The Strategic Role of ICT within the Turkish AEC Industry

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Abstract

Today it is widely accepted that ICT is becoming a strategic asset for any organisation to deliver business improvement and achieve sustainable competitive advantage. However, traditionally the construction industry has approached investing in ICT with a lack of strategic focus and low level of priority to the business. The nature of such investments have been made very much in an ad hoc manner with the focus on improving specific processes predominantly driven by technology, rather than towards business improvement driven by the strategic objectives of the business. As such, this may have delivered isolated areas of improvement within the organisation but has contributed little in the context of strategic benefit. This paper presents a recent study focused on investigating the current strategic role of ICT in the Turkish Construction Industry. The study explores issues relating to the role of ICT strategy, reasoning behind ICT investments, barriers to the successful implementation of ICT and role of ICT through the lifecycle of a facility/project.

Keywords: ICT, Strategic Role, Investment, Turkish AEC Industry, Construction

1. Introduction

Over the last 30 years the evolution of ICT has led to construction organisations increasingly adopting technology in support of their businesses. ICT is now widely accepted as becoming a key element of any organisation as they strive to ensure sustainable competitive advantage. However, since the initial enthusiasm of the industry during the 70’s in their adoption of CAD applications, the investment in ICT has (in the main) been extremely ad-hoc. Traditionally, ICT investments have been driven either by demands generated at operational levels to satisfy particular needs (bottom-up) or requests issued by senior management to meet specific business
requirements (top-down). This ‘Technology Push’ approach to investments in ICT results in the development of ICT-driven solutions that are unlikely to deliver real strategic benefit to the organisation. Furthermore, the nature of the industry has been such that ICT investments have not been perceived of strategic importance and a priority to the business. Although the introduction of several advanced ICT applications may have contributed to the improvement in the efficiency and performance of a number of processes, often the overall efficiency and performance of an organisation has not been realised in terms of meeting the strategic business objectives. This is a result of the development and implementation of ICT that is not part of an overall ICT strategy and/or the implementation of an ICT strategy that is not aligned to the strategic objectives of the business. Emphasis therefore in facilitating sustainable competitive advantage has to be on establishing strategic policies for ICT investment that are formulated to align with the business strategy thereby leading to more business-driven ICT solutions. The results of previous research on measuring the ICT use and trends in Turkey [1] indicated that, as similarly to many countries, the Turkish construction industry has been facing difficulties related to communication and loss of information due to fragmentation in the industry. In 2002, ICT was viewed as a strategic resource by senior industry figures in Turkey and they indicated that they were ready to spend time and effort in order to increase the ICT awareness and improve training. The overall research aimed to identify whether the Turkish construction industry currently views ICT as strategically important. The research methodology is summarised in the following section.

1.1 Research Methodology

The study began with a comprehensive literature review in the area by looking at the role of ICT in the AEC industry and the studies on evaluating the usage and benefits of ICT for AEC organisations. In the next stage semi-structured interviews were conducted with contractors and consultants in light of a questionnaire. During the interview process a range of areas such as the role of ICT strategy in the organisation, the reasons for investments on ICT and barriers to successful implementation of ICT for the organisation were investigated. The results of the literature review are summarised in the next section, followed by the findings of the interviews along with an analysis of these findings.

2. Background

2.1 The Role of ICT in the AEC Industry

The literature review identified numerous questionnaire surveys and case studies on investigating the usage and the strategic role of ICT in the construction industry. For example, Li and Wang [2] presented a “5Cs” evaluation framework to assist construction companies to predict, measure and evaluate the potential benefits that can or should be gained by the introduction of IT. Love at al. [3] presented findings of a questionnaire survey related with IT investments of SMEs in the Australian construction industry. Three findings were mentioned as (i) the different organization types significantly differ in the amount they invest in IT but this is not influenced by organisation size, (ii) strategic benefit varies with different organization types
and (iii) the way in which employees adapt to change as a result of IT implementation differs with organisation size. Based on the above mentioned findings, Love et al. [4] proposed a pragmatic ex-ante IT evaluation framework which can be used by construction organizations to ameliorate their investment decision-making process. Peansupap and Walker [5] explored the factors influencing ICT adoption within construction organizations. As a result, researchers determined that individual and environment factors generally have a high impact upon ICT diffusion but management and technology factors have a slightly above moderate impact. Following this, Peansupap and Walker [6] stated that people-related factors are crucial in effective ICT implementation and support at the personal, workplace and organisational level is clearly needed. Hua [7] conducted an IT Barometer in Singapore and compared the results with previous IT Barometer studies on Nordic Countries. Hua [8] later conducted an industry-wide survey by adopting the IT Barometer questionnaire and applying stratified sampling to Singapore’s AEC SMEs. In the study, the characteristics of ICT usage by the AEC companies were compared and the alignment of business and ICT strategies of the AEC companies was examined. Tse and Choy [9] investigated the differences in the use of IT by conducting an in-depth interview with three major quantity surveying organisations in Hong Kong. The authors found that the full potential of IT to improve organizations’ efficiency, effectiveness and flexibility has seldom been reached and then they apprised that a sector to enter the IT era must employ the right sort of technology by a sufficiently large number of the supply chain and stakeholders.

A significant amount of research has also been carried out related with the barriers for ICT implementation and the critical success factors to implement ICT. Stewart et al. [10] presented a conceptual framework for incorporating the impediments like operational factors, financial constraints, limited marketing and human resource management expertise, limited strategic planning and ineffective IT implementation. The authors [11] then explored the most effective coping strategies to overcome these impediments. A survey study was undertaken in Australia by Gajendran et al. [12] to identify the critical success factors that underpin the integration of ICT in supply chains. As a result, organizational commitment, organizational attitude to communication, rights and duties, investment drive and guarantee/protection/assurance were identified as critical issues to be addressed by organisations wishing to successfully adopt and integrate ICT into their supply chain operations. Ugwu and Kumaraswamy [13] identified two trajectories of IT project success and failure in construction, and the critical success factors that could be useful for IT applications, based on the research conducted over the period 2000-2004 in Hong Kong. Brandon et al. [14] identified the ingredients such as convergence, connectivity, culture, creativity, content improvement and collaborative working needed to “tip” the balance for an accelerated penetration of information technologies into the construction industry. The authors suggested that design and nD modelling, B2B and KM are the areas where current and future research may lead to a transformation of how the industry behaves.

2.2 Evaluating the Usage and Benefits of ICT for the AEC Industry

Another field of research to emerge during the literature review is that of evaluating the usage and benefits of ICT (and ICT applications). For instance, Andresen et al. [15] recommended a
framework for measuring the benefits of IT implementations. Parasuraman [16] ameliorated a multiple-item scale to measure readiness to embrace new technologies in marketing.

Other recent studies in the area include El-Ghandour and Al-Hussein [17] who presented a holistic view of ICT applications in construction during the years 1992 and 2002, Rivard et al. [18] who conducted case studies about the usage of IT in Canadian construction industry, Oladapo [19] who investigated the level of use ICT usage and the factors impacting the level in the Nigerian Construction Industry, Scheer et al. [20] who sought the application experiences of IT in construction industry in Brazil, and El-Mashaleh [21] carried out a modified version of an IT Barometer survey in Jordan’s AEC industry.

In addition, [22] [23] [24] can be referred to as further studies related to the applicability and usage of ICT in Construction, while there have been other studies for determining the role of ICT in AEC which can be found in [25],[26],[27]

2.3 Background on Use of ICT in Turkish AEC Industry

The literature review in the field identified three research papers that investigated the role of ICT in the Turkish AEC industry. The first is entitled “A survey of ICT use in the Turkish Construction Industry” [1]. The study examined the ICT capabilities of the Turkish construction industry via 22 semi-structured interviews with senior construction professionals within government and private organizations. In the study the authors investigated the usage and applicability of current information systems and technologies and assessed priority topics for the future of ICT. As a result, ten priority areas where IT use can facilitate processes were identified. A second study entitled “Use of Information and Communication Technologies by Small and Medium-Sized Enterprises (SMEs) in Building Construction” [28] analysed four major research questions associated with perception of the impact of ICT, extent of investments in ICT, level of usage of ICT and the software preferences of the SMEs by conducting a questionnaire survey of 227 building construction organisations in Turkey. Finally, Tas and Irlayici, [29] investigated the current and the planned use of IT and its impact on the construction industry in the case of acquiring building product information in Turkey. The authors conducted a questionnaire with both the supply side (manufacturers) and the demand side (architects). In the paper, the supply side’s behaviour on providing building product information and the demand side’s methods of getting product information were discussed.

3. The Interview Process and Results

In the next stage of the research semi structured interviews were conducted with 21 major contractors and consulting organisations in the Turkish AEC industry in light of a questionnaire. A questionnaire was formulated consisting of 19 questions. The first group of questions investigated the role of ICT strategy in the organisation, while the next set explored the reasons behind ICT investments. Further questions focused on the role of ICT in recruitment, structure of ICT departments, barriers and facilitating factors for the successful implementation and
management of ICT in the organisation and finally, the role of ICT through the various phases of the construction lifecycle.

3.1 Methodology

The semi-structured interviews were conducted generally with ICT managers by visiting each organisation. The interviews started with an informal introduction to the research which lasted around 20 minutes. The interviewees were later interviewed based on the questionnaire by two interviewers. The interview results were cross-checked by the interviewers and a copy of a completed questionnaire was reviewed by the interviewers and the interviewee in order to validate the answers given by the interviewee. The overall interview process with each organisation took between 1 and 1.5 hours. The list of interviewees is provided in Appendix 1.

3.2 Findings into the Strategic Role of ICT within the Turkish AEC Industry

Role of ICT Strategy

The first two questions investigated the general role of ICT in their organisational strategy. In response to the first question, the majority of the organisations mentioned the role of ICT as value adding (58%) and critical (38%) in order to gain advantage against their competitors. On the other hand, only a few organisations (10%) viewed ICT as simply a tool for supporting their business processes.

The second question investigated the role of ICT in order to win work, and in response more than half of the participants indicated the role of ICT as value adding (40%) and critical (20%). In fact, 40% of the participants found ICT as a non-critical resource for winning work, with 30% viewing ICT as a supportive tool to win work, and the remaining participants (10%) argued that ICT does not have any positive impact for winning work.

The next set of questions was focused on the role of ICT strategy within the organisation and in the context of the organisations’ overall business strategy.

The following question aimed to identify how organisations formulate their ICT strategy. The majority of the respondents (81%) indicated that their organisations’ ICT strategy is formulated by focusing on their strategic business objectives. On the other hand, a few participants (19%) indicated that their ICT strategy is formulated primarily focusing on implementing the technological innovations. In response, the interviewees also mentioned that a successful ICT strategy can only be developed by focusing on both the technological aspects and the organisations’ business objectives.

The fourth question asked whether the organisation has a well formulated and documented ICT strategy, i.e. an agreed set of actions to be taken in the investment in ICT and written in the form of a strategy document. The results demonstrated that the majority of the organisations (65%) do not have a documented ICT strategy while 30% mentioned that they do have a documented
ICT strategy (in the form of a written strategy report). Those organisations that do not have a
documented ICT strategy indicated that their ICT vision is based on following the technological
developments and advancements, while making ICT investments in parallel with their business
(strategic) needs. In contrast, the actions and ICT investments of their competitors’ has no
influence on any of the organisations that have an undocumented ICT strategy. On the other
hand, 5% of the interviewees mentioned that their organisation does not have any form of an
ICT strategy.

The next question explored the role of the organisations’ ICT strategy in the context of the
organisations’ overall business strategy. In response, 76% of the organisations mentioned that
their ICT strategy is either value adding or a critical part of their overall business strategy, while
24% pointed out that their ICT strategy only supports their overall business strategy.

The sixth question investigated who engages in the formulation of the ICT strategy. More than
half of the respondents (60%) mentioned that the organisations’ ICT strategy is formulated by
their central/core ICT department to align with the operational needs, which is dependent on the
feedback from various departments. On the other hand, 33% pointed out that their central/core
ICT department alone formulates the organisational ICT strategy (without input from other
departments), and 7% stated that individual departments are responsible for formulating their
own ICT strategy.

**ICT Investment**

The following group of questions focused on understanding the reasoning behind ICT
investments and investments related to ICT R&D and training. The first question investigated
the strategic reasoning behind the investments in ICT. In response, 42% stated that their
organisation invest in ICT to reduce the cost of the processes, 39% indicated that ICT
investments are made to add value to the current form of processes, while only a small
percentage (19%) mentioned that their organisation invest on ICT to gain strategic advantage. In
contrast, none of the respondents indicated that their ICT investments are made to avoid losing
strategic advantage.

The following question asked if the organisations measure the Return-on-Investment (ROI) for
their ICT expenditures. 45% of the respondents mentioned that they measure ROI, however
only a limited number (15%) undertake this regularly, while 30% calculate ROI when needed.
On the other hand, 30% expressed that they do not calculate ROI as they do not have a reliable
method for ROI calculation for ICT investments in construction. A quarter of the respondents
(25%) do not perceive ROI as an important indicator for determining their ICT investment
policy, thus they do not calculate it.

The next question in this group explored the organisations’ focus on investments on software
and information systems development. In response, 5% of the interviewees indicated that their
focus is on developing in-house software and IS, and in contrast 35% mentioned that they only
outsource software development. More than half of the interviewees (55%) stated that their
organisation implement a mix-and-match approach where some parts of their IS is developed in-house, while the development of some components is outsourced.

The following two questions investigated the organisations’ perspective on ICT related research and development (R&D) investments. The first question was with regard to the organisations’ focus on R&D activities. 47% of the interviewees mentioned that their organisation has never thought of investing on R&D. On the other hand, 48% stated that they have considered investing on R&D efforts, but only 37% actually recognise R&D as a part of their organisational vision. A small percentage of the organisations (5%) have joined an R&D effort initiated by an ICT organisation. The next question queried the organisations’ willingness to participate in a national or European research project. 61% of the respondents indicated that their organisation may be interested in getting involved in a research project related to ICT. On the other hand, 39% mentioned that their organisation have no interest in joining such projects.

The next set of questions focused on whether organisations invest on ICT training along with the reasoning for investing on training activities. In response to the first question, 80% of the organisations stated that they invest on ICT training, while 20% make no investment at all. However, interviewees mentioned that even when a separate budget is not dedicated to ICT training (i.e. as 20% mentioned that they do not invest on ICT training); this does not necessarily mean that training is not provided for their employees.

The second question explored the reasoning behind the investment on ICT training. 36% indicated that ICT training is necessary to facilitate the business processes, while 25% mentioned ICT training has a strategic importance to win work. On the other hand, 19% indicated that their organisation is investing on ICT training in order to have better human resources (HR), and 19% stated that their organisation is providing ICT training as ICT is a necessity in accomplishing several tasks in their business processes.

**Role of ICT in Recruitment**

The following question investigated the role of ICT knowledge in employing white-collar staff for the organisation. 61% of the respondents indicated that a high level of ICT knowledge plays an important role for getting better employment opportunities. 34% mentioned that their organisation only require a certain level of ICT knowledge, which will be necessary to complete their tasks. On the other hand, 5% mentioned no importance is given to level of ICT knowledge while employing white-collar staff.

**Structure of ICT Departments**

The following two questions focused on the ICT department of the organisation. In response, 86% of the respondents indicated that their organisation has an ICT department, while 14% pointed out that their organisation does not have a department dedicated to ICT. The survey results showed that 56% of the ICT department consists of only support staff, and of the remaining 44%, the staff is responsible for strategy development, systems implementation along with providing support for solving ICT (hardware/software) related problems.
Barriers and Critical Success Factors to the Successful Implementation of ICT

The next question investigated the possible barriers to successfully managing ICT in the organisation. In this question the interviewees were given a set of ‘possible’ barriers to which they were requested to answer whether the given issue has been a barrier for the organisation. The results are summarised in Table 1. Problems related to network and communication infrastructure, inefficient use of software and processes that are not defined successfully are indicated as the biggest barriers to preventing the efficient implementation and management of ICT in the organisation. On the other hand, the organisations state that their senior management does not underestimate the role of ICT for their processes and also indicate that no problems are due to the lack of an ICT strategy. The majority of interviewees also pointed out that as their ICT strategy is driven by their business needs, the lack of business driven ICT strategy has therefore not been a barrier.

The following question explored the critical success factors in order to implement and manage an information system (IS) within the organisation. First, the interviewees were given a set of factors which might be critical and were requested to select whether the given factor is either, not important, moderately important or critical for the successful implementation and management of IS. The results are given in Table 2. Continuous training on ICT (55%) and support from software vendors (55%) were found as the most critical factors for successful IS implementation. On the other hand, 47% of the respondents mentioned that experience gained from previous IS implementations in the organisation plays an important role on the success of future IS implementations. Another issue that 37% of the organisations found as critical was the re-design of current processes. The interviewees pointed out that their organisations faced several difficulties due to ill-defined processes. Finally, investment on new technologies has been found as an important issue by the majority of the respondents, but only 25% found technology-focused investment critical for the success of an IS, as many organisations thought that their IS should be designed towards their business objectives.
### Table 1: Barriers to the successful implementation of ICT

<table>
<thead>
<tr>
<th>Problem</th>
<th>Has not been a barrier for successful ICT implementation</th>
<th>Has been a barrier for successful ICT implementation but does/did not have a direct effect on our business processes</th>
<th>Has been a barrier for successful ICT implementation and has/had a direct negative effect on business processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problems in the physical network and communication infrastructure</td>
<td>20%</td>
<td>35%</td>
<td>45%</td>
</tr>
<tr>
<td>Problems related to hardware</td>
<td>40%</td>
<td>25%</td>
<td>35%</td>
</tr>
<tr>
<td>Problems related to data storage</td>
<td>50%</td>
<td>20%</td>
<td>30%</td>
</tr>
<tr>
<td>Problems related to data exchange</td>
<td>60%</td>
<td>30%</td>
<td>10%</td>
</tr>
<tr>
<td>Inabilities of the software</td>
<td>37%</td>
<td>37%</td>
<td>26%</td>
</tr>
<tr>
<td>Inefficient use of software</td>
<td>21%</td>
<td>37%</td>
<td>42%</td>
</tr>
<tr>
<td>Not well defined processes</td>
<td>47%</td>
<td>16%</td>
<td>37%</td>
</tr>
<tr>
<td>The lack of ICT strategy</td>
<td>83%</td>
<td>6%</td>
<td>11%</td>
</tr>
<tr>
<td>Lack of Business driven ICT strategy</td>
<td>88%</td>
<td>6%</td>
<td>6%</td>
</tr>
<tr>
<td>The view of management that underestimates the role of ICT</td>
<td>85%</td>
<td>5%</td>
<td>10%</td>
</tr>
<tr>
<td>The staff with insufficient ICT skills</td>
<td>50%</td>
<td>30%</td>
<td>20%</td>
</tr>
</tbody>
</table>

### Table 2: CSF for the successful implementation and management of IS

<table>
<thead>
<tr>
<th>CSF</th>
<th>Not important</th>
<th>Moderately important</th>
<th>Critical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous ICT training</td>
<td>5%</td>
<td>40%</td>
<td>55%</td>
</tr>
<tr>
<td>Investment on new ICT</td>
<td>0%</td>
<td>75%</td>
<td>25%</td>
</tr>
<tr>
<td>Support from software vendors</td>
<td>5%</td>
<td>40%</td>
<td>55%</td>
</tr>
<tr>
<td>Benchmarking with competitors</td>
<td>55%</td>
<td>30%</td>
<td>15%</td>
</tr>
<tr>
<td>Re-design of current processes</td>
<td>16%</td>
<td>47%</td>
<td>37%</td>
</tr>
<tr>
<td>The feedback from previous IS implementations that failed or successfully implemented</td>
<td>10%</td>
<td>45%</td>
<td>45%</td>
</tr>
</tbody>
</table>
Role of ICT through the Construction Lifecycle

The final question investigated the role of ICT for organisations in different phases and for different aspects of the construction lifecycle. In the beginning the interviewees were given a set of lifecycle phases and processes and requested to identify the role of ICT in terms of ‘not needed, supporting or critical’ for the given lifecycle phases/processes. The results are given in Table 3. The majority of the respondents indicated that ICT has a supporting role for all lifecycle phases. On the other hand, 38% interviewees mentioned that ICT is vital during the feasibility phase (for feasibility studies and sketch design), 44% pointed out that ICT is vital for architectural design and structural analysis, and 31% mentioned that ICT is vital for supply chain coordination and management. In most of the lifecycle phases, only a minority of the respondents (6%) stated that they do not use ICT in support of their business processes, i.e. most of the major LSEs in Turkey do not underestimate the role of ICT in managing AEC projects.

Table 3: Role of ICT through the construction lifecycle

<table>
<thead>
<tr>
<th></th>
<th>ICT is not needed/ not used within the organisation</th>
<th>Currently ICT are supporting the process</th>
<th>ICT are vital for process (task) to function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feasibility Studies</td>
<td>6%</td>
<td>56%</td>
<td>38%</td>
</tr>
<tr>
<td>Sketch Design</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Architectural Design</td>
<td>6%</td>
<td>50%</td>
<td>44%</td>
</tr>
<tr>
<td>and Structural Analysis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bidding</td>
<td>6%</td>
<td>67%</td>
<td>27%</td>
</tr>
<tr>
<td>To manage activities</td>
<td>0%</td>
<td>78%</td>
<td>22%</td>
</tr>
<tr>
<td>in Construction Site</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply Chain Management /</td>
<td>6%</td>
<td>63%</td>
<td>31%</td>
</tr>
<tr>
<td>Procurement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time/Cost Management</td>
<td>0%</td>
<td>68%</td>
<td>32%</td>
</tr>
<tr>
<td>Quality Management</td>
<td>0%</td>
<td>89%</td>
<td>11%</td>
</tr>
<tr>
<td>Facilities Management</td>
<td>13%</td>
<td>74%</td>
<td>13%</td>
</tr>
</tbody>
</table>

4. Analysis and Discussion

The results of the first two questions demonstrated that ICT is seen as a value adding resource as a part of an overall business strategy, for gaining competitive advantage and for winning work. For example, around 1/3 of the organisations viewed ICT as a critical resource for their competitive strategy and similarly 38% mentioned that ICT strategy is a critical element of their overall business strategy. In contrast, 40% viewed ICT as non-critical in winning work. These results suggest that the strategic role of ICT is not completely underestimated among the organisations. The fact that the role of ICT in winning work is not found critical is due to
customers not usually requesting a well established ICT infrastructure as one of the main requirements in the bidding process.

Most of the organisations that participated in the interviews mentioned that they do not have a properly documented ICT strategy, while the organisations that have a documented ICT strategy developed this in the requirement for standardisation reasons (i.e. ISO 9001). The findings indicate that the organisational culture in terms of ICT has not reached a level of maturity where ICT activities are planned and managed with a properly documented strategy. The majority of the organisations have chosen to follow technological developments/advancements in order to make decisions for further investments on ICT. This approach can be seen as a technology-oriented/driven approach for forming a strategy. However, the organisations are not aware of the bigger (industry) picture while formulating their strategy, as most of them are not driven by their competitors’ actions and investments. The survey results highlight that business needs/objectives play an important role in forming ICT strategies. However, the organisations also follow an approach towards implementing the latest technologies possible to accomplish their business objectives.

The results indicate that in most of the organisations there is a well balance (of contribution) between ICT department and other departments of the organisation in forming the organisational ICT strategy. This well balanced contribution is necessary for the development of a successful strategy, and the results indicated that the organisational culture is mature enough in this manner.

The majority of the organisations invest in ICT either to reduce costs or add value to the current form of processes, i.e. ICT investments are not made for strategic reasons (gaining competitive advantage) but are made for supporting the processes. As previously explained, the findings indicated that the organisations do not completely underestimate the strategic role of ICT, but this has not been reflected in the organisational investments. This result raises the question if organisations recognise the strategic importance of ICT investments then why are they not investing in this manner?

The findings of the interviews showed that although not practiced as a regular activity, calculating ROI for ICT expenditures is quite evident (45%), which is an indicator that ICT investments is recognised as of critical importance in terms of the business.

The majority of organisations (90%) outsource IS development, but 55% also carry out in-house development to mainly align IS into their business needs. The organisational view in regard to this issue is towards developing and implementing systems on an ‘as-needed’ basis, and issues such as major changes in processes are not considered.

While half of the organisations have never considered investing in ICT related R&D, the findings of the survey indicate the willingness of 61% of organisations to participate in such activities. This raises the question of how many of these organisations would actually become
involved in a research and technology development project/initiative without the recognition of a major industry-wide necessity.

In parallel with the results of a previous survey [1], training on ICT appeared as an important aspect of the overall organisational strategy. The reasoning behind ICT training was various but the main focus was towards facilitating business processes through the better use of technology.

Most of the organisations have an ICT department. However, the ICT departments are mostly composed of support staff rather than of staff responsible for strategy development and systems implementation. In contrast to the willingness of middle level management to join R&D projects, this result indicates that senior management still views ICT as a supporting resource.

The greatest barriers related to successfully implementing and managing ICT were identified as infrastructure problems and inefficient use of software. The infrastructure problems indicated are mainly related to telecommunications, e.g. low bandwidth in communications and internet access, while the inefficient use of software is mainly due to the lack of support from software vendors in Turkey. On the other hand, the importance given to ICT training and support from software vendors appeared as the most critical factors for successfully implementing ICT. The interviewees thought that ICT training acts as a road from failure to success, in parallel they also believe that without the support from software vendors a successful ICT implementation cannot be accomplished. In fact, the authors disagree with this industrial point of view, and believe that the success in ICT implementations should never heavily depend on external factors. In response to final question, the majority of interviewees mentioned the role of ICT as ‘supportive’ in different phases of the construction lifecycle; this indicates that (similar to the role of ICT from organisational point of view) ICT is also not seen as a strategic resource (by the majority of respondents) from the construction lifecycle management perspective.

5. Conclusion

There is a shift towards the recognition of the strategic importance of ICT in terms of value adding in winning work and achieving strategic competitive advantage, as opposed to simply supporting and facilitating business processes. However, although there is recognition of the strategic importance of ICT, the focus of investments in ICT is very much towards business process improvement rather than achieving strategic competitive advantage. This poses further research into exploring this gap between the ‘strategic thinking’ and the actual ‘process-focused practice’. Furthermore, the development of a well formulated and documented ICT strategy is not common practice. In such cases, the strategy is driven by business needs by focusing on technological advancements/developments, while the investments of competitors are of no concern, i.e. pointing towards an internally focused nature to investment. Organisational ICT strategy is being developed by a core/central ICT group/department, which in the main is still driven by operational business processes. However, there is evidence that some ICT departments are influencing the ICT strategic direction of their organisation.
Although not a regular activity, measuring the return on ICT investment is quite evident and further demonstrates the valuing of the critical importance of ICT investment to the business. In addition, it is the issue of the lack of a reliable method that is preventing many organisations from measuring the return/impact of their investments rather than any undervaluing of their investments. While on the other hand, measuring the return on ICT investments is still perceived by some as having no importance on their ICT strategic planning.

ICT-related R&D is still not perceived an important strategic activity by the construction industry and therefore receives very little attention and investment. Although interestingly, there is significant interest in possibly becoming involved in ICT construction related research. This raises a further question at what level of involvement would encourage their engagement?

ICT training is evidently important in terms of investment, which in the main is towards delivering the ICT strategy, i.e. business process improvement facilitated by technology. However, where the strategic importance of ICT on the business is not recognised/undervalued, the activity of training and the associated budget is not encompassed as part of the overall investment in ICT.

In terms of the successful implementation and management of ICT, the main barriers identified are predominantly technological and process related rather than associated to people and strategy. In terms of the critical success factors, these are very much aligned with the barriers in that continuous training policy, learning from previous implementation efforts, and the re-design-engineering of currently ill-defined processes were identified. Interestingly, benchmarking against other competitor organisations was not identified as important, which further substantiates the internally focused nature of organisations in their ICT strategy and investments.

Finally, overall ICT is having a supporting role throughout the lifecycle of a facility/project. However, ICT is perceived vital particularly during the design phases along with the management of time/cost and the supply chain. The role of ICT is in the main valued in the management of AEC projects in Turkey.

References


## Appendix 1

**List of Interviewees**

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Contact Person</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Guris Insaat</strong></td>
<td>Handan YUCEL</td>
<td>IT Manager</td>
</tr>
<tr>
<td><strong>KC Group Yapı</strong></td>
<td>Bedir AKSAN</td>
<td>IT Manager</td>
</tr>
<tr>
<td><strong>Tepe Insaat</strong></td>
<td>Ferhat BOLUKBAS</td>
<td>IT Manager</td>
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<tr>
<td><strong>Nurol Holding</strong></td>
<td>Emine ONGUN</td>
<td>IT Manager</td>
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<tr>
<td><strong>Metis Insaat</strong></td>
<td>Secimer TEZ</td>
<td>MIS Manager</td>
</tr>
<tr>
<td><strong>MNG Holding</strong></td>
<td>Murat KASABOGLU</td>
<td>IT Manager</td>
</tr>
<tr>
<td><strong>Akfen Holding</strong></td>
<td>Sinan OZKAN</td>
<td>IT Manager</td>
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<tr>
<td><strong>Mesa Mesken Sanayi</strong></td>
<td>Semra CANKIRILI</td>
<td>IT Manager</td>
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<tr>
<td><strong>Gama Holding</strong></td>
<td>Mehmet BESEN</td>
<td>IT Manager</td>
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<tr>
<td><strong>Akturk Yapı Endüstrisi</strong></td>
<td>Timucin DIKMEN</td>
<td>IT Supervisor</td>
</tr>
<tr>
<td><strong>Koray Yapı Endüstrisi</strong></td>
<td>Dr. Vehbi TOSUN</td>
<td>IT Manager</td>
</tr>
<tr>
<td><strong>Tekfen Insaat</strong></td>
<td>Cem AKTAS</td>
<td>IT Manager</td>
</tr>
<tr>
<td><strong>Eston Yapı</strong></td>
<td>Kutay SEYYALIOGLU</td>
<td>Planning Engineer</td>
</tr>
<tr>
<td><strong>Sinpas Yapı Endüstrisi</strong></td>
<td>Taner AKKAS</td>
<td>ERP Specialist</td>
</tr>
<tr>
<td><strong>Alarko Taahhut Grubu</strong></td>
<td>Osman ISHAKOGLU</td>
<td>Planning Manager</td>
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<tr>
<td><strong>STFA Insaat Grubu</strong></td>
<td>Ali AVCAR</td>
<td>System Administrator</td>
</tr>
<tr>
<td><strong>Soyak Holding</strong></td>
<td>Murat TANATAR</td>
<td>IT Coordinator</td>
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<tr>
<td><strong>Yuksel Proje</strong></td>
<td>Sükrü BAYKAN</td>
<td>IT Manager</td>
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<tr>
<td><strong>Limak Holding</strong></td>
<td>Ersun GULBAS</td>
<td>IT Manager</td>
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<tr>
<td><strong>Dolsar Muhendislik</strong></td>
<td>Ali Onur KUYUCAK</td>
<td>Head of IT Division</td>
</tr>
<tr>
<td><strong>Borova Yapı Endüstrisi</strong></td>
<td>Murat YAMAN</td>
<td>IT Manager</td>
</tr>
</tbody>
</table>