The role of network the impact of information technology assignment

Business, Management

“ The built environment can be seen as a synthesis of social, environmental and economic issues, reflecting immediate and long-term problems and opportunities.

Since the design, construction and maintenance of buildings and infrastructure are essential for economic development and sustainable growth as well as for the quality of life of citizens, the answers to many of the challenges facing Europe depend on the construction sector” (ECTP, 2005). 1. 1 Problem description Construction companies are nowadays facing market and business conditions that are changing at a rapid pace. The situation is forcing them to deal with requirements that were unusual a few years ago.

Indeed it is widely recognized that business and social trends are driving the construction industry through a period of a radical change (Betts, 1999). These trends are, among others, the growing intensity of competition, which has resulted in a continuous reduction in the profit margin for each project and for global sales; the participation of an increasing number of foreign companies attracted by stable markets with high growth potential; the increasing requirements of clients, especially concerning quality and time; new materials; and the greater complexity and technological demands of current construction projects (Stewart, 2002).

Innovation and technology development, in particular information technology (IT), provide opportunities with which construction companies could face present and future needs and challenges. Technology development is faster each day and new IT applications are regularly offered for potential

implementation in construction companies (Stewart, 2002). When comparing construction companies with companies from other industries (e. g. banking, automobile, insurance, manufacturing, etc.) they are traditionally slower to adopt innovative IT solutions.

One could discover many reasons why they are lagging behind; however one of the reasons is particularly important, i. e. lack of experience in IT management. Unfortunately management of IT is not the only knowledge gap that construction companies have to struggle with. According to Cheah (2002), majority of researchers focus on project and construction site management issues rather than strategic management at the business and corporate level. This is somehow irrational, given the size and importance of the construction sector.

We live in a time when everybody wants to have her/his own strategy. To be without strategy is like wandering in the darkness and being incapable to do things right. And it is not important weather it is a corporate strategy, a strategy of individual business area or a department strategy (e. g. IT strategy) as long as there is one. It is difficult to exactly and precisely define meaning of 1 the term strategy (Pucko, 1999). In spite of different understanding and definitions, one could perceive a common idea, i. . how to manage given resources and conditions to achieve competitive advantage over a rival. The process of strategy development is an “ art” which should include all the available information, techniques and analytic research methods. When company is developing IT strategy it should keep in mind following questions: Does top management have a vision of IT? Is top

management aware of global trends in IT? Are opportunities that IT can bring being considered in the process of business strategy development?

Is there a common understanding of the business needs and processes that IT is intended to satisfy? Is there a person in charge of aligning IT strategy and business strategy? Only if company knows answers on these questions there is a chance of successful development and realization of IT strategy. Otherwise the company is sentenced to high investments with low or no tangible returns, unsatisfied employees and even higher reluctance to IT. 1. 2 Purpose and objectives of master thesis The purpose of this work is to disseminate and to link knowledge from three fields, i. e. onstruction sector, strategic management and IT, and to provide understanding of how important for construction companies is to acquire and use knowledge on strategic management when trying to materialized the opportunities that IT is offering. Thus strengthen the belief that the strategy is fundamental for success of a company. Another purpose of this master thesis is to help construction companies by presenting real life cases. Two construction companies were chosen and analyzed individually and with a cross-case analysis. Both companies are national market leaders in construction, one in Slovenia and another in Portugal.

Research had an emphasis on management of IT and the role that IT has on business strategy development process. Expected objectives of this research are: • • • To recapitulate the essential parts of literature review about strategic management, IT and construction sector. To provide a better understanding of the nature of IT within construction companies. To promote

understanding of the importance of IT management and its potential to enlarge the technical and project management knowledge already embedded in construction. Comparison of two national market leaders in construction sector. • • Conceptual recommendation for two studied companies. 1. 3 Research questions To increase understanding of the impact that IT has on development of business strategy in construction companies, this research will address the following questions: • • • • • • • What is the role that IT has in construction companies? How IT influences development of business strategy in SCT? How IT influences development of business strategy in Mota-Engil? How IT strategy is developed? What are the benefits and barriers of IT in construction company? How IT benefits are measured?

Why construction companies lag behind companies from other sectors in IT adoption? 1. 4 Methodology The selection of a research strategy is dependent on: the types of research questions asked, control of the behavior environment and contemporary events. Based mainly on research questions " what" and " how", this research is categorized as an exploratory and descriptive approach. The strategy for this research is based on two individual case studies and a cross-case analysis, that help to build an understanding of the impact that IT has on business strategy development in construction companies.

Figure 1 illustrates the steps which were conducted in this research. First phase is a design phase and includes: literature review, selection of cases and design of data collection protocol. To gain more in-depth knowledge about the strategic management (business strategy and IT strategy),

construction sector (EU, Slovenia and Portugal) and IT; review of relevant literature was conducted and logically summarized. Another purpose of literature review was development of sharper and more insightful research questions. For more detailed research two construction companies were selected.

First, market leader in Slovenian construction sector – SCT and second, market leader in Portuguese construction sector – Mota-Engil. Data for each of these two companies were gathered from multiple sources (financial annual reports, articles, web pages and in-depth interviews with relevant employees). 3 Figure 1: Case study research methodology DESIGN SINGLE-CASE DATA COLLECTION AND ANALYSIS CROSS-CASE ANALYSIS Select Cases Develop Theory – strategy – const. sector – IT – SCT – Mota-Engil Conduct 1st Case Study: SCT – fin. reports – articles – web pages – interviews Write Individual Case Report: SCT

Draw Cross-Case Conclusions Modify Theory Design Data Collection Protocol Conduct 2 Case Study: Mota-Engil – fin. reports – articles – web pages – interviews nd Write Individual Case Report: Mota-Engil Develop Policy Implications Write Cross-Case Report Source: Yin, 2003, p. 56 Second phase is labeled as single-case data collection and analysis. In this phase the research is focused on each case individual. In the first part thorough research is conducted and later individual case reports are written. As mentioned above, data for both studied companies were collected from different sources.

The most insightful information was gathered form in-depth interviews with top and middle managers of both companies. For these interviews two questioners were composed, the first was covering strategic part and the second IT part1. Third phase is a cross-case analysis. In this phase individual cases are being compared to identify differences and similarities among them. On the bases of these differences and similarities theory can be modified and new policies can be developed. However the purpose of this work was not to modify theory but rather to increase awareness of the importance and to provide better understanding of studied topics.

At the end of the research a cross-case report is written. 1 Questioners used for in-depth interviews can be found in Appendix A. 4 1. 5 Master thesis' structure The structure of this thesis is consistent with determined objectives and research methodology and it is divided into 6 chapters. Chapter 1 introduces an overall view of this study. It addresses the research background, the problem, the purpose and objectives of the work. Further this chapter presents what are the research questions, what kind of methodology will be used and finally the thesis framework.

Chapter 2 provides a theoretical background on the topics studied. It presents a literature review of IT and strategic management, in particular business strategy, IT strategy and alignment of business and IT strategy. Next, the overview of construction sector in EU, Slovenia and Portugal is made. The chapter ends with description of the role that IT has in construction companies. Chapter 3 starts with a description of a case study

research methodology. Further two individual cases of construction companies are presented; SCT from Slovenia and Mota-Engil from Portugal.

Both case studies have predefined structure: company’s history, brief overview, international presence and role of IT. Chapter 4 presents a cross-case analysis. Case studies from chapter 3 are being compared and analyzed simultaneously. The chapter describes general similarities and differences between two studied companies. It concludes with providing the main findings of the cross-case analysis research. Chapter 5 provides conceptual recommendations for both studied construction companies according to relevant issues and gathered information. Next, the research limitations are described.

It is important for reader to be aware of the research limitations. And finally the conclusion of the master thesis is done. Chapter 6 is the last chapter of the thesis. It presents all the sources of information that were used for creating this work. These sources are: scientific literature, interviews of relevant people from studied companies, annual reports, and internet sources. 5 2 CONCEPT REVIEW: THEORIES AND PRACTICES The aim of this chapter is to provide a general overview of the key concepts based on the literature review. The chapter begins with description of information age and IT.

It then provides a background on business strategy, IT strategy and their alignment. Next it presents an overview of construction sector in European Union, Slovenia and Portugal. The chapter ends by illustrating the role of IT

in construction sector (history, benefits, barriers and vision). 2. 1 Information age The single most important factor in shaping modern society is the cruel acceleration of the technological clock, a clock that boosts the rate of change in modern society to greater heights each day (Lewis, 1995). Projects that once took a decade now take a month; tasks that used to take a day now take merely seconds.

People no longer live by the biological clock but rather by the constant flow of the information, services, and products that wrap the world in a 24-hour business day. Since the beginning of the mankind people went through different evolution phases. Civilization evolved through five, generally recognized overlapping stages characterized by their main human activity: hunter – gatherer, agrarian, industrial, post-industrial and informational. The industrial and post-industrial ages are often merged together into a single machine age; on the contrary Lewis (1995) argues that there are two distinct ages.

The current age is the so-called information age. Under conventional economic theory, the information age is also called the era where information is a scarce resource and its capture and distribution generated competitive advantage. According to Lewis (1995), information age which has started approximately in the beginning of 1990’s, will last perhaps no more than two decades, and will be the last of the major ages. One of the major characteristics of living in the information age is constant, heartless, maximum change.

Alternatively it can be said that information age had its origin in the second half of the 19th century with invention of telephone and telegraph. However for the purpose of this work the term information age will be used more narrowly applying to the 1980s onwards. One of the things that could be observed throughout all ages is also shift in management paradigms as shown in Figure 2. During the agricultural age and backwards, especially during the Middle Ages when the system of primogeniture prevailed, institutional power was distributed primarily by lineage and gender.

The eldest sons inherited the father’s wealth and position. Accordingly the fundamental assumption of this era seems to have been “ father knows best”. 6 This agricultural society was characterized by a relatively orderly society, there was limited information available, limited means of transportation, relatively homogeneous groups of followers, limited professional opportunities, limited education, relatively modest technological innovation, male domination, limited resources and modest but stable population growth. Figure 2: Paradigm shifts in management Primogenitura Aristocracy

History through 18th century Max Weber Bureaucracy 19th and 20th centuries Bennis Process Information age A Power is distributed by gender and lineage. Assumption is father knows best. TIME B Power is distributed by gender and office. Assumption is boss knows best. P Power is redistributed by key process contributors (KPCs). Assumption is KPCs know best. Source: Clawson, 1996, p. 7 With the industrial revolution, which started in the late

eighteenth century (including the discovery of oil, the invention of the steam engine and mass production techniques), the situation changed dramatically.

In the Figure 2 it can be seen that there was a transition period between each major paradigm (presented by a diagonal line), i. e. time for the old principles to vanish and the new ones to take a cultural root. It can be tracked down, for example, vestiges of the agrarian paradigm even today almost 200 years from the beginning of its decease. In the industrial age the power was still distributed among males, however no longer so much by lineage. According to Weber’s definition back in 1910, the new bureaucratic paradigm was a system in which law superseded the judgment of the feudal father (Weber, 1947).

Therefore the fundamental assumption of this era seemed to be “ the boss knows best”. This presented a major shift in the industrializing societies of the time. Finally, most people generally came to accept the principle that the office and not people possesses authority (consequently the term “ bureaucracy”). Furthermore the obedience and loyalties were given to the offices and not to individuals. In that era work was divided rationally and employees were expected to adjust to their work assignments, and not the other way around. It can be argued that workers were seen almost as if they were parts of machines, thus easily replaceable.

On the other hand managers were theoretically not supposed to be owners, and the authority structure was written down. In that time the prevailing leadership principles were planning, organizing, motivating and controlling. 7

Besides the paradigm shift in management during industrial era there were also two other important issues that should be mentioned. Technological innovation and worldwide population went sky-high. As can be seen from the chart in Figure 3, the rate of growth (change in the slope after the industrial revolution) in the population changed dramatically during this era.

By the mid twentieth century, however, critics of the industrial paradigm appeared. They began to observe the defects and indicate them. Bennis, for example wrote about the coming death of bureaucracy (Bennis, 1996) and Shapiro wrote how corporate truths became competitive traps (Shapiro, 1991). In that time corporate leaders began to realize that they do not have, and more important they could not have all the answers needed to guide their giant corporations. For that reason they began to put in place new mechanisms based on a new truth, i. e. hat the key contributors to the key processes of their organizations knew better than they did what needed to be done. Figure 3: Worldwide population growth Source: Clawson, 1996, p. 8 Worldwide economic structure in the second half of the twentieth century had contributed to their recognition through many features. Some of the features are: rapid technological change, social growth due to the extensive and prompt information flow around the globe, rapid and cheap mass transportation and mass education. Apparently the conditions were made for creation of increasingly diverse societies and intensive competition from unexpected directions.

With appearance of the information-based era organization leaders had to reshape their organizations if they wanted to stay competitive. New, flatter,

networked, team-based organizational forms 8 were prosperous. Competition demanded shorter time cycles for product development and timeto-market deployments, dramatic changes in management/labor relations, and a wider distribution of power in organization. There was a huge shift from manufacturing to a servicebased economy and empowerment of workforce. Due to an important role that IT has played in causing its birth, the most widely accepted term for this era is the information age.

Nevertheless, given the corporate reactions, it could also be called the process age. By using the new volumes of information many corporations re-examined their basic processes and have made fundamental changes in the way they decide what is to be done and how it should be done. “ The new paradigm demands a different kind of leadership” (Clawson, 1996, p. 8). As it is presented in Table 1, old industrial age (i. e. bureaucratic way) can be contrasted with new information age (i. e. process way) regarding the management process.

Table 1: Industrial age versus information age bureaucratic way planning focus on the structure focus on the title controlling enacting excluding focus on organization meeting set goals hierarchy oriented results oriented Source: Clawson, 1996, p. 8 process way scanning focus on the work focus on skills empowering harmonizing including focus on customers continuous improvement team oriented relationship and results oriented 2. 1. 1 Data, information and knowledge The word information is nowadays often used to much loosely. It can cover a basic data, information or knowledge; but it has more narrow meaning.

Therefore it is necessary to distinguish between these three terms: • • • Data is (or are) collections of facts, measurements or statistics. Information is organized or processed data that is timely and accurate. Knowledge is information that is contextual, relevant and actionable. 9 Data is what a company usually has too much of and, although necessary for management or for operating any computer systems, it needs to be carefully selected for its timeliness and accuracy, to become information. Knowledge brings to a company the most value, but unfortunately it is in shortest supply.

It contains strong experiential and reflective elements that distinguish it from information (Sun and Howard, 2004). 2. 1. 2 Information technology Nowadays information is becoming a key resource within any business activity. IT and information systems are being applied by researchers, software developers and practitioners to automate selected phases of the business process. Therefore also in the construction sector the use of IT is becoming increasingly sophisticated with the virtual reality, knowledge-based systems, object-oriented approaches and neural networks among the latest technological advances.

But on the other hand the thought given to the business and management implications of the technology are less advanced. Even more, there appears to be some reluctance to recognize that IT can enlarge strategic opportunities for IT use across the whole construction sector and not merely within individual parts of the process (Love et al. , 2001). Due to the relatively limited detailed research that has been carried out in the field it is

difficult to clearly define the scope and boundaries of the use and performance of IT in construction (Bjork, 1999).

For some, IT in construction represents the use of all electronic means of information transfer – computer networks, local area networks LANs, Internet, mobile phones, faxes, etc. For others IT stands for the use of the latest technology, such as knowledge-based systems, computer-based decision support systems and object-oriented CAD. Moreover IT can also be seen as part of the management strategies and the concepts of concurrent engineering, just-in-time production and process re-engineering. Due to a very wide area influenced by IT a number of different definitions emerged.

Similarly as Steward in his dissertation, this thesis adopts an information-centric definition, which contains the use of electronic machines and programs for the processing, storage, transfer and presentation of information. According to the definition IT plays the key role in improving the efficiency of communication and information exchange in the context of managing a construction company (Steward, 2002). 2. 1. 3 Chief information officer The chief information officer (CIO) is a job title for a person who is in charge of IT department within an organization.

This is a person who is leading the relationship between IT and the rest of the business units. The role of CIO over the years has changed dramatically. The changes are 10 similar to the changes that IT function went through. According to Smaczny (2001; Hansell, 2000) the role of CIO went through three main phases which are presented in Table 2. Table 2: Role of CIO

Period Role Mainframe era until the end of 1980s The role of a functional head responsible for operational management Distributed era 1990s The role of a strategic partner responsible for expectation management, technology advises and informed buying of hardware and software.

To align IT with business. Web-based era Now The role of a business visionary responsible for business innovation and utilization of opportunities created by the technology To drive strategy. Key objective To deliver on promise. Source: Adopted by Smaczny, 2001. If going a step further one could suggest that the CIO should work closely with the chief executive officer (CEO) to continuously develop business strategies. Therefore the role of organization strategist, in general associated with CEOs, is now shared between CEOs and CIOs. Moreover, the CIO becomes the head of strategy.

The question is how many CEOs are ready for such a paradigm shift (Smaczny, 2001). 2. 2 Business strategy and IT strategy Throughout the history the term strategy reflected strong military roots. Army leaders used strategy in dealing with their opponents. Numerous military theorists (Sun Tzu, Alexander, Clausewitz, Napoleon, Stonewall Jackson, Douglas MacArthur, etc.) have written about strategy from many different perspectives (Pitt, 2000). More recently the word is used in a different way; nevertheless the basic idea is still the same – how to manage given resources and conditions to achieve competitive advantage over a rival.

Henderson (1989) described strategy as a deliberate search for a plan of action that will develop business’s competitive advantage and compound it.

Another great economist Porter (1979, p. 11) argues that “ the essence of strategy formulation is coping with competition”. On the contrary Ohmae (1988) did not put the competition in the first place when making a strategy. He agrees that it should be taken into account, but should not come on the first place. In his opinion the most important thing is careful attention to the needs of customers.

Before company test itself against competition, strategy should take shape in the determination to create value for customers. 11 One can with certainty affirm that strategy is hard. Its intellectual foundations are made from pieces of various primary disciplines including finance and economics, organizational sociology, political science, and cognitive psychology, all of which are continuously evolving at their own pace (Cheah, 2002; Rumelt et al. , 1994). In addition, the involved people in strategy (formulation, analysis, definition, assessment, etc. are diverse, ranging from academicians to managers and consultants acting in different industries and sectors. Apparently, this mixture of different disciplines and players ensures that consensus about “ strategy definition” is almost impossible to be made. Although there have been many studies and researches done on the field of strategic management, yet no author could identify one best strategy that would fit to all companies and would achieve equal success. Even more, there is also no single recipe to make a good strategy. According to Goold and Campbell (1987) “ there is no one best way to do that.

Rather, the best way always depends on the nature and needs of the businesses in the company’s portfolio, on the styles of the people in the

corporate office, on the company’s strategy and goals”. The core of strategic management is strategic planning, i. e. the process of: setting missions, goals and objectives; clarifying policies and principles; and searching for opportunities and threats while preparing to exploit the first and avoiding the second. This process differs from one firm to another. It can be formal or informal, regular or not, depending on the business environment and the organization’s strategic aims (Price, 2003).

Edum-Fotwe (1995) asserts that, although the construction industry operates within a highly turbulent and competitive environment, few construction companies had adopted formal processes of formulation of long-term strategies. In contrast just three years later Junnonen (1998) examined strategy formation in construction firms and concluded that strategic thinking had become increasingly important to construction organizations as a result of the industry’s dramatically changing business environment. 2. 2. 1 Business strategy

The main reason why company would develop a competitive business strategy is to achieve a competitive advantage over its competitors. The essence of competitive business strategy for organization is achieving a favorable match between firm’s distinctive competence and the external environment in which it competes. Therefore it is crucial for firm to focus on different dimensions of its environment while making a business strategy. The most important of these are to discover new opportunities, to divert potential threats, to overcome current weaknesses, to 12 sustain existing strengths, and apply strengths to new fields (see Figure 4).

Every firm has to deal with these strategic environmental factors on a continuous basis (Pitt, 2000). Another thing that should be addressed when talking about the strategy is a distinction between business strategy and corporate strategy. Nowadays many companies, while pursuing a higher return and lower overall corporate risk, diversify their business portfolio, i. e. they are competing in different businesses. Thus, business strategy is referred as the one that ensure successful ventures of individual business unites, whereas corporate strategy concerns the operations of the entire corporation.

Figure 4: Business strategy INTERNAL strength apply, sustain EXTERNAL opportunity discover STRATEGY overcome divert weakness Source: Pitt, 2000, p. 8 threat Porter (1985a) identified three main types of generic strategies that companies can adopt as being: cost leadership, differentiation and focus (see Figure 5). A company’s relative position within an industry is given by its choice of competitive advantage, either cost leadership or differentiation, and its choice of competitive scope. Regarding the competitive scope company can target broad industry segment or focusing on a narrow segment.

Generic strategies are useful because they characterize strategic positions at the simplest and the broadest level. Furthermore Porter argues that achieving competitive advantage requires a company to make a choice about the type and the scope of its competitive advantage. There are different risks inherent in each generic strategy, but if a company tries to do

deliver “ all things to all customers” it is a sure strategy to end up somewhere in the middle and consequently not achieving any advantage.

Traditional approach to procurement in construction sector has been through a tendering process based on minimum cost, with many construction organization adopting cost leadership (low cost) 13 strategies. This has the benefit of producing low initial tender cost for the construction phase, but on the other hand it often also results in a hostile relationships and little attention being given to whole life value to the client (Price, 2003; Latham, 1994; Egan, 1998).

Lately the situation is changing, many clients, particularly those in the public sector, are now procuring construction work based on best value and/or partnering criteria. This has been encouragement to many construction companies to adopt differentiation strategies, such as: design and build, construction management and facilities management (Price, 2003; Hillebrandt and Cannon, 1989). Figure 5: Porter’s generic strategies COMPETITIVE ADVANTAGE Lower Cost Differentiation Broad Target Cost Leadership Differentiation COMPETITIVE SCOPE Narrow Target Focus on Cost Focus on Differentiation

Source: Porter, 1985a, p. 12 2. 2. 2 IT strategy Many authors have explained that IT undergoes a development inside every organization, form a means to improve the efficiency and effectiveness of the organization to a means to influence the strategic position of the company, when applied more intensively. The way how management perceives and controls IT has

changed simultaneously (Klouwenberg, Koot and Van Schaik, 1995). The primary task of IT management is to design and manage the flow of information in an organization in a way that improves productivity and decision making.

Data must be collected, stored, and synthesized in such a manner that it will answer important operating and strategic questions. An organization’s information system can be strength or a weakness in multiple areas of strategic management. Nowadays IT should not merely aid in environmental scanning and in 14 controlling an organization’s activities, it can also be used as a strategic weapon in gaining competitive advantage (Wheelen and Hunger, 2006). Businesses of all types have to review their processes from the viewpoint of emerging technology to maintain their competitiveness.

Business process reengineering is a management technique for doing this. Integration of different software tools is leading to enterprise resource planning systems that can hold most of the information a company needs for managing its processes. What cannot be held in computer networks, e. g. the knowledge possessed by employees, is also the subject for new knowledge management systems that record where the knowledge can be found. Information management has become a serious problem with the growth of expected results that IT should deliver. There are too many solutions of variable quality on the market.

How can a company find what kind of information system it needs and establish its reliability? Techniques such as data warehousing and data

mining are needed to find what is required, and intelligent search engines and agents can help to identify the information someone needs. Most businesses are nowadays dependent upon IT for their survival and the IT systems themselves must be managed and their value to the company properly evaluated (Sun and Howard, 2004). According to Cheah (2002) and his conceptual model for corporate strategy (see Figure 6), IT strategy should be separated from technology strategy.

Specifically, IT strategy should focus mainly on the use of technology to leverage information to a firm’s advantage rather than other types of technology development in general, that should be content of technology strategy. This distinction can be justified by the fact that IT has grown into an important market sector and research area by itself since the middle of 1990s. The basic emphasis of the model is on building stronger appreciation of how IT can provide an impact on corporate strategy and not muddling in the technological aspects per se.

Linkage between IT and corporate strategy can be insightfully presented by Ross and Rockart’s (1999) IT Infrastructure Pyramid model (see Figure 7). The fundamental idea of the model is that upper level components are built upon the lower ones, with corporate strategy being the cornerstone of all the others. Ross and Rockart suggested that IT-related components, i. e. systems, IT infrastructure and IT architecture, should be utilized as an “ enabler” to connect the corporate strategy of the firm with its operational processes. Accidentally, an “ enabler” should not be confused with a “ driver” of corporate strategy. 5 Figure 6: Seven strategic fields of corporate

strategy Business Strategy Financial Strategy Operational Strategy Technology Strategy CORPORATE STRATEGY IT Strategy Human Resource Strategy Source: Cheah, 2002, p. 103 Figure 7: The IT Infrastructure Pyramid Marketing Strategy Process System IT Infractrucrure IT Architecture Corporate Strategy Source: Cheah, 2002, p. 110 Cheah (2002) has identified that the current trend of IT investments and implementations within the construction industry appeared to follow very fuzzy goals.

There are many examples of participants from the industry investing in IT that have forgotten their original identity as companies that provide construction services, thus putting their core competitive advantages at 16 stake. Usually these investments are lacking in terms of establishing linkages between processes and corporate strategy in the long run. However, since the “ crash” of technology stocks in May 2001, those days are over. Rationality, once again, has come back to reign. Another issue that could be tackled regarding IT strategy is outsourcing versus internalization of IT.

The answer depends upon how IT strategy can be managed to link processes with corporate strategy and should be assessed on a case-by-case basis. Since each company’s strategy is and should be unique, it is often difficult to manage the development process in collaboration with external parties. Similarly, although purchasing “ off-the-shelf” platforms and systems available in the market would turn out to be less costly and risky option, these might be found to be too universal in nature if the intention is to utilize IT support long-term competitive advantages (Cheah, 2002).

IT management refers to the way of how organizations plan and implement IT initiatives to achieve their business objectives and results. IT management within organization is critical and consists of three processes that predict the realization of IT benefits (Andresen et al. 2000): • • • strategic IT planning to support business strategy and opportunities; IT adoption and implementation decision-making to facilitate IT transformation within an organization and to ensure ongoing use and adoption of IT; and measurement of an IT investment and its benefits.

Similarly, Steward (2002) asserts, to effectively employ IT in construction, the IT project lifecycle should have elements of three essential phases: IT project selection (benefits, risks and costs), IT implementation and monitoring (applications, deficiencies and reviews), and IT performance evaluation (measurements, corrective actions and lessons learned). Strategic IT planning Strategic IT planning has been recognized as one of the primary areas that influence the success of IT implementation.

There are several terms that have been proposed to guide the development of IT planning such as information systems planning, strategic information system planning (SISP), information systems strategy planning, and business systems planning. These terms can be broadly labeled as strategic IT planning (Ward and Peppard, 2002). One should distinguish between strategic IT planning and strategic IT thinking because planning includes learning from previous experience and data, and then synthesizing these data with innovative ideas to develop new vision and strategy (Mintzberg, 1994).

The main purpose of strategic IT planning is to review an opportunity and accordingly select the investment IT option that enhances a business 17 need. Strategic IT planning helps to reduce problems of IT investment loss and to avoid investing in IT initiatives that provides less value-added benefits to the business than it was planned (Peansupap, 2004). Most studies on strategic IT planning focus on the techniques (Ward and Peppard, 2002) and methods (Earl, 1993) that helps managers to analyze and prioritize IT initiatives and to also decide upon which aspects most benefit a business information system strategy.

According to Earl (1993), although there are many techniques and methods for developing an IT strategic plan, these objectives could be grouped into five common areas: aligning information system with business goals, search for a competitive advantage through IT, drawing commitment from top management, estimation of the appropriate resource needs, and development of technology policy and future planning. Although it is important, many researchers argue that merely establishing an IT strategy plan is not enough to obtain IT adoption success (Earl, 1993; Ward and Griffiths, 1996; Wilson, 1989).

In construction research, strategic IT planning has been recognized as useful for investigating IT applications that benefit the construction business objectives, prioritizing available options, and decision-making on these. Pena-Mora et al. (1999) developed a specific framework of IT planning for large scale A/E/C2 projects. The framework consists of four main processes: environmental scanning, internal review, IT diffusion analysis, and IT

investment modeling. Environmental scanning focuses on business objectives, relationships of IT programs and business objectives, and also on project participants who are involved in the IT project.

The second emphasis is the internal review which aims to analyze processes in detail in an A/E/C project that can be deployed using an IT capability. Next emphasis is on understanding the stages of IT diffusion of both the internal organization and external project participants. Finally, the investment model helps to evaluate costs and benefits of IT investment. From the above literature review it is clear that strategic IT planning assists in prioritizing and selecting an IT investment as well as in assessing potential benefits.

This should help managers to make a decision on what IT initiative should be invested in to gain the desired business results in a way to optimize synergies between interaction of people, technology and organizational structure. IT adoption and implementation decision making Next to precise strategic IT planning a successful IT management also needs a matching IT adoption strategy. An IT adoption strategy is the decision making adoption approach within an organization. The first stage is awareness when an organization searches for an IT solution to 2

A/E/C stands for Architecture, Engineering and Construction. 18 meet its strategy. One potential problem that is likely to occur and prevent an organization to move beyond awareness is that the organization becomes reluctant to adopt and invest in the required IT initiative. According to Mitropoulos and Tatum (1999), early innovation adopters may fear that they

are taking an unacceptable risk due to adoption uncertainties while late adopters may fear losing competitive advantage benefits through offering novel services after others have already offered those benefits (Love et al. 2001). According to Mitropoulos and Tatum (2000), strategic IT adoption behavior may depend upon general organizational innovativeness. Similarly to Rogers (1995), they argue that organizational innovativeness relies on variables such as leader characteristics, and characteristics of both the internal and external organization structure. Although these characteristics can influence an organizational adoption decision, Ginzberg (1981) argues that these variables are hard to change and thus can only be used to measure organizational innovativeness.

Regarding the implementation process, Bikson (1987) defines it as “ the translation of any tool or technique, process or method of doing, from knowledge to practice”. Eason (1988) asserts that an organization attempts to transform its current IT practice by adapting it to its environment and then continues to maintain it through an IT implementation process. Next, Tornatzky and Fleisher (1990) argue that implementation is a sub-process of innovation that occurs after the adoption of decision. Phase of IT implementation has been recognized as the one of the most difficult tasks and with several problems.

Therefore IT implementation management should play an essential role in creating a proper fit between organizational needs and user requirements (Peansupap, 2004; Korunka, Weiss and Zauchner, 1997). Griffith, Zammuto and Aiman-Smith (1999) argues that the root cause of IT failure is the “

invisibility problem” of implementation such as overestimation of a new IT initiative’s value or lack of concern for issues related to people. To overcome this problem they suggested that project managers should focus on issues related to implementation such as funding, support, and realistically estimating an initiative’s technology benefits.

There are two main approaches that could be pursued to understand IT implementation: a factor approach and a process approach (Peansupap, 2004; Fichman, 1992). A factor approach is focusing on understanding those factors, variables or criteria which influence successful IT implementation. The aim of this approach is to predict and measure IT implementation success. On the other hand a process approach focuses upon understanding key activities or stages of IT implementation so that the way in which the IT implementation can be understood and optimized depends on the nature of the prevailing circumstances.

Both approaches can be beneficial when used to better manage the development of IT maturity in an organization. 19 Measurement of IT performance and benefits The last phase of IT management process is identification of any existing gaps between expected and actual result. This helps organization to monitor any IT implementation problems and improve its IT strategy. A measurement of expected results refers to the assessment of expected IT benefits before IT implementation. This requires evidence of the IT impact on an organization’s operation and so it also depends upon a system of measuring impact.

Many researchers tried to define a framework which would enable organization to evaluate IT performance. Baldwin et al. (1999), categorize IT innovation benefits as efficiency, effectiveness, and performance. Their study provides a guideline of IT benefits related to business but did not include measurement scales for these categories. IT performance refers to assessment of actual results. According to Li (1996), measurement tools such as financial ratios lack measurement of intangible benefits.

Therefore IT performance measurement should include unquantifiable benefits such as user satisfaction, system flexibility, and system quality. He suggests six performance indicators: information value, information quality, user satisfaction, information accessibility, management redundancy, and module compatibility to measure IT performance. Andresen et al. (2000) divides IT benefits into efficiency benefits (quantifiable and valuable), effectiveness benefits (quantifiable but non-valuable) and business performance benefits (nonquantifiable and non-valuable).

Under this framework, they measure both expected benefits and actual benefits. After the review of different studies it can be argued, that the key concept of IT performance measurement is the identification of key performance indicators that provide a holistic measure of success, and then translating these indicators into measurable factors to provide quantifiable data for monitoring the level of success. Apparently in this way expected benefits are clear and unambiguous and there is a mechanism in place to determine the degree of success so as to allow corrective action to realign implementation plans. . 2. 3 Alignment of business and IT strategy It is

perhaps a truism that the role and the impact of IT on today’s organizations has significantly changed over the last decade. Across a wide spectrum of markets and countries, IT is exceeding its traditional “ back office” role and is evolving toward a “ strategic” role with the potential not only to support chosen business strategies, but also to shape new business strategies. Meanwhile, there is increasing concern that the expected value of the investment in IT is not achieved.

Many 20 times the reason for inability to realize value from IT investment is lack of alignment between organization’s business and IT strategy (Henderson and Venkatraman, 1993). The concept of strategic alignment originates from the fact that many organizations discovered that they were developing information systems which did not support their business strategy. Alignment enables an organization to maximize its IT investments and achieve harmony with its business strategy and plans, which leads to greater profitability.

Therefore it is obvious why for many years practitioners and academics have tried to answer the question of how to strategically align the objectives of IT and business. A strategic alignment model has been developed and improved over the years. Strategic alignment model Henderson and Venkatraman (1993) developed a model in response to a rapidly changing environment of businesses. An idea is to replace a traditional functional linkage model of IT planning with one that requires a highly integrated strategic management process.

The model (see Figure 8) explores the interrelationship between business and IT. It is based on two distinct linkages: strategic fit and functional integration. Strategic fit is the vertical linkage dealing with the integration of external environment in which organization competes (e. g. business scope, partnership, alliances, core competencies) and the internal environment in which the organization performs (e. g. organizational structure, human resources, business processes). It is the ability of an organization to make a decisions concerning organization’s market positioning.

Thus enables an organization to structure itself in order to execute the positioning strategy. On the other side functional integration is the corresponding horizontal link between business and IT. This linkage extends the concept of internal and external fit to IT. It enables organization to align their functional strategies, structure and processes using both internal conditions and also external environment’s variables. According to these two linkages one can determine the relationships between IT and business in an organization. The model is divided into four quadrants.

They are business strategy, IT strategy, organizational infrastructure and processes, and IT infrastructure and processes. These four quadrants are mutually interrelated. Few years later Weil and Broadbent (1998) used that alignment model as a basis for a theory that recommends how technology infrastructure investment should be made in organizations to 21 support business strategies. The theory is well defined idea based on the authors’ practical experience. Figure 8: Strategic alignment model Business Strategy IT Strategy technology scope systemic competecies linkage xternal business

scope distinctive competencies business governance automation administrative infrastructure processes IT governance strategic fit architectures internal processes skills skills Organizational Infrastructure and Processes business IT Infrastructure and Processes information technology functional integration Source: Henderson and Venkatraman, 1993, p. 476. Similarly Sauer and Yetton (1997) used the alignment model and expanded it by developing a lead-lag model and recommending a cyclical model.

The lead-lag model is based on assumption that organizations rarely experience dramatic growth in IT without first undergoing organizational change. Despite the lead-lag model, Yetton (1997) moved closer to more integrated approach between business and IT strategies. He suggests that IT strategy needs to become part of the business strategy rather than be treated as separate part which needs to be passively aligned with the business strategy. Successful organizations will become those who make IT managers an essential part of defining business opportunities and not just the builders of other managers' solutions.

Further the author asserts that if IT strategy is separated from business strategy this situation by default leads to misalignment. Likewise Smaczny (2001) questioned adequacy of the alignment model due to the fact that it requires business strategy to be developed separately to IT strategy and then synchronization 22 happens. Therefore the business strategy is set without considering opportunities that can be created by IT if a more holistic method was to be used. He argues that business strategy and IT strategy should not be separated to achieve maximal fit between strategies. . 3

Construction sector overview In every country, the construction sector is a source of great economic and social benefits. It is a major employer, typically accounting for 10 % or more of the workforce and offering employment requiring a wide range of skills and abilities. Construction sector has been characterized as being complex, fragmented and unique (Cheah, 2002; Egan, 1998, Howard et al. , 1989, Latham, 1994). This assertion is made for a variety of reasons. First, most construction projects involve many phases such as feasibility, design, construction and maintenance.

Second, each phase involves communication and coordination among many project participants such as the owner, contractor, designer, consultant, subcontractors, and suppliers. This may lead to serious problems of communication and information exchange. Each project is unique according to construction type, location, and its project participants. Consequently traditional management practice within construction environment has been criticized for not being conducive to improving construction productivity (Latham, 1994).

The basic characteristics of construction sector as seen by European Construction Research Network (2005) are as follows: Fragmentation of responsibilities, processes and resources The structure of responsibilities varies both between countries and between different types of projects, and it is typically within construction for design, site works and operation to be the independent responsibility of different organizations, with many sub-contractors and specialists.

This immediately provides scope for confusion of responsibilities and ambiguity in communication. The consequence is that in all countries the industry itself is highly fragmented, with very small companies (less than 10 employees) being predominant. The size of these companies has also negative implications for their ability to absorb and utilize new information and new technologies and take overall responsibility for the final product or service. This fragmentation prevents learning process.

The relationships that are formed and the experience which are gained in one project should be carried forward to another, but in many cases the project partners did not work together before. The collective learning, necessary to 23 achieve progress, adjust for innovation risks and learning curves of any new process and incorporate innovations is impossible without long term alliance. Lack of focus on end-users The complexity of interests involved in construction, with most having no direct link with the client or user, means that users’ requirements can be hidden by other objectives.

Clients and users may not play a significant role after initial discussions, and the tools available for communicating the developing design to users are inadequate; they typically require the user to interpret and imagine the consequences of 2D drawing and associated specifications. The result is that the final product is the outcome of interactions within the construction process, rather than of continuous and informed dialogue with the client. New tools (for example, virtual reality systems) will assist this dialogue, however a more fundamental re-thinking of the way that users are engaged in the process is required.

Lack of performance indicators In most sectors, products and services compete on the basis of the relationship between performance and cost, conventionally labeled as “ value for money”. For this to work effectively, customers must be able to distinguish between competing offers on the basis of defined performance metrics, i. e. delivery time, capacity, size, etc. Unfortunately construction has few such metrics; buildings and infrastructure are commissioned on the basis generally of other indicators (e. g. capacity) rather than by reference to their effectiveness in supporting the activities within them.

Moreover little feedback of operational experience takes place, due to the separation of responsibilities, and in most parts of construction, in contrast to other industry sectors, there is no culture of “ continuous improvement” of a design whose performance has been well characterized.