E-Readiness Model: A Comparative Review

Nur Mardhiyah Aziz
(Universiti Malaya, Kuala Lumpur, Malaysia, nurmardhiyah@gmail.com)

Hafez Salleh
(Universiti Malaya, Kuala Lumpur, Malaysia, hafez@um.edu.my)

Abstract
A rapid change in business patterns and pressure has heightened the need for IT/IS implementation to facilitate organizations to achieve their business objectives. Report from many researchers had shown a continued increase in IT/IS investment in organizations over the years. Despite the high investment rate in IT/IS over the past decade, ample evidence showed that IT/IS had failed to deliver the expected return. Extensive studies on the IT/IS failure carried out had discovered that one of the main attributes of the high percentage of failure is due to the ‘soft issue’ which involve people and their readiness prior to the implementation of IT/IS in an organization. Currently organizations are more focus on the evaluation of the hard issue aspects such as speed, profit returns and quality of the information produced, which are all being evaluated after the project had been completed. Consequently, this approach leads to the failure of IT/IS implementation. Therefore to avoid failure, measuring the current readiness for the implementation of IT/IS in an organization becomes critical. The purpose of this paper is to present and comment on the recent and previous readiness model available, highlighting their suitability to the construction industry. It is anticipated that the recommendation made on this model will make the construction industry aware about the importance of assessing their readiness prior to the implementation of IT/IS in their organizations. The comparative review of existing readiness model discussed in this paper is expected to enrich knowledge, primarily on the differences on each of the model.

Keywords
IT/IS, readiness model, IT in construction industry.

1. Introduction
The Information Age has made IT/IS the ‘backbone’ of various industries including construction. Understanding and leveraging IT/IS is crucial for nations as it become the main agenda that will contribute to a nation’s development, and act as a major force which will lead the nation towards the global economy. The spread and usage of IT/IS have good impact on the business pattern, thus heightening the need for its implementation to facilitate the organization in achieving their business objectives. Numerous studies from researchers had shown that IT/IS investment continue to rise over the years, as does its use in the construction industry. The use of IT/IS had become a worldwide phenomenon with no signs of a slowdown (Barthelemy & Geyer, 2004; Computer Economics, 2006; Lin, Pervan, & McDermid, 2007). According to Davies (2008), there has been a considerable increase in the use of information and communication technology at the office level in construction companies. In 2008, organizations' spending on information technology (IT) continue to increase even in the face of potential economic downturns (Kanaracus, 2008).
Despite the high investment rate in IT/IS over the past decade, ample evidence showed that IT/IS had failed to deliver the expected return. Estimates of the level of failure may vary, but over the past 30 years they have tended to stay uncomfortably high (Ashurst, Doherty, & Peppard, 2008). Standing, Guilfoyle, Lin and Love (2006) had identified the top five reasons for IT/IS failures. These include: lack of user support and involvement, lack of properly defined project scope, lack of executive management support and commitment, imprecise defined objectives and knowledge of the IT project and poor project management and leadership. In order to reduce the failure rates, it is believed that there is a need to assess the e-readiness capability prior to IT/IS implementation in order for the industry to identify and plan for their IT/IS implementation. Since the development of the first e-readiness tool, several e-readiness tools have emerged through efforts of development agencies, research organizations, academia, business enterprises and individuals (Ghavamifar, Beig, & Montazer, 2008). Proper planning is essential to reduce the pitfalls and yield positive outcomes. As a result of the e-readiness capability assessments, areas that need more attention can be identified for a successful implementation of IT/IS. E-readiness assessments are meant to guide development efforts by providing benchmarks for comparison and gauging progress (Bridges.org, 2005b). Therefore, it is important to compare the most common e-readiness assessment models/tools and examine their appropriateness to be used in construction industry.

2. Definition of e-readiness

The concept of e-readiness originated as a result of an attempt to provide a unified framework to evaluate the breadth and depth of the digital divide between the developed and developing countries during the later part of the 1990s (Mutula & Brakel, 2006). Various definition of e-readiness could be found from literature on the subject. The first efforts in defining e-readiness were undertaken by the Computer Systems Policy Project (CSPP) in 1998, in which e-readiness was defined with respect to a community that had 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 favorable to promote connectedness and use of the network (Beig, Montazer, & Ghavamifar, 2007). According to a definition provided by Economist Intelligence Unit (2009), e-readiness is the state of play of a country’s information and communications technology (ICT) infrastructure and the ability of its consumers, businesses and governments to use ICT to their benefit. Dada (2006) on the other hand, defined e-readiness as the measure of the degree to which a country, nation or economy may be ready, willing or prepared to obtain benefits that arise from information and communication technologies (ICT). Harvard University Centre for International Development’s (CID, 2000) defined the term e-readiness as the degree to which a community is prepared to participate in the Networked World - a world in which everyone, everywhere, has the potential to reap the benefits of connectivity to the network. McConnell International comes out with their own definition on e-readiness, which is the capacity of nations to participate in the digital economy (Budhiraja & Sachdeva, 2002). World Economic Forum Consultation Report on E-Readiness on the other hand, defines e-readiness as the ability of the ICT networks to effectively adapt to the social and economic advancement (Budhiraja & Sachdeva, 2002). From the above, it can be concluded that there is no accurate definition for the concept of e-readiness because e-readiness depends on the various contexts, different situations and different users. The different definitions for the concept of e-readiness is due to the different ways that are used to measure it, thus resulting in a variety of assessment, analysis and benchmarking reports at different levels of detail (Shareef, A., & Janowski, 2008). Generally, the term e-readiness is to measure the capability to adopt IT prior to its implementation.

3. Recent and Previous Readiness Model

Numerous surveys or assessments on e-readiness had been carried out over the years. According to the United Nations Development Program (UNDP) and Bridges.org (2005b), e-readiness assessments are
meant to guide development efforts by providing benchmarks for comparison and gauging progress. The need to assess the e-readiness capability becomes extremely important in order for the construction industry to identify and plan for their IT/IS implementation. Proper planning is essential to reduce the pitfalls and yield positive outcomes. From the assessment, areas that need more attention can be identified in order to successfully implement IT/IS. E-readiness assessments are meant to guide development efforts by providing benchmarks for comparison and gauging progress (Bridges.org, 2005b). Bridges.org (2005a) further divided e-readiness assessment tools and models into two main categories, focusing on e-economy and e-society. The tools or models that strictly focus on the people’s readiness towards the business and economic growth as well as the basic infrastructure of the nations were regarded as the e-economy. An example of this is the APEC E-commerce Readiness Assessment Guide, which was created to assess the readiness level of the economies, cities and the communities in taking part in the digital economy (Information Technology and Broadcasting Bureau, 2000). The e-society tools/model on the other hand, looks at the capability of the whole society in maximizing the benefit from implementing ICT. An example is the tools designed by McConnell International in the year 2001; Ready? Net. Go!, which was used to assess a country’s e-readiness, or capacity to participate in the global digital economy (Dutta, Lanvin, & Paua, 2003). Briefly described below are some of the e-readiness models/tools that are being widely used.

Readiness for the Networked World
The readiness model for the Networked World was developed by the Centre for International Development of Harvard University and IBM in 2001. It is a generic model that assesses the e-readiness capability of the community in developing countries. There are 19 different categories of indicator which can be grouped into 5 different sections that are Network Access, Networked Learning, Networked Society, Networked Economy and Network Policy. Each indicator was rated based on scale from 1 to 4 with a different criterion for each stage. The model seeks only to offer a starting point in an ICT planning process (Harvard Center for International Development).

E-Readiness rankings
This model was created in year 2002 to measure a country’s ICT infrastructure as well as the capability of governments, consumers and businesses to obtain benefits by implementing IT. Created by the Economist Intelligence Unit, this model consist more than 100 different qualitative and quantitative criteria which can be grouped into 6 main categories. Each category has their own weight depending on their importance as influencing factors. The categories are Connectivity and Technology Infrastructure (Weight in overall score: 20%), Business Environment (Weight in overall score: 15%), Social and Cultural Environment (Weight in overall score: 15%), Legal Environment (Weight in overall score: 10%), Government Policy and Vision (Weight in overall score: 15%) and Consumer and Business Adoption (Weight in overall score: 25%).

E-commerce Readiness Assessment Guide
This readiness tool was created in year 2000 to assess the e-readiness capability of the economies, cities and the communities in taking part in the digital economy. There are 6 indicators; Basic Infrastructure and Technology, Access to Necessary Services; Current Level and Type of Use of the Internet; Promotion and Facilitation Activities; Skill and Human Resources and Positioning for the Digital Economy.

Readiness Guide for Living in the Networked World
There are hundreds of criteria that are being used to assess e-readiness for the networked world which can be grouped into 5 main categories. These include The Network Infrastructure, Networked Places Access, Networked Applications and Services, Networked Economy and Networked World Enablers. Developed by Computer systems Policy Project (CSPP) in 1998, the guide was created to measure the level of readiness of town, city, county, state, country or any community.
Ready? Net. Go!
The framework designed by McConnell International and Worlds Information Technology and Services Alliance (WITSA) in year 2001, was used to assess a country’s e-readiness, or capacity to participate in the global digital economy (Dutta et al., 2003). Five dimensions were used in this framework in evaluating the country’s e-readiness capability. Connectivity, E-leadership, Information Security, Human Capital and E-business Climate were used in determining the country’s e-readiness level.

TRI index
The TRI index developed by Parasuraman & Rockbridge Associates in year 2000 was designed to assess people’s readiness to interact with technology. TRI refers to people’s propensity to embrace and use technologies for accomplishing goals in home life and at work (Parasuraman, 2000). Four dimensions were used; that are optimism, discomfort, innovativeness and insecurity.

Global Diffusion of the Internet Project
This model was developed in 1998 by the Mosaic group. The main purpose of this model is to indicate the phases of internet development focusing on six internet statistic. These are pervasiveness, geographic dispersion, sectoral absorption, connectivity infrastructure, organisational infrastructure and sophistication of use.

International Survey of E-Commerce
Developed by Worlds Information Technology and Services Alliance (WITSA) in year 2000, this model were used to find out business and consumer awareness on electronic commerce and to identify potential action areas using 7 main criteria of assessment: trust, technology, workforce issues, public policy, taxation, business process, costs and consumer attitude.

Network Readiness Index (NRI)
Designed by the Center for International Development (CID) at Harvard and the World Economic Forum, this model was to be used by communities of any size, to measure technological capabilities according to a four level scale. The assessment criteria are the environment for IT, the readiness of the community and the actual use of IT.

Negotiating the Digital Divide
Center for International Development and Conflict Management (CIDCM), University of Maryland, developed this model to describe the processes and outcomes of negotiations between key players over the phases of development. The framework measures four categories of information for each country: background and history, key players in Internet development, ICT policy over time and negotiations between players in developing the country's Internet.

4. Comparison of the Model
Ten models/tools that are currently being used were chosen and compared (See table 1). Comparisons were made based on a few criteria, which include:
- Focus of the model/tools: identify the category of the model/tools, either e-economy or e-society. E-economy are those that focus on basic infrastructure or a nation’s readiness for business or economic growth (Bridges.org, 2005a) while e-society are those that focus on the ability of the overall society to benefit from ICT (Bridges.org, 2005a).
- Purpose: describing the main aim of the model/tools.
- Assessment criteria: identifies categories to be assessed in each of the model/tools.
- Assessment method: identifies method used to collect data/information. The assessment methods were identified and grouped into four categories.
o Questionnaires: used to collect the primary data by asking the same set of direct questions regarding IT and policy in every assessment
o Statistical methods: analyzing prior data mathematically to test for the relationship between the individual factors for example, by looking for a casual relationship between Internet access and political democracy
o Best practices: direct comparison with other countries or using experiences learned from other countries
o Historical analysis: analysing economic, political and social events of a country to explain and forecast its information technology

- Assessment result: indicating the types of results that can be obtained from the assessment. There are description, diagnosis and proscription.
  o Description: the results only explain or describe the situation
  o Diagnosis: the results indicate the problematic area but did not suggest any solution
  o Proscription: give recommendation on action to be taken

- Strength: identify the strong points of the models/tools
- Weakness: identify the drawback of the models/tools
- Suitability to be used in construction industry: assess the potential use of the model/tools in the construction industry

5. Discussion

Even though there are many e-readiness models/tools developed, Steward and Mohamed (2003) found that compared to the other industries, the construction industry is still lagging behind in achieving comparable rates of IT implementation. The reasons might be due to the nature of the construction industry itself, such as having unique characteristics in terms of its product, complexity, size and also location of the project, where no two projects are exactly similar. A commonly cited problem that exist with e-readiness is the fact that there are many different types of measures available today and that there is no standardization of these measures (Dada, 2006).

The comparisons made showed that the models/tools can be categorized into two groups that are e-economy and e-society. Each of the developed models/tools has their own intended purpose, thus having their own different assessment criteria and assessment method in order to find the intended result. Results obtained from the assessment can be grouped into three different categories: description, diagnosis and proscription. Most of the models/tools only describe the current situation and diagnose the problematic area. Only a few models/tools provide recommendations for improvements. Majority of the assessments are based on questionnaire, statistical analysis, best practices and historical analysis. Most of the studies did not have explanation on how the indices were constructed. Each model/tools have their own objective and thus have a different definition of e-readiness. From the table, it can be clearly seen that most of the models/tools are descriptive and diagnosis. Results from assessment carried out only explain the current situation and some of it able to identify areas of improvement. Only few models/tools however, provide recommendation to overcome the problems. Most of the listed models/tools in this paper are post-implementation; where the assessments were carried out after the implementation of IT/IS. According to Dutta et al., (2003) there are three main motivations for assessing the readiness level: first as policymaking and evaluation tool for countries, second; to measure state of internet acceptance (or e-readiness) in a country or community and finally to measure the growth of internet in the world.

In identifying the suitable models/tools to be used in construction industry, one should consider the models/tools e-readiness definition, areas to be assessed (either e-economy or e-society), the assessment
criteria, methods of assessment, the availability of data and so forth. According to Ghavamifar et al., (2008) to select a suitable tool, the most important issue is that the chosen e-readiness assessment tool must fit the user's goal.
### Table 1: Comparison of E-Readiness Models/Tools

<table>
<thead>
<tr>
<th>Tools/Models</th>
<th>Developer</th>
<th>Focus</th>
<th>Purpose</th>
<th>Assessment Criteria</th>
<th>Assessment method</th>
<th>Assessment result</th>
<th>Strength</th>
<th>Weakness</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Readiness for the Networked World (2001)</td>
<td>Center for International development at Harvard University and IBM</td>
<td>e-society</td>
<td>assesses the e-readiness level of the community in the developing country</td>
<td>• Network Access, • Networked Learning, • Networked Society, • Networked Economy, • Network Policy</td>
<td>Questionnaire, Statistic</td>
<td>Diagnosis</td>
<td>A general tool that is applicable to various developing countries</td>
<td>Does not provide guideline in using the tools</td>
<td>Can be used in identifying the current level of e-readiness</td>
</tr>
<tr>
<td>E-Readiness rankings (2002)</td>
<td>The Economist Intelligence Unit and Pyramid Research</td>
<td>e-economy</td>
<td>measure country’s ICT infrastructure as well as the capability of government, consumers and businesses</td>
<td>• Connectivity &amp;Technology Infrastructure • Business Environment • Social &amp; Cultural Environment • Legal environment • Government Policy &amp; Vision • Consumer and Business Adoption</td>
<td>Statistic</td>
<td>Description</td>
<td>Provide useful comparison on the technology aspects among countries</td>
<td>No recommendation for improvement</td>
<td>Half of the assessment criteria in this model are relating to the capability of the government</td>
</tr>
<tr>
<td>E-commerce Readiness Assessment Guide (2000)</td>
<td>Asian Pacific Economic Cooperation (APEC) electronic Commerce Steering Group</td>
<td>e-economy</td>
<td>assess the readiness level of the economies, cities and the communities</td>
<td>• basic infrastructure &amp; technology; • access to necessary services; • current level and type of use of the Internet; • promotion &amp; facilitation activities; • skill &amp; human resources; • positioning for the</td>
<td>Questionnaire, statistic</td>
<td>Diagnosis, proscription</td>
<td>Clearly stated area of improvement (those with less than optimal answers)</td>
<td>Stressing on the government related criteria making it complicated to carry out changes</td>
<td>Were used by the governments to develop policies, based on input from the business community</td>
</tr>
<tr>
<td>Model/Tool</td>
<td>Organization/Author</td>
<td>Category</td>
<td>Description</td>
<td>Diagnosis</td>
<td>Assessment</td>
<td>Practicality</td>
<td>的目标</td>
<td>Suitable to identify either the community/county is ready for the implementati on of ICT</td>
<td></td>
</tr>
<tr>
<td>----------------------------------------</td>
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<td></td>
</tr>
<tr>
<td>Readiness Guide for Living in the Networked World (1998)</td>
<td>Computer systems Policy Project (CSPP)</td>
<td>e-society</td>
<td>measure the level of readiness of town, city, county, state, country or community</td>
<td>Questionnaire, statistic</td>
<td>Diagnosis</td>
<td>Only an approximate measurement on the technology usage</td>
<td>No</td>
<td>Suitable to identify either the community/county is ready for the implementati on of ICT</td>
<td></td>
</tr>
<tr>
<td>Ready? Net. Go! (2001)</td>
<td>McConnell International’ s &amp;World Information Technology and Services Alliance (WITSA)</td>
<td>e-economy</td>
<td>assess a country’s e-readiness to evaluate who is e-ready: which countries are enabling businesses, Governments &amp; citizens to flourish in network economy.</td>
<td>Statistic, best practices, historical analysis</td>
<td>Description, diagnosis</td>
<td>Focusing exclusively on e-business and e-government</td>
<td>No</td>
<td>The model/tool can be used as a guide in comparing the e-readiness level of nations</td>
<td></td>
</tr>
<tr>
<td>TRI index (2000)</td>
<td>Paraszaman &amp; Rockbridge Associates</td>
<td>e-society</td>
<td>assesses people’s readiness to interact with technology</td>
<td>Questionnaire</td>
<td>Description</td>
<td>Can be used as assessment tools to identify technology readiness of employee</td>
<td>Does not recommen d ways for improveme nt</td>
<td>A model/tool that focus solely on the people readiness concerning the technology</td>
<td></td>
</tr>
<tr>
<td>Global Diffusion of the Internet</td>
<td>The Mosaic Group</td>
<td>e-economy</td>
<td>measure and analyzes the growth of</td>
<td>Questionnaire, statistic, best practices,</td>
<td>Description</td>
<td>Provide a detail analysis on only focus on Internet</td>
<td>No</td>
<td>A useful model/tool to study about</td>
<td></td>
</tr>
</tbody>
</table>
| Project (1998) | internet throughout the world | • Sectoral absorption  
• Connectivity infrastructure  
• Organisational infrastructure  
• Sophistication of use | historical analysis | economic, political and social factors in technology growth and usage | community in developing the policy as it makes a comparative analysis of nations; complex with a balanced approach addressing individuals, government & business stakeholders. |
| International Survey of E-Commerce (2000) | World Information Technology and Services Alliance (WITSA) | To find out business and consumer awareness on electronic commerce and to identify potential action areas. | Questionnaire, statistic | Diagnosis  
Proscription | highlighting global issues which is the primary concern in developing e-business  
Highlighting on policy issues involving the government, making it complicated to carry out changes  
Most of the criteria assess in this model/tools are dealing with policy issue which are under the government’s concern |
| Negotiating the Net | Center for International Development (CID) at Harvard and the World Economic Forum | Designed to be used by communities of any size, to measure technological capabilities according to a four level scale | environment for IT  
• readiness of the community'  
• actual use of IT | Questionnaire, statistic | clearly shows the performance of the nations in relation to the ICT development  
No recommendation for improvement  
The model/tool that mainly focusing on the infrastructure |
| Model (2001) | Development and Conflict Management (CIDCM), University of Maryland | of internet in developing countries | • key players in internet development  
• internet development and ICT policy  
• negotiation between the players in developing the country’s internet | historical analysis | major controversial issues likely to remain problematic in the future | tools | outcomes of negotiations between key players over the phases of development |
All of the models/tools highlighted in this paper have their own drawbacks and require re-designing in order to produce comprehensive models/tools to be applied in the construction industry. Regardless, two models had been identified as suitable to be applied in the construction industry; Technology Readiness Index (TRI) developed by Parasuraman & Rockbridge Associates in year 2000 and Network Readiness Index (NRI) developed by Center for International Development (CID) at Harvard and the World Economic Forum. However, these two models address different issues. While the TRI index is focusing on assessing people’s readiness to interact with technology, the NRI is focusing on the infrastructure development. As previously mentioned, in order to choose the right models/tools, it has to suit the user’s goal. The user should choose a tool that measures what they are looking for, and does it against a standard that fits their own view of an e-ready society (Bridges.org, 2005a).

The other models/tools studied were found to be not really suitable for implementation in the construction industry because most of them address issues relating to e-governance which are beyond the control of the industry. These assessment criteria were instead used in helping governments develop policy prior to the ICT implementation.

6. Conclusion

Finding the best way of implementing IT/IS had become the major concern in most industries including construction industry as is evident in the findings of some of the researchers which showed that construction firms are still having problems in the application of IT. Generally, IT is useful for construction firms to improve communication and prevent loss of information (Jaafar, Ramayah, Abdul-Aziz, & Saad, 2007). The industry players have to be ‘e-ready in order to effectively implement the technology. Several e-readiness models/tools have been created and used by different groups, each looking at different angles of ICT, society, and the economy in order to identify the e-readiness capability. The main objective of this paper is to identify the suitable models/tools to be applied in construction industry. Factors such as the models/tools goal, assessment criteria, method of assessment and others need to be considered in identifying the suitable models/tools. Considering these criteria, two models were found to be suitable for the construction industry which are; Technology Readiness Index (TRI) and Network Readiness Index (NRI). It is believed that the construction industry may benefit from the adoption of these two models/tools in helping them assess two different elements involved in construction industry.

7. Future Research

Finding shows that most of the models/tools are only able to assess the e-readiness capability and diagnose the problem without making any recommendation for improvement. One of the most important aspects in assessing the e-readiness capability is not only to identify the current capability but also to find ways of improvement. Therefore, the author feels that there is a need to develop a new maturity model to be applied in construction industry, where the model will not only be able to identify the current readiness level but can also suggest ways of improvement in order to maximize the full benefit of IT/IS prior to its applications.

References


Harvard Center for International Development. Harvard University Centre for International Development

Readiness for The Developed World: A Guide for Developing Countries


