E-READINESS: HOW READY ARE UK CONSTRUCTION ORGANIZATIONS TO ADOPT IT

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Electronic readiness (e-readiness) as a global agenda is not entirely a new proposition, but e-readiness at the organizational level is still in its infancy. In this context, an advanced state of organizational e-readiness is needed for a business to expand domestically and internationally; to compete readily in the global open market. It is therefore, imperative that organizations align their strategies inline with their organization's readiness to adopt IT. Organizations must be readily prepared to adopt new methods of working, to create or reengineer new business processes, and be prepared to leverage information technology in order to gain competitive advantage and improve business efficiency. This paper investigates the initiation, development and practice of e-readiness, and presents a case for possible adoption for organizations in the construction industry.

Keywords: built environment, e-readiness, organization.

INTRODUCTION

The European Commission, through the European task force on IT Competitiveness and Uptake, highlighted the importance of IT based innovation in bringing productivity improvements and competitive advantage to industry (European Commission 2006). This report observed that since the mid 1990s there was a constant decline in labour productivity, which was mainly attributed to the lack of IT related investment. This evidence also highlights that higher productivity growth rates were observed in the USA and other world trade partners of Europe through the greater use/integration of Information and Communication Technology (IT) by all segments of the economy. However, industries have not been in a position to capitalize on the investment in terms of productivity growth (OECD 2003).

From a construction standpoint, the Construction Industry contributes one of the largest shares of wealth creation to Europe's business economy. It accounts for 9.7% of gross domestic product (GDP) and almost 60% of gross fixed capital formation (GFCF), with housing being the largest single segment at 20% GFCF, thus representing 27% of the total construction output. The building construction industry consists of 1.2 million companies, 7 million direct employees and 18 million direct and indirect employees with at least half of this figure being employed by Small to Medium Enterprises (SMEs) – organizations with less than 20 operatives. From a value perspective, the construction sector is of significant importance to the EU economy, with a Gross Domestic product (GDP) contribution of 9.8% (Business Watch, 2005), and around 8% of GDP in the USA (Researchandmarkets, 2010).

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However, from an investment perspective, there is ample evidence to denote that IT has failed to bring about competitive advantage to organizations in spite of large investments being made. For example, research by Salah (2003) shows that 75% of IT investments within construction organizations fail to meet their business objectives. In this respect, projects were abandoned, significantly redirected, or simply "kept alive" in spite of the failure to integrate them into organizational business. Therefore, the cost of funding such projects (and the missed opportunities of not benefiting from their intended capabilities) constituted a tremendous loss for organizations. This dissolution of not being able to realize the strategic benefits of IT is currently forcing many construction organizations to reconsider their IT investment decisions to procure competitive advantage. Therefore, the rate of IT not achieving its intended business objectives (IT failure) is increasing, the landscape of which was echoed by Lientz and Larssen (2006), stating that 40% of IT projects failed to deliver tangible benefits, and less than 50% were completed on-time and on-budget. Many more failure stories can be cited, e.g. The Standish Group (2001), Heeks (2002), Michaelson (2006) and Xia and Lee (2004).

In an attempt to further understand the current status of industry towards IT investments, a joint study was recently carried out between Construct IT and the Research Institute of the Built and Human Environment to assess the state of Construction Executive thinking towards IT investment for continuous improvement and sustained competitive advantage (Construct IT, 2008). The findings from this report indicated that the main inhibitor to IT investments was the lack of know-how or mechanisms which can guide managers to successfully absorb new technologies into their work practices towards achieving competitive advantage. This demonstrates that there is a gap between what executives think is necessary to be done" to achieve IT-based innovation, and "how best to implement it". In this respect, the industry appears to understand the strategic benefits that can be realized through IT, however the mechanism to realize these benefits to maximize the likelihood of success of IT investment is not yet fully understood. This is in line with the main literature in this field which highlights this problem, and attributes the successful implementation of IT investments to organizational factors, mainly: people and process; the enabling work environment; and the IT infrastructure. For example, Basu and Jarnagin (2008) stated that business executives did not fully recognize the full functionality and value of technology to the business, nor did IT personnel possess an understanding of the business and it strategic objectives. This resonates with the findings by Goulding *et al.* (2007) regarding the importance of understanding technology adoption and diffusion issues, and with findings by Mata *et al.* (1995) concerning investment uncertainty. Whilst a 'technology push' approach may bring about 'first comer' advantages to the organization, implementing advanced IT applications to create sustainable competitive advantage can only be leveraged by improving processes in line with management objectives using IT as an enabler (Alshawi, 2007). Furthermore, the latter can only be achieved if the organization is in a state of 'readiness' to effectively absorb IT enabled innovation into its work practices prior to investment. Such issues embrace recurrent themes of interoperability, organizational maturity, technology transfer, training, process capability etc. These are real issues, which invites a sector-wide question of "how ready is the United Kingdom construction sector to fully leverage IT?" (especially in comparison to other sectors). This paper investigates the e-readiness of nations and presents a case for possible adoption for organizations in the construction industry. International e-readiness assessments, reports and rankings of nations were sourced through globally respected institutions, non-profit organizations and business

entities. This provided a good blend of objectives derived from each report. For example, the United Nations (UN) reports concentrated on the welfare of the nations; whereas, university-led reports were more academically and research focused; while business entities, such as The Economist, concentrated on business process and commercially driven issues. Thus, it was acknowledged that a congruence of aims, focus and objectives from these reports was untenable. However, it was possible to ascertain the key issues, indicators and gaps for e-readiness from a national perspective. In this respect, key success factors of construction businesses within the built environment were ascertained by identifying the strengths, gaps and the future directions of organizations. This was explored intensively through seminal literature from business driven articles (e.g. The Harvard Business Review, The Economist, Academia Reports etc.). By combining the key indicators of e-readiness of nations to achieve business success and competitive advantage, the pervasiveness of e-readiness within the built environment arena was determined. E-readiness is seen as a tool to unlock the 'fear' and the way forward for adopting IT within the organization.

ELECTRONIC READINESS (E-READINESS) FOR NATIONS

For a start, there is no single accurate definition for e-readiness; different groups describe it differently. To provide a holistic overview, a few thoughts are outlined here to help prompt this discussion. The World Information Technology and Services Alliance (WITSA) states that an e-ready country requires consumer trust in e-commerce security and privacy; better security technology; more trained workers and lower training costs; less restrITive public policy; new business practices adapted to the information age; and lower costs for e-commerce technology (WISTA, 2004). While the United Nations appraise e-readiness as the public sector e-Government initiatives of member states according to a weighted average composite index of e-readiness based on website assessment; telecommunication infrastructure and human resource endowment (UN, 2008). The community assessment of e-readiness by the Center for International Development (CID, 2007) describes an e-ready society as one that has the necessary physical infrastructure (high bandwidth, reliability, and affordable prices); integrated current ITs throughout businesses (e-commerce, local IT sector), communities (local content, organizations online, ITs used in everyday life, ITs taught in schools), and the Government (e-Government); strong telecommunications competition; independent regulation with a commitment to universal access; and no limits on trade or foreign investment. On the other hand, the Technology CEO Council (2005) views an e-ready community as being equipped with high-speed access in a competitive market; with constant access and application of ITs in schools, Government offices, businesses, healthcare facilities and homes; user privacy and online security; and Government policies which are favourable to promoting connectedness and use of the network. E-readiness can also be defined as the aptitude of an economy to use Internet-based computers and information technologies to migrate traditional businesses into the new economy, an economy that is characterized by the ability to perform business transactions in real-time – any form, anywhere, anytime, and at any price (Bui *et al.*, 2002). A brief synopsis of these reports and definitions can be seen in Table 1.

In spite of all the differences in definitions and opinions, this paper takes the position of e-readiness as "measure of the degree to which a country, nation or economy may be ready, prepared or willing to obtain benefits which arise from the digital economy" (Lou *et al.*, 2008).

Table 1: Various definitions of e-readiness

Report	Definition of E-Readiness
Economist Intelligence Unit (2009)	E-readiness is the "state of play" of a country's information and communications technology (IT) infrastructure and the ability of its consumers, businesses and governments to use IT to their benefit. When a country does more online – or, as is increasingly the case, wirelessly – the premise is that its economy can become more transparent and efficient.
Center for International Development (CID), Harvard University (2007)	Readiness is the degree to which a community is prepared to participate in the Networked World. It is gauged by assessing a community's relative advancement in the areas that are most critical for IT adoption and the most important applications of ITs. When considered together in the context of a strategic planning dialogue, an assessment based on these elements provides a robust portrayal of a community's Readiness. The value to a community of assessing its Readiness lies in evaluating its unique opportunities and challenges.
Asian Pacific Economic Cooperation (APEC) (2000)	Readiness is the degree to which an economy or community is prepared to participate in the digital economy. Every economy, regardless of its level of development, presents a readiness profile on the global stage, composed of its national policies, level of technology integration, and regulatory practices. Readiness is assessed by determining the relative standing of the economy in the areas that are most critical for e-commerce participation.
McConnell International and WITSA (2000)	E-Readiness measures the capacity of nations to participate in the digital economy. E-Readiness is the source of national economic growth in the networked century and the prerequisite for successful e-business.
The World Information Technology and Services Alliance (WITSA) (2004)	The report of the survey states that an 'e-ready' country requires consumer trust in e-commerce security and privacy; better security technology; more trained workers and lower training costs; less restrITive public policy; new business practices adapted to the information age; and lower costs for e-commerce technology.
United Nations (2008)	This UN report assesses e-government readiness of Member States, according to a quantitative composite readiness of e-readiness based on website assessment; telecommunication infrastructure and human resource endowment.

INTERNATIONAL E-READINESS ASSESSMENTS, REPORTS AND RANKINGS

Today, there are various e-readiness assessments, reports and rankings available to the public – formulated through quantitative and qualitative research by numerous Governments, private and non-profit organizations. Each report is often the product of different methodologies, and divergent definitions of e-readiness. Therefore, the findings of the various studies are not consistent with each other. Nonetheless, every e-readiness assessment, report and ranking are meant to guide nations by providing benchmarks for comparison and gauging progress, and can also be useful for judging the impact of IT, to replace exaggerated claims and anecdotal evidence with concrete data tool. In this context, a study conducted by bridges.org (2005), reported that a total of 1506 e-readiness assessments have been conducted and a total of 188 countries have been assessed by at least one tool. The report further states that a total of 68 countries have been assessed between five and ten times by different organizations, while a further 69 countries have been assessed over ten times. Only four countries have never been assessed: North Korea, Tuvalu, Monaco and Nauru.

E-readiness assessments, reports and rankings can be divided into two main categories: those that focus on basic infrastructure or a nation's readiness for business or economic growth (e-economy), and those that focus on the ability of the overall society to benefit from IT (e-society). The e-society tools incorporate business growth and use of IT as part of their larger analysis, and consider business growth necessary for society's e-readiness; CID (2007) model looked at how IT is used in society, while

Table 2: Various reports and measuring tools for e-readiness.

Report	Measuring tool
Economist Intelligence Unit (2009)	There are nearly 100 separate quantitative and qualitative criteria, which are scored by EIU country analysts and organized into six primary categories – Connectivity and technology infrastructure (20%), Business environment (15%), Social and cultural environment (15%), Legal environment (10%), Government policy and vision (15%) and Consumer and business adoption (25%). These are, in turn, weighted according to their assumed importance as influencing factors.
Center for International Development, Harvard University (2007)	The Guide requires significant participation and interpretation on the part of its users. It examines 19 different categories of indicators, ranking each by levels of advancement in Stages One through Four. The categories fall within five groups – Network Access, Network Learning, Networked Society, Networked Economy and Network Policy. The categories are linked, each driving the others, such that a community cannot concentrate solely in one area, but must pay attention to each, noting where it might be able to capitalize on synergies among the categories.
Asian Pacific Economic Cooperation (APEC) (2000)	APEC presents a readiness profile on the global stage, composed of its national policies, level of technology integration, and regulatory practices. Six broad indicators of readiness – Basic Infrastructure and Technology, Access to Necessary Services, Current level and type of use of the Internet, Promotion and Facilitation Activities, Skills and Human Resources, and Positioning for the Digital Economy – for e-commerce are developed into a series of questions that provide direction as to desirable policies that will promote e-commerce and remove barriers to electronic trade.
McConnell International and WITSA (2000)	The ratings combine a dynamic evaluation of the relevance and accuracy of available quantitative data with an understanding of myriad cultural, institutional, and historical factors relevant to the actual situation in each country. The ratings measure status and progress on five interrelated attributes; Connectivity, E-Leadership, Information Security, Human Capital, and E-Business Climate.
United Nations (2008)	This UN Index is a composite index comprising the Web measure index, the Telecommunication Infrastructure index and the Human Capital index. The Web Measure Index is based upon a five-stage model, which is ascending in nature, and builds upon the previous level of sophistication, of a state's online presence. The telecommunication infrastructure index is a composite weighted average index of six primary indices based on basic infrastructural indicators, which define a country's IT infrastructure capacity; and the data for the human capital index relies on the UNDP 'education index' which is a composite of the adult literacy rate and the combined primary, secondary and tertiary gross enrolment ratio with two third weight given to adult literacy and one third to gross enrolment ratio.

the APEC (2000) method focussed on government policies for e-commerce. The e-economy tools include some factors of interest to the larger society, such as privacy and universal access, such as McConnell and WISTA (2000) and EIU (2009) reports; e-society include CID (2007) and UN (2008) reports. A brief synopsis of the reports and associated measuring tools can be seen in Table 2.

The identification of gaps to prepare the construction industry to harness the power of IT is critical – to both the country and organization. Results from existing reports, assessments and rankings have demonstrated wide differences in methodologies and assessment methods, and are not specifically dedicated to the construction industry. From an e-readiness ranking perspective, the pervasiveness and coverage of reports have been all-encompassing – see Table 3. Thus, from Table 3, it can be seen that there is no shared congruence of agreement between the findings.

ORGANIZATIONAL E-READINESS

There have been significant advances in the technological development of tools to effectively manage projects over their life cycle such as virtual reality environments, simulations, BIM, and DAD. Elements of such technologies have clearly influenced

Table 3: Selected e-readiness rankings

	Economist Intelligence Unit (2009)	United Nations (2008)	AT Kerney (2006)	ITU (2008)	Waseda University (2007)	World Economic Forum (2007)	World bank (2007)
United Kingdom	13	10	12	12	9	9	9
Ireland	18	19	4	26	-	21	14
France	15	9	23	-	12	23	20
Denmark	1	2	5	2	-	1	2
Finland	10	15	13	8	7	4	4
Sweden	2	1	10	1	10	2	1
United States	5	4	3	11	1	7	10
Singapore	7	23	1	14	2	3	-
Total countries assessed	70	182	62	178	32	122	137

work practices in organizations. In general, it is widely accepted that IT is becoming a key element of any organizational infrastructure. However, for larger organizations, the scenario is more complex where IT infrastructure plays a key role in supporting core business functions within and among organizations. IT holds tremendous potential for improving construction businesses, while the industry is facing globalization and an expanded knowledge-based economy, the capability of IT is undeniable for achieving competitive advantage (Cartelli, 2007). However, there is ample evidence that IT has failed to bring about a competitive advantage to organizations in spite of the large investments over the past decade, and a large percentage of systems have failed to achieve their intended business objectives. Recent studies in the in the area of 'IT failure' have shown that 75% of IT investments did not meet their performance objectives (Alshawi, 2007). Such projects were abandoned, significantly redirected, or even worse, they were 'kept alive' in spite of their failure. The cost of funding such projects and the missed opportunities of not benefiting from their intended capabilities constituted a tremendous loss for organizations. This dissolution in the strategic benefits of IT is currently forcing many construction organizations not to invest in IT for competitive advantage, but for the reasons of bringing efficiency and effectiveness to business processes.

Technical problems were almost never the reason that new IT systems failed. Human and process problems were often to blame (Lou and Alshawi, 2008). People typically resisted adopting new systems, often because the cost (the effort) outweighed the benefits. One of the primary explanations for the extent of project failures and the size of ultimate write-offs was the presence of agency problems and especially the escalation of commitment on the part of the manager (Mahaney and Lederer, 2003). Escalation is generally defined as continued commitment of resources after receiving negative feedback about a project.

A joint study was recently carried out between Construct IT and the Research Institute of the Built and Human Environment to assess the state of Construction Executive thinking towards IT investment for continuous improvement and sustained competitive advantage (Construct IT, 2008). This report indicated that the main inhibitor to IT investments was the lack of know-how or mechanisms which can guide managers to successfully absorb new technologies into their work practices towards achieving competitive advantage. This established that there is a gap between "what executives think is necessary to be done" to achieve IT-based innovation, and "how best to implement it". In this context, the industry appears to understand the strategic benefits that can be realized through IT, however the mechanism to realize these

benefits to maximize the likelihood of success of IT investment is not yet fully understood. This is in-line with the main literature in this field which highlights this problem, and attributes the successful implementation of IT investments to organizational factors, mainly: people and process; the enabling work environment; and the IT infrastructure.

The Construction Industry has invested in IT, the result of which has led to a certain level of innovation and business improvement. However, the industry is predominantly project-oriented, where teams of companies get together to design and construct a project, and are disbanded after the project has been completed. Whilst it can be argued that the industry's main functions and processes are still relatively unchanged, there has been a real challenge to improve performance and reduce cost using IT as the lever of change (Marsh and Flanagan, 2000). However, although the potential to improve performance exists, efforts are often hampered due to several barriers, not least the industry's structure, a fragmented supply chain, lack of investment in IT, and limited IT 'champions' who are able to: a) understand IT-based innovation challenges, and b) have the support and empowerment of senior decision makers within the organization to sanction, augment, and drive forward change. Now, whilst new and advanced technologies are increasingly being marketed as "all encompassing solutions", this paradigm is fundamentally fractured, as the industry embodies stakeholders with different drivers and modus operandi. Therefore, the success of IT projects is typically measured by the successful installation of the system, i.e. the hardware and software, or by the level of users' satisfaction. However, a more important success factor is whether the organization can effectively absorb, integrate and leverage core capabilities through the system in order to procure sustained competitive advantage. In this respect, the two critical elements that can significantly influence the level of IT project integration into an organization's work environments are: process alignment (ability to align the organization's processes with the proposed system's functionalities, whether it is a commercial system with embedded "best practices" or a bespoke system with a newly adapted processes); and people (ability of employees to accept and adapt to the system).

Literature poses several challenges regarding the precise mechanisms through which IT-based sustainable competitive advantage can be achieved in the construction industry. These challenges are complex, multifarious, and need to be carefully evaluated. For simplicity, these factors can be represented into a simple enabling concept, Figure 4. The Figure highlights the importance of augmenting business dynamics with technology – the essence of which is enshrined in the central core. This picks up the issues portrayed in the 5 layer model –building IT capability issues are embraced through the corporate 'competence', 'culture', 'vision and leadership', and 'IT infrastructure' operands, identified as outer circle dependencies in Figure 4. The 'business pressures' outer circle signifies the operating environment through which the business drivers are countered. Whereas, the 'organizational maturity' outer circle embraces the relationship between the maturity in process management and IT, along with the maturity of the organization in order to marshal corporate energies to secure strategic advantage. Finally, the 'IT Investment' identifier, represents the "decision" to invest. This decision is based on the culmination of all factors, specifically; the position the organization is currently in regarding its internal competence and overall level of maturity to leverage IT in order to improve its performance, specifically against the core threats of competition and external pressures ascribed from external market forces.
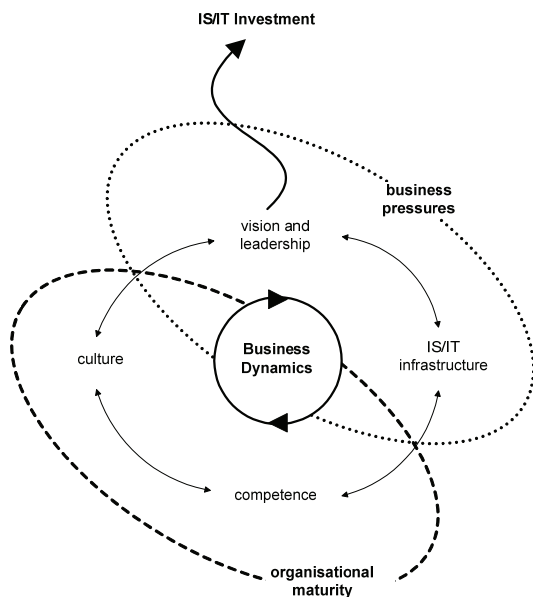
Figure 4. Enabling Organizations to Achieve Sustainable Competitive Advantage (Alshawi, 2007)

This enabling concept provides construction organizations a conduit through which IT decisions can be evaluated against the driving push/pull forces often associated with internal business systems and external business drivers. It includes a high level of granularity covering a range of factors, including work environment that supports, motivates and empowers employees to innovate and seek improvement changes in line with the business objectives; through to the availability of an advanced IT infrastructure that allow employees to focus and exploit tacit experience into commercial success.. This concept does however need to be countered by a rational and temporal-framed approach to assessing the corporate competence and maturity of the organization in order to fully leverage aspirations, as failure to understand the importance of aligning these dependencies will have a direct impact on success. Thus, organizations are encouraged to understand and assess their "required level of capability", and "organizational readiness" (where they are now; where they want to be) prior to any IT investment decision.

THE WAY FORWARD

E-readiness as a global agenda is not entirely a new proposition, but e-readiness at the organizational level is still in its infancy. Whilst the precise terminology of e-readiness has not yet been readily defined, this paper presented its definition "as a measure of the degree to which a country, nation or economy may be ready, prepared, or willing to obtain benefits which arise from the digital economy". Thus, organizations must be readily prepared to adopt new methods of working, to create or reengineer new business processes, and be prepared to leverage information technology in order to gain competitive advantage and improve business efficiency. The real question is however "how ready is my organization to adopt IT?"

Achieving e-readiness within organizations will undoubtedly need to embrace change. As commercial entities, organizations in this sector are increasingly dependent on e-commerce, specifically with the increased emergence of electronic transactions and e-tendering. Thus, there is a strong argument that the organizations need to adopt a 'measured approach' in order to help them be 'e-ready' – the rubrics of which could be augmented through some form of a practical framework which allows them to measure their e-readiness.

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