings does not always match the expectations from the clients today so efforts must be done to improve the process. Another urgent issue is to deal with existing buildings. In Sweden today there is a great need of building new apartments and an urgent mission to renovate about 600.000 apartments from the sixties and seventies in a bad condition. Many apartments from the Million programme (built in 1960-1970) are generally owned by the communities and only a few by private companies. Many of the tenants in these housing areas have a low socio/economic status that also states the importance of using the resources in a considerate and efficient way. Several signals, from preferable young men, as burning cars and riots tell us that they don't feel part of our society. This phenomenon creates a great risk to the social sustainability. The problem is shared by the individual, the Real Estate Company and the society.

Participatory governance can describe the citizens' democratic right to participate in decision-making concerning building or renovation processes. Several Swedish laws and United Nations Convention on the rights of the child, states the rights for all individuals to express ideas and be part of decisions concerning their every day environment.

The public sector in Sweden discusses the possibilities of working more systematically with the ambition to use all the resources in a better way and with an end-user perspective.

Working processes involving the tenants supports the democratic right to be part of societal

development and can also be used as a source of knowledge.

Today different processes seem to be parallel and do not always support one another. How can we achieve the best quality in the integrated process and in the end-product? Can a genuine dialogue and integrated processes be one way to achieve a better result?

Frequently, the supply of building materials to the construction site is fraught with difficulties which can have a significant effect on productivity. Major productivity gains are possible, particularly if the building process is planned from a logistics perspective. The concept of logistics was developed initially within the manufacturing industry, and now constitutes an important management tool to ensure an overall strategic perspective on the flow of materials in the production process. This paper contends that logistics are relevant also to the construction industry, and describes the development of a logistics model to manage the flow of materials from suppliers to installation on-site and its application to a Danish house building project.

The case study evidence suggests that the primary focus of the logistics concept in construction is to improve coordination and communication between project participants during the design and construction phases, particularly in the materials flow control process. The logistics concept requires accurate scheduling of materials to programmed delivery dates keyed to actual site layout and storage arrangements. The logistics approach also involves a new role for materials suppliers, including early involvement in the design phase and overall responsibility for the flow of information relating to materials.

## 2. Problem

The Building Industry faces challenges both in new building projects as well as when dealing with existing housing areas. The economical resources are limited and the regulations and restrictions are many.

Examples from the Swedish building industry show severe problems with quality and how to manage the financing of the damages (Fig 2.1 ,2.2, 2.3). The knowledge and awareness ought to be within all actors involved in the process but the question is if there are obstacles for using it?



Fig 2.1 Building in Ystad collapsing two weeks before inauguration as “the House of Health”



Fig 2.2 Stucco facades with problem



Fig 2.3 Moisture damage

A traditional building project contains different parts and resources added in a chain of time like competence, money, and building materials. Traditionally the process is like a parallel relay with a high risk of a communication gap between the actors involved.

Where and when shall the resources be adopted to the process and which are the effect of a more integrated way of working? A gap can often be indentified between different processes and actors involved (*fig 2.4*) in this complex industry dealing with governing the built environment:

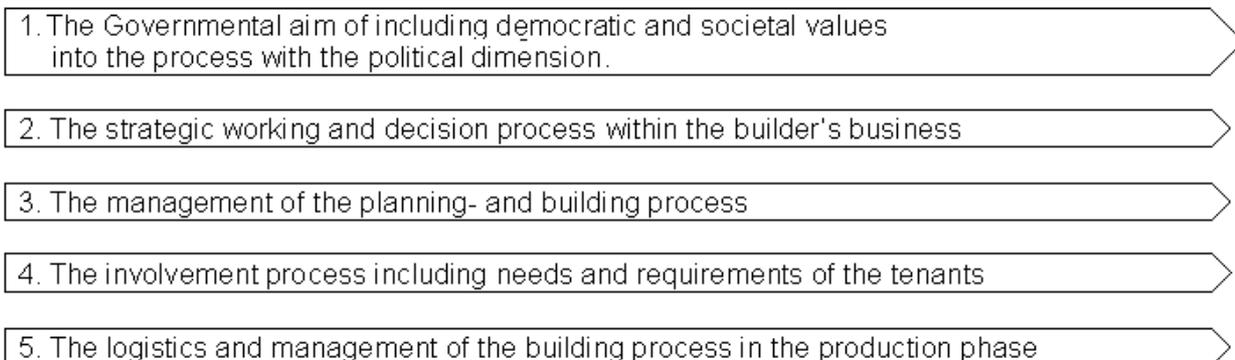


Figure 2.4. Parallel processes.

**1.** A problem with achieving a societal sustainability is that some residents do not feel that they are a part of society. Segregation and exclusion are accelerating in some neighbourhoods. The governmental aim to include the residents actively seems to have difficulties to be integrated into the planning and building process.

**2.** The builder can work with different goals and strategies but must always get positive results of their investments. The Municipal Housing companies in Sweden are governed by a law since 2011 to return profits of their operations. The conditions from regulations and the bad state of the existing housing are a challenge to deal with. Working with a traditional calculus bill does not always give a positive result and therefore requires an integrated accounting with a societal perspective.

**3.** Architects and Engineers and the other actors involved in the building process do not always

share the same interpretation of the order from the builder/client. Digital tools and project portals with drawings and information seem to minimize the opportunities to discuss and understand the drawings.

4. Knowledge about economy and property management is not always a common focus and the tenant seems often not to be part of the process. A dialogue with the tenants is rare.

5. The production phase is supposed to solve all the questions expressed during the early phases in the building process. Drawings are handed over before they are properly investigated and discussed. The lack of time stresses the actors involved. At the building site when very few things can be changed lays all kinds of problems accumulated during the process.

### 3. Theoretical framework

In the planning- and building process several kinds of flows are managed simultaneously. The flows are governed within and between the companies involved, the residents and the governmental framework of regulations and laws. If using a combination of theories from transport logistics, design methods and quality management maybe some of the existing gaps in the process could be avoided.

*“A process is a repetitive used network in order of linked tasks that uses information and resources to transform ‘object in’ to ‘object out’, from identifying to the satisfaction of customers needs”. [1]*

Increased competition on the market makes the companies work more efficient with a process-based business development. The challenge is to see the possibilities in new demands in services and products. New skills, competences and attitudes are required when working with processes. It is also of great importance to create an understanding and acceptance for the changes.

A process- based business must work with:

- A holistic perspective
- Customer focus
- Employee focus
- Strategy
- Flexibility and an ability to change
- Effectiveness
- Measurement
- Time

#### 3.1 Customer driven processes

Starting with defining and focusing on the end-user in the process can be an important unifying force. Customer driven processes and a modern perspective on quality puts the end-users needs, expectations and requirements in focus. QFD, Quality Function Deployment can be described as a systematic way of working in order to achieve “quality of design” and do also support communication and participation [2]. Four steps are used when involving the end-users requirements into the process in comprehensive QFD:

- Product planning
- Product design
- Process design
- Production design

This method can be used both for products as well as for services and the positive effects are lower planning costs and much shorter time for the product development. As a bonus effect the customer also helps to identify weaknesses in the competitive companies that can be used when dealing with strategic decisions. Benefits from working with customer driven processes are mentioned as: better communication, better transferring of knowledge, more of consensus within the project team and better constructions. There are no negative effects mentioned by using the customer as a focus point. But if you lack of support from the management, lack of commitment in the project team and too few resources there can be a problem in achieving the goal [3]. In Kansei Engineering by Nagamachi [4] the management of the product development are assumed by client’s statements and feeling about their experiences.

In order to achieve the best customer satisfaction a company can combine the strategy with Business Development and Business Performance Measurement and Balanced Scorecard [5] It is all about the Management's ability to evaluate the organization's efficiency and the manager's capability to take initiative for development. SIQ the Swedish Quality Award can be compared to TQM Total Quality Management is based on thirteen fundamental values. The goal is to create a strong driving force from inside for working with continuous improvements.

### 3.2 Design

Using theories from the design area one could start with looking into Architectural design where decisions influence the artificial environment in our every day life. The act of designing is a complex activity undertaken a close cooperation with many other actors. There is a growing recognition of the importance to think more creative and dynamic by adding values and culture into the process. The softer approach takes a new perspective on the process while moving away from the production line. Integrated teams and value-based techniques can be a better way of working in delivering the product and services to the clients.

*"Design is an expert activity that improves the usability, functionality and quality of the built environment, i.e. design adds value to our every day lives. Design is also a collective effort based on degrees of compromise and commitment, combining the skills and knowledge on a wide range of individuals to provide creative solutions to poorly defined problems"* [6]

Emmitt also states that when the project team strives to deliver value there is a constant and creative tension between the design and the production of buildings. He describes the construction industry as fluid and dynamic collection of specialists with temporary groupings of individuals and organisations with a very few established supply chains. Unlike the car industry with repeat building types lean production to the design and production of buildings may be misleading and inappropriate. Construction remains dependent on site-specific conditions despite the amount of off-site prefabrications. What's fundamental is the effectiveness of the relationship between the architects and the clients. It is important to discuss goals, opportunities, risks and values; the closer the interaction is the better the understanding. The creative tension helps stimulating innovation in product and process and makes it to a fascinating and challenging activity.

### 3.3 Lean

If implementing the lean thinking philosophy and tools into construction industry [6] one must include lean ideals and tools into the participating organisations. Eliminating waste and maximising value must be applied into the processes within the organisations as well as on site-based construction. Traditionally lean thinking philosophy is used in manufacturing processes and quality management work but it can be successfully used with modification in a construction project context. Using Information technology has transformed the way of working and there is a move towards more cooperative interdisciplinary work and using multidisciplinary teams. To reach real integration a social parity between actors is needed to achieve a more collaborative way of working. By improved interaction and communication the effect of these creative clusters can be knowledge transfer, feedback and constructive critical analysis which characterize good management. Trust, risk and uncertainty have to be handled in a considerate way in the process. Clear communications and identification of roles and responsibilities support this work. *"we don't trust an organisation per se; we trust the individuals working in the organisations with which we have contact on a regular basis [6]"*

Processes can always be improved and a pragmatic business approach can use "Six Sigma" as a strategic method [7]. The method is a formalised, systematic, heavily result oriented project-by-project improvement methodology to achieve improvements. If looking at three different key indicators of process performance it can form an improvement triangle for processes. The key dimensions are:

- Variation -How close to the target value?"
- Cycle time – "How fast?"
- Yield – "How much?"

Variation is the main key because a measurement can be applied to assess the performance of cycle time and yield of processes. Through improvement variation always affects the other two positively. Six Sigma was pioneered by Motorola in 1987 and consists of five steps : Define, measure, analyse, improve and control.

Four elements are embodied in a strong corporate framework:

- Top management commitment
- Stakeholder involvement
- Training scheme
- Measurement systems

Six Sigma is described as a long-term strategic initiative that requires hard work and close attention. “The primary reason for the success of Six Sigma is its rigorous pursuit of top line and bottom line results in all improvement activities associated with the initiative [7]”

### 3.4 Logistics

Logistics commonly refers to coordinating and organizing the movements of components, final goods and their distribution. It was first used systematically for military purposes but have been gradually spread to commercial endeavors, often referred as logistics management or supply Chain Management. The Council of Supply Chain Management Professionals (CSCMP) defines logistics management as: — “...that part of supply chain management that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services and related information between the point of origin and the point of consumption to meet customers' requirements.”

In reality, the scope of logistics issues for construction firms go beyond the —traditional tasks of physical storage and movement of goods because of its complexity. The concept covering this broader scope is Supply Chain Management (SCM), Business related logistics or SCM services which include customer service, demand forecasting, documentation flow, inter-firm movements, inventory management, order processing, packaging, parts and service support, production scheduling, purchasing, returned products, salvage scrap disposal, traffic management, warehouse and distribution centre management, and transportation. These services must be planned, coordinated and controlled to maintain the building process. This is today undertaken on an ad hoc basis and with a more integrated and planned process there are major potentials.

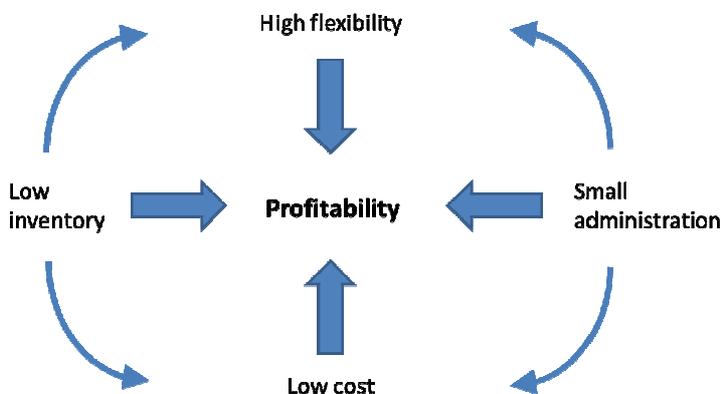


Figure 3.1 The benefit of using lean logistics in the construction industry

Logistics activities commonly involve movement and storage for the purpose of having the desired object of at the right place at the right time. Transport, storage and distribution are cornerstones of logistics and its most visible manifestations.

For the construction industry, logistics comprise planning, organization, coordination, and control of the materials flow from the extraction of raw materials to the incorporation into the finished building [8]. Some may argue that there is little difference between a logistics management system and an integrated materials management system. The former system is the means whereby the needs of customers are satisfied through the coordination of materials and information flows that extend from the building process, to the market place, through the resources and its operations and beyond that to suppliers [9]. It is broader in scope than the latter, and operates at the strategic level. The scope of logistics spans the total organization [10]. We can also find a close connection between integrated logistics and sustainable systems when applied in the building sector [11].

### **3.5 Governmental regulations**

Several Swedish laws emphasize the importance of the involvement of residents and end-users in the planning- and building process. The Planning and Building Act PBL 1987:10 [12] regulates the planning process and the actor's responsibilities and roles.

The Swedish Government has established The National Council for Innovation and Quality in the Public Sector to improve the efficiency and quality of public activities in national, regional and local level.

The remit includes:

- describing government agencies' work on innovation, quality and business development;
- clarifying whether the current regulations imposed on government agencies for management, control and accounting support innovation and value creation;
- identifying the extent to which quality and efficiency analysis are carried out in different areas of the public sector and how these are processed to be translated into concrete improvements;
- assessing whether such analysis can be an instrument in efforts to achieve greater quality and efficiency;
- identifying areas, services or processes that are considered to have great potential for development and, in close coordination with voluntary participants, preparing development strategies for some of these areas;
- studying public sector organisations adopting the management philosophy known as 'Lean', looking at research into the use of 'Lean' in public sector organisations and, if deemed appropriate, supporting those public organisations that want to implement 'Lean'; and
- proposing measures to promote innovation and development in the public sector.

Efforts are done also by the Swedish Association of Local Authorities and Regions and The Swedish National Board of Housing, Building and Planning to support a sustainable development.

Social sustainability is indicated to be our next challenge to deal with in urban planning and housing.

### **3.6 Communication, cooperation and knowledge transfer as a tool**

Communication and knowledge transfer can be used as a tool for combining parallel processes. The communication process can be used to inform, coordinate and motivate people in the exchange of information, facts ideas and meaning [13]. Poor communication often results in low morale and low productivity and therefore analyzing communication behaviour is vital. Interpersonal and organizational problems can be related to poor communication skills. People must communicate effectively to develop goals, channel energy and identify and solve problems.

Examples of barriers that can reduce the effectiveness:

- Inarticulateness - can result in subsequent misunderstandings
- Hidden agendas - results in low trust and cooperation
- Status - distortion by perceptions of position
- Hostility – difficulties in sending and receiving a message
- Distractions – not focusing of the subject of the communication
- Differences in communication styles – listen less carefully because they are distracted
- Organizational norms and patterns of communication- may prevent questions and discussions

By coaching and mentoring the employees they can develop both reflective listening skills and communication skills that can improve effectiveness and enhance productivity.

Promoting a successful teamwork and cooperation is based on mutual goals that encourage trust and the ability to rely on others. Incompatible goals create suspicions and doubt and can lead to a communication break down [14]. In the process teams must be provided with adequate resources, with financial, staffing and training support. With a well defined task and both technical and group process assistance available, the performance can be better. It requires efforts from both

individuals and the organization. The potential lies in the fact that that a whole is greater than the sum of its parts. The collective work of a group of people is more than its individuals could accomplish separately.

Digital communication networks offer the possibility of better links between clients, designers, construction organizations and suppliers [15]. These systems have the potential to provide the infrastructure for knowledge acquisition and accumulation, enhancing the possibilities of providing feedback and the potential to learn from previous experience. *“Conventional construction processes has usually involved sequential decision making, in which the decisions were passed from one group specialist professionals to the next, all of whom had to make inputs if overall project goals were to be realized. Decisions were transferred and translated in a process which changed semantics such the original intent could be lost or altered.”* ICT technology systems change the type of involvement of each participant. With the new technology the timing, sequencing and hierarchy of decision making changed fundamentally. This could also offer customers value-added services with the intent of developing better user - producer relationships and give possibilities to improve overall performance. The linear- sequential approach changed into a interactive- integrated model of construction. Designer can use the information and communication technology to simulate and test design options and coordinate between different specialists. New design skills will be needed in the total design and construction process to produce complex buildings and social uses in a variety of different markets. *“Uncertainty remained high in most building processes, because of the ways in which they were organized with weak feedback loops and poor opportunities to learn from project –to – project. They needs to simplify processes, using modular component parts and standard interconnections were one response to growth in project complexity”* [15].

The organizational learning includes some informational content like a learning product, a learning process (acquiring, processing and storing information, and a learner (to whom the learning process is attributed).

There can also be a particular kind of learning that consists of unlearning when information leads to subtracting something from an organizations existing store of knowledge[16].

If treating an organizational entity as an impersonal agent is like adopting a machine language and seems to reflect the rising influence of the computer. Phenomenon that used to be attributed to thought, will, deliberation, feelings or habits have a tendency to employ computer language. There is a risk in this growing tendency to treat organizations as impersonal agents. It is important to come close enough to be aware of the individual interpersonal processes that underlie an organization's behaviour within which individuals think and act. Usually learning is used in a positive sense but Agyris & Schön also discusses that people can learn collectively to maintain patterns of thought and action that inhibit productive organizational learning. For example by responding to error by use of scapegoating, games of unilateral control, systematic patterns of deception and camouflage of intentions that keep critical issues undiscussable. This can be changed by using inquiries to let the organization explore and reconstruct the values and criteria's for the meaning of improved performance.

## **4. Case study results**

Three case studies are used to exemplify different levels of collaboration and integration between parallel processes. Case I and II was part of a doctoral thesis [17] and the third case is an ongoing research project not yet documented.

### **4.1 Case I**

The project Campus Östersund, an old military regiment was transformed into Mid Sweden University by Vasallen with the mission from the Government to: manage, to improve and then sell. New tenants with new activities demanded a total change of design but with the limitations of considering strict regulations regarding heritage buildings. Vasallen clearly stated the demand to all actors involved to involve the end-users' into the process and to work with continuous improvement. All the consultants and construction companies involved were educated in this spirit to fully understand the ambition in the project. Full scale rooms were built up in order to improve the

possibilities to discuss the design of the indoor environment. When the tenants realised their opportunity to influence the process it was too late, the contracts were already written and the construction company were procured. This fact prevented the end-users from influence the result, the doors were closed. A positive effect with the full-scale room dialogue was the discussion and the exchange of experiences between Vasallen and the craftsmen. Details were designed that saved a lot of resources as time and material in the process. The craftsmen were also involved in daily information and planning throughout the building process. The tenants' satisfaction with the result was followed-up and dialogue and continuous improvement was one of the key-word in the process. All actors involved was content with the result and long term leases is one example as well as a tripled profit compared to the investment of about 35 billion Euros. The municipal planning was not supporting the process and at the end Vasallen purchased consultants to plan the surroundings meant for additional companies and activities. The plans were then presented for the political committee as a decision support without involvement of the City planning office. This is not the traditional way of working in the planning process but the understanding of Vasallens ambition was crucial for the total result and demanded this operation.

## **4.2 Case II**

The project Maria Sofia, a multi-storey housing project in Helsingborg with 200 apartments built by the municipal real estate company (Helsingborgshem) with the mission: new apartments with the best possible quality with a predetermined cost ceiling. All actors involved took part of meetings and workshops in the early phases of the project in order to learn more about each other. The tenants were represented by people working in the very front line of the organization knowing a lot about how the tenants think and act. Priorities were made in order to get the most out of the resources. A lot of time was used in the beginning of the project that made everybody save time and money during the process. A common goal and efforts to reach the best quality for the end-users made everybody to work in a collaborative way. Experiences and knowledge were exchanged and even the craftsmen were involved. One apartment was made ready as a "role model" which could be the base for a discussion about and interpretation of the ordering. The quality of the end-product were discussed and understood of every actor involved. The City planning office was invited to the early workshops and discussions but they refrained to be part of the process. There were difficulties concerning the role as an authority to come close to one project because there were several parallel projects going on at the same time. The tenants were invited to visit the building site as soon as they signed the leases and they also attended the final inspection of their apartments. Technical details and questions about functionality were told at this occasion and gave effect on their preparedness as future tenants. Their knowledge of why things were as they were could be explained and their role in the process became clarified. The goal was to serve their demands and requirements and the results of the project were good. By using time, money and knowledge from all actors involved in the right way, the quality of the apartments became very good. A smooth process is not a common thing in the building process. Keeping both time schedule and budget is even rarer. Sharing a common goal and working with a joint ambition has this effect in this project.

## **4.3 Case III**

The project Drottninghög in Helsingborg, an existing housing area with 1100 apartments from the Million programme (built between 1962-1972) owned by the municipal real estate company with the mission to: take care of both the tenants and the buildings and to double the number of apartments with a sustained energy use in the area. The working process so far has been using the same ambitions and common goal as case I and II. (Using resources and the knowledge of the actors involved in the best way to reach the best quality for the end-users)The big difference in this case is that the City planning office has been deeply involved in the early phases of the project. Dialogue with the existing tenants and learning from other projects in order to make the process better are ambitions that can give positive effects. Ongoing research and experiences done are used as well as other networks dealing with the same tasks. Developers and future property owners are not involved yet, but they are invited to workshops and meetings to exchange general experiences. Construction companies are not contracted so they are not part of the process yet. Qualities and values in the neighbourhood are indentified by using methods for dialogue with children and young ones from the school. These qualities and values are formulated and gathered and are now a part of the formal planning program determined by the political committee. The

project will proceed in this spirit and can give more experiences of working in a more integrated way with the processes going on at the same time. The plans are now that the process to open up, connect and to densify this part of the city will go on for fifteen to twenty years. Long term thinking about both people and buildings are keywords with sustainability in a social, technical, economical and environmental perspective.

## 5. Case study analysis

Case studies on large scale projects in Sweden shows that working with the end-users needs and requirements in focus can support the complex building process. Working in a more integrated way can support the complex mix of technology, people and decisions involved.

Recourse logistics models and customer driven process methods can support the integration of parallel levels and phases in the process. The dialogue between the actors involved where experiences are shared can also give new and useful knowledge if it can be developed in a generous atmosphere.

Experiences from two case studies in large scale projects in Östersund and Helsingborg [17] shows that time and resources that are put in to a project, in order to increase the communication between the actors involved, can be considered as well paid investments. The time and the efforts made to communicate the goals, listen to the end-users requirements and to really understand these and use them as a resource, gives certain effects to the whole organisation and the quality of the product. Knowledge can be used and discussed, experiences from both end-user and craftsmen supports a process where problems are solved in the early faces of the building process. The same information about the project can be shared and discussed in order to make sure that everybody understands the meaning of the information. The discussions and conversations at the meetings with representatives from all actors involved can clarify questions and different perspectives are used to solve problems.

All the actors involved can use their energy to work with the issues that concerns a common goal instead of watching their back. Money can be saved due to less problems and obstacles in the process and at the building site. The efficient use of resources gave the product a better quality and was customized for the end-users requirements. Very little time were used to repair the negative effects of miscommunication that are the usual tradition. On the question to the persons responsible for the projects in both case studies: "Was it worth to put in all these time and effort to communicate in the early faces of the project?" the answer was "that is only a matter of how and when the resources are used in a project".

### **Case I**

Bad cooperation with the City planning administration – alternative ways gave good results anyway

### **Case II**

Trying to cooperate with the City planning administration with bad success- but good result to the rest of the process-planning and production with a active co-operation with the construction company

### **Case III**

Active and creative participation with a common goal for all actors involved (except the construction companies) – an ongoing project in the early phase of the process

## 6. Conclusions

Some experiences from three different case studies in Sweden shows that it could be possible to use more of logistic models and "Considerate Lean" models in the building and planning process. There is an opportunity to get long term sustainable housing by involving the residents and end-users and by using their knowledge in the process.

Logistics require that all involved processes are communicating with each other. If not, the lean model will be hard to apply. Lean is about taking away all waste that is not used in the value added

process. It concerns time, products, costs, etc. If this is done in a proper way it is possible to make a shift to a more value added process i.e. storing activities can be used for more productive and value adding work.

With a low integration in the building process it generates ad hoc activities. This can lead to two types of problem. First, some materials may be purchased just before they are required, resulting in delays, and interruptions to the working schedule. Second, other materials are procured in large quantities without complying with production needs on site. This can result in a waste of resources during stocking, handling and transporting. Responsibility for waste concerns all project participants. It concerns general management as well as site management; any solution to the problem should involve all parties, i.e. those who design the building, those who design the materials and components; and those who specify, describe and account for the work and the suppliers of materials. In selecting a method of handling building materials, the materials' characteristics (weight, vulnerability to damage, etc.), the method of packaging, the storage on site, the movement to the workplace and any obstructions, and the plant available and best suited to the task, are all aspects to be considered.

In the long term this will create a building process that will be positive for the environment as well as the final customer that will live in the building after it is finished.

This way of working requires a certain attitude towards the task and a fully understanding of the effect of genuine communication and dialogue. By using the dialogue, knowledge transformation can take place, but this needs a good leadership and a supporting organization to succeed. The most important resources can be summarized as time and competence. Responsible and considerate actors with suitable skills are required to create a safe and creative working atmosphere in which the best result can be achieved.

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