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Research Article

An Electronic Readiness Assessment Model for More Efficient Electronic Commerce Adoption by Iranian Small and Medium Contractors

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Abstract

More than 90% of companies in Iran construction Industry are small and medium sized contractors. Only 5% of them are using the electronic commerce services and facilities for their businesses. SMCs must re-evaluate every aspect of their strategies and quickly move to a working model where the e-commerce is essential for their success. The concept of electronic readiness assessment for SMCs has received limited attention in the literature. This paper proposed developing a valid model for assessing the capacity and capability of SMCs to adopt e-commerce in Iran construction industry. The research involved a comprehensive review of related literature and the collection of data to identify the indicators and criteria by means of documentary analysis and using a combination of more frequent e-readiness factors in current models and SMCs obstacles in e-commerce implementation. Focus discussion group was conducted by using interviews with SMCs' stakeholders for e-commerce to understand the contextual factors that influence the norms and attitudes prevailing in SMCs that affect their adoption of e-commerce. To test the conceptual model, a questionnaire was used to collect data from larger sample of SMCs in Iran. The collected data were analysed using a combination of "hermeneutical analysis" and Structured Equation Modelling. The findings confirmed that IT infrastructure, human resources, financial investment, owners or top management attitudes and cultural issues were the most important indicators that measure in detail the level of the e-readiness of SMCs to adopt e-commerce in Iran construction industry.

***Keywords*:** Small and Medium Sized Contractors; electronic readiness; electronic commerce adoption; Iran construction Industry

1. Introduction

Electronic readiness (e-readiness) is defined as a complex multi layered subject with several dimensions, including telecommunications infrastructure, human resources, and legal and policy framework (Gammack, 2004). E-readiness can mean different things to different people, indifferent contexts, and for different purposes (Peter, 2001). E-readiness of a Small and Medium Contractors (SMCs) is defined here as the ability of an SMC to successfully adopt, use and benefit from e-commerce. Electronic commerce (e-commerce) as a feature of Information and Communication Technology (ICT) is defined as the exchange of information, goods and services via the Internet (Sanayei et al., 2012). It has transformed the traditional methods of commerce in recent decades. As a developing economy, e-commerce has for some time now been widely used by various economic sectors for international and domestic business and economic transactions. It involves on-line or internet banking and business transactions, and on-line sales and supply of goods and materials. Many small and medium businesses who adopted e-commerce has also benefited from increased efficiency in management skills, financial planning and control, marketing, and possess the necessary motivation to be, for want of a better term, productive and entrepreneurial in industry (Fathian et al., 2008).

According to Ministry of Road and Urban Development (2018), 44% of small and medium businesses in construction as a big sector in Iran have a particular condition in technical, social, cultural, economic and political trends with little attention paid to e-readiness assessment studies. In the construction industry, SMCs play a key role both in number and contribution. Limitation in resources and infrastructure, the traditional and discontinuous business processes and importance of participant's and environmental issues are considered the characteristics of SMCs.

Iran construction industry has adopted e-commerce successfully. Also, the major large contractors have implemented e-commerce in their business practices. In this environment, SMCs left the others behind in incorporating e-commerce. The government's policy has pushed SMCs to adopt e-commerce to improve their current business practices. Though, SMCs put great hope in the use of e-commerce, they have experienced difficulty and even failure in transferring e-commerce into practice despite spending thousands of dollars (Ministry of ICT, 2018).

It is a relatively strong view among SMCs that e-commerce is difficult for effective adopting. As a result, it can be said that slow e-commerce adoption in SMCs could be attributed to factors in lack of capability and capacity of SMCs in the organizational level (Alaghbandrad *et al*., 2019). Effective adoption of e-commerce by organizations is required to be effectively ready both internally and externally being to better prepare for future e-commerce implementation (Peansupap and Walker, 2005).

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The organization's capability and capacity should be measured to obtain benefits which arise from e-commerce (Fathian *et al.,* 2008). The readiness assessment concept measures the current position of the SMC as compared to the targeted implementation requirements of the proposed system using several categories, and the targeted implementation requirement is referred to as readiness criteria (Karanasios *et al.,* 2006).

Due to the increasing use of information technology (IT) systems in all fields and the high failure rate of IT adoption, it is essential to effectively manage these projects is essential (Karimi *et al.,* 2020). According to a review of the literature, little consideration has been given to the factors associated with e-commerce exploitation in SMCs in the

construction industry. With the successful adoption of e-commerce, a comprehensive strategy should become a business objective for SMCs in Iran construction industry. It should give equal prominence to technology, people and processes involved in SMCs. SMCs need to get reliable information about the organizational capacity and capability to plan successfully their strategy for e-commerce adoption.

2. Literature Review

2.1 E-readiness models and concepts

Despite the growth in the utilization of information and communication technologies (ICT) in the Iran construction industry, there is a concern for e-readiness. There are different models and tools for e-readiness assessment nations and societies with different aims and objectives. However, the use of these tools would not be suitable for a comprehensive analysis of e-readiness in others due to their characteristics (Al-Omari and Al-Omari, 2006). According to (Fathian *et al*., 2008) the winners in e-commerce adoption will be those who consider structure, characteristics and culture in business that suit the requirements of e-commerce.

Statistics stated that the most SMCs use of the current models to measure their readiness has failed because SMCs related criteria are not included in the context of these models. There is a necessity to develop an e-readiness assessment model for SMCs to identify e-readiness gaps before any implementation of e-commerce adoption. However, there are some models for e-readiness assessment in the world, but these models have placed little emphasis on the e-readiness criteria in SMCs because:

Some studies have been conducted in micro- level as whole, but only limited studies have done SMEs e-readiness assessment (Salehi, 2006). Development of a model for readiness assessment of Iranian SMCs has a little literature. These studies have mainly concentrated on the organization as a whole or in different industry with different nature. For example Hourali *et al* .(2008) studied SMEs who has active in the ICT industry and Nabavi and Davidrajuh (2009) developed an e-readiness assessment model for SMEs in general. A comprehensive e-readiness assessment in the SMEs at the organization level cannot, therefore, be discounted in the building and implementation in Iranian SMCs where there are differences in business environment and organizational characteristics.

This study identified fourteen (14) models from valid resources were implemented for e-readiness assessment of SMEs in developing countries. These models were introduced below:

Molla, A., *et al.,* (2010) investigated the previous circumstances of sector based e-business use. The aim of this research was to understand the extent of e-business utilization in the horticultural supply chain, an area where there was little research coverage. This research reported that some of the reasons appear to be lack of pressure from market forces and the fact that respondents are yet to be convinced about the value of e-business to generate efficiency and return on investment. The results have established of e-readiness assessment mode, it provides no account for other requirements such as human capital and cultural concerns.

Salah, K. and Irwin, B., (2006) proposed a conceptual framework for examining the interaction of structural properties of e-commerce in SMEs in Least Developing Countries (LDCs). The framework integrated the structuration theory concepts with factors drawn from e-commerce studies in SMEs in LDC. . The conceptual framework was constructed with key success factors, organizational, external factors and innovation factors. They added two new constructs mobile technology, and Socio-cultural factors to Molla and Licker's (2005) Perceived e-Readiness Model (The PERM) as factors that influence e-commerce from the environment.

Kurnia, S. and Karnali, R. (2008) examined a variety of e-readiness factors inside Indonesia, along with its compelling factors and impediments. A multiple case study was conducted involving eight organizations with different background and positions in the supply chain within the Indonesian grocery industry. The grocery industry was chosen as the study focus because it often pioneers technology adoption in various countries due to the characteristics of the industry that involves high transaction volume and low profit margins.

Rizk (2004) did a study intending to evaluate the SMEs e-readiness in the Egyptian Textile industry, in particular their readiness for electronic commerce. Based on findings in this research, Based on findings of the study, increasing the e-readiness of small and medium sized firms required heavy investment in human capital, to be complemented by raising awareness and upgrading levels and types of connectivity.

Ramayah Lim, T. *et al.,* (2011) carried out a research to assess SMEs e-readiness in Malaysia. The aim of this research was to investigate the factors contributing to the e-readiness of SMEs in Northern Malaysia. The findings showed that in general top management commitment and infrastructure and technology have a significant impact on SMEs' e-readiness. However, human capital, resistance to change, and information security did not have a significant impact or contribution on e-readiness in SMEs.

Dada(2006)investigated the critical review of the e-readiness concept, concentrating specifically on SMEs in developing countries. After an examining numerous relevant theoretical frameworks, the author identified two models (PERM and UTAUT) which seemed combination of them is an appropriate starting point for developing countries. This model was proposed which gives importance to both e-readiness (the environment) and technology acceptance (the organization), in order to gain understanding of the situation.

Molla, A. and Licker, P.S. (2005) developed Perceived Electronic Readiness Model (PERM) for e-readiness assessment of SMEs in developing countries. In order to make the model parsimonious, they have identified two constructs Perceived Organizational E-Readiness (POER) and Perceived External E-Readiness (PEER). Taken together, PEER and POER were hypothesized to predict e-commerce adoption and explain a significant part of the variance in the level of e-commerce adoption in developing countries. ICT business knowledge of top management; unique business relationships and partnerships which offer resource complementarities; and the use of social capital and networks to innovate e-commerce applications are among the critical internal or firm specific resources identified in this paper. The external resources include the government's readiness in creating an enabling environment through policy and ICT infrastructure; and the accessible global resources.

Zakaria, M.S. and Janom, N. (2011) conducted a search to contribute to the development of inter-organizational or business-to-business (B2B) e-commerce Maturity Application (BeMA) for Small and Medium Enterprises (SMEs) in Malaysia, which focus specifically on the validation process of e-readiness assessment indicators categorized to three main dimensions include: Individual, Organization and Environment. The model and tool developed in this research were multidimensional constructs composed of theoretical dimensions that capture key elements involving individual, organizational and environmental aspects of B2B e-commerce including eight indicators.

Nabavi, A. and Davidrajuh, R. (2009) developed an e-readiness assessment model for evaluating the e-readiness of ICT Companies (IIC) in Iran. The role of decision makers in organizational level, financial structure of SMCs and culture are not assessed in this model. The implementation of this model is easy for SMEs because it provided a set of questions for assessing e-readiness.This model also was implemented to assess e-readiness of three companies in Iran, but it is not possible to implement for Iranian SMCs e-readiness assessment, due to different characteristic of companies.

Hourali M., *et al.,* (2008) developed E-readiness of Small and Medium Enterprises (ESME) model for e-readiness assessment of non-profit SMEs was active in IT area in Iran. This research first reviewed the e-readiness assessment models proposed for countries at macro scale and then identifies the critical factors for SMEs e-readiness assessment. Four important factors were extracted which show the critical issues for ESME assessment. The first factor includes Skills and Human Resources, ICT Management and Policy, Investment and Financial Support for ICT Development and Revenue on electronic services that were named as Organizational features.

The second factor consists of Information Infrastructure, Network Speed and Quality, ICT Services and Support, and ICT Employment Opportunities and was named as Information and communication technology infrastructures. The third factor includes Internet Availability and affordability, Information and Communication Technologies in the Workplace, and People and Organizations Online. This factor was named as IT availability; and final factor 4 including Security and Encryption, and Legal Environment and Regulations is named Security and legal environment.

A conceptual model for e-tendering readiness in any construction organization developed by Moath Al Yahya *et al.* in 2018 (e-TRM). This involves a review of previous e-tendering models, the importance of e-tendering models for the construction industry and the requirements for developing e-TRMs. A model contains five themes: people, process, work environment, technology and service providers. The e-TRM themes consist of 13 constructs representing the basic items for e-tendering readiness. Ultimately, the e-TRM can be used worldwide; however, the model needs to be tested empirically for verification.

Eric C.W. Lou *et al*., (2019) developed a framework for e-readiness self assessment for UK small and medium enterprises building services providers in construction industry (ERiC). They stated cultural concerns, technology competence and financial commitment as key readiness assessment factors for electronic commerce in UK construction companies.

Salma S. Abed (2020) examined factors that affect e-commerce adoption by SMEs in Saudi Arabia. Using the Technology-Organisation-Environment (TOE) as the theoretical framework, the researcher tested the model and related hypotheses, employing structural equation modelling. The results from a survey of 181 SMEs in Saudi Arabia indicate that trading partner pressure in the environmental context, followed by top management support in the organisational context, and perceived usefulness in the technological context, have the most significant influence on behavioural intention to use social commerce.

Stephen Akunyumu, *et al*., (2021) determined the applicability of existing models for assessing the readiness of construction organizations to adopted e-commerce. Five models of organizational readiness assessments were identified and compared based on a set of identified criteria. The comparative analysis revealed that three of the criteria can be used to assess the readiness of construction organizations for e-commerce adoption, albeit with varied scopes of modification. The research presents human capital, top management commitment and resistance to change as the most appropriate factors to assess their readiness.

Table 1
Influence Factors in E-readiness Assessment Models

Model Name	Anther	Factors
E-readiness of SME (ESME)	Hourali *et al.* (2008)	Organizational Infrastructure IT availability Technologies in the workplace,
E-readiness of Iranian ICT Companies (IIC)	Nabavi, A. and Davidrajuh, R.(2009)	Human resource, Network application, Network world enablers, Promotion and facilitation, E-infrastructure
Business to Business E-commerce Maturity Application (BeMA)	Zakaria M.S. and Janom. N. (2011)	Personal Traits, Organizational Features, People Competencies, Technical Resources, Business Process, Market Forces, Supporting Industry
Perceived Electronic Readiness Model (PERM)	Molla, A. and Licker, P.S. (2005)	Government commitment, Market Managerial capabilities, Social networks. Technology Infrastructure
SMEs E-readiness Assessment Tool in Africa (SEATA)	Dada (2004)	Organizational Features, Behavioral Factors, Environment, E-readiness Measure
SMEs E-readiness Assessment Tool in Malaysia (SEATM)	Ramayah Lim. T., C.Y. Mohamed and Sulaiman (2011)	Infrastructure & technology, Human capital, Information security concern, Top management commitment, Resistance to change.
SMEs E- Readiness Assessment Tool in Egypt (SEATE)	Rizak (2004)	Human capital, Awareness.
SMEs E-readiness Assessment Tool in Indonesia (SEATI)	Kurnia, S. and Karnali, R., (2008)	Perceived Benefits Top Management Foreign Influence Coercion
An Integrated E-business Use Model for SMEs (IEUS)	Molla, A., Peszynski, K. and Pittayachawan, S., (2010)	Human capital Cultural concerns Technology competence, Financial commitment, Perceived environmental e-Readiness Organizational size.
E-readiness of SMEs in Least Developing Countries (LDC)	Salah, K. and Irwin, B., (2006)	Top managers ability Owners' support Structural assurance Existing institutional structures IT labor force IT literacy Business partners' benevolence Political leadership Business environment Financial support Trust enablers Market forces Supplier's behavior and performance Innovation factors.
E-tendering readiness in Saudi Arabia construction industry (e-TRM)	Moath Al Yahya, Martin Skitmore, Adrian Bridge, Madhav Nepal, David Cattell (2018)	people, process, work environment, technology and service providers.
E-readiness in construction (ERiC)	Eric C.W. Lou, Angela Lee, Jack Goulding (2019)	Cultural concerns, Technology competence, Financial commitment.
Social commerce adoption (TOE)	Salma S. Abed (2020)	Trading partner pressure in the environmental context, Top management support in the organisational context, Perceived usefulness in the technological context.
E-readiness assessing of construction organisations	Stephen Akunyumu, Frank D.K. Fugar, Emmanuel Adinyira, James Cofie Danku (2021)	Human capital, Information security concern, Top management commitment, Resistance to change.

Despite the importance of e-readiness assessment models, an investigation existing measurement model in this paper identified various limitations to assess SMCs readiness.
The models that were introduced in this study are developed with different aims, objectives and nature. According to Vaezi et al. (2009) e-readiness assessment of SMEs is a very difficult job where each SME has its own issues and priorities. Barzilai-Nahon (2006) stated that many businesses do not have the same environment in e-commerce implementation in developing countries. These inequalities have a negative impact on all models for e-readiness assessment of SMCs.

Despite the similarities, e-readiness assessment across each country is faced with unique factors that are very relevant to the particular country to facilitate effective assessment Abdallah and Fan (2012), and therefore these unique factors must be identified for the purpose of assessment. The characteristics of industries and firms are important factors in e-readiness assessment. These factors arise from differences between the countries technical, social and political situation, the nature of the industry, kind of business and firms size (Bruque and Moyano, 2007). Current e-readiness assessment models have not seen Iranian SMCs characteristics are considered

some factors with different variable weight. Therefore, these models cannot assess e-readiness in SMCs accurately.

An in-depth survey of existing models showed that some of these tools are uncertain and ambiguous in practice (Azab *et al*., 2009). The main reason identified is the lack of detailed criteria and guidelines for practical assessment of e-readiness. This issue has led to different results from different measurements. If the limitations of SMCs in financial resources, skilled IT staff and time take into consider, these models are not easy to use for e-readiness assessment of SMCs.

A comprehensive model can assess SMCs e-readiness success. This is to say that no assessment model is likely to cover all topics and deliver a complete set of required data (Karanasios *et al*., 2006). The barriers of SMEs to use e-commerce should be also counted as factors in their e-readiness assessment (Gretzel and Fesenmaier, 2001). Consideration of these problems in e-readiness assessment model can lead to the proper set of tools. The models studied in this research are not developed for SMCs so they could not cover SMCs related problems in e-commerce adoption. In order to answer the research questions, extensive and detailed discussion of literature has been undertaken to identify major factors that influence e-readiness in SMCs. Theories about the diffusion of innovations such as e-commerce have also been discussed and used to support the main constructs identified in the proposed model.

2.2 Small and medium contractors

The SMCs are mainly small and medium sized single proprietor companies run by individuals or as family businesses. The SMCs are companies which undertake construction contract work not more than USD 1 million. The Table 2 shows undertake construction contract by contractors.

Table 0
Undertake Construction Contract by Contractors (DPSPC, 2010)

Firm Size	Number of Employees	Annual Incomes
Small	5-49	< 300000 USD
Medium	50-99	< 1000000 USD
Large	More than 100	> 1000000 USD

In the context of Iran construction industry, small and medium size contractor (SMC) is an organization who does construction work individually or prepares services for general contractors (DPSPC,1990). SMCs play a key role in the economy makes a strong contribution to the Iranian construction industry (Naserolmemar *et al*., 2011). SMCs construct buildings and other infrastructure facilities for the major part of the population (60%) who are distributed in rural and remote area (Bagherinezhad *et al*., 2007). SMCs undertake the small and scattered projects which are among the key components of development required in the country (Housing and Building Research Centre, 2010). SMCs employ about 47% of formal employment in Iran construction industry (Iran Statistics Centre, 2011), and SMCs create a competitive market due to the low price of their services (Emamgholi, 2018). Majority of the SMCs are still being run or operated in a traditional business way which is much manual in nature. They have simple structure where decisions are made by the owner himself.

The SMCs operating in remote areas and are still operating in a traditional way, using a workable system that is inefficient, slow, and labour intensive. Business process in SMCs is still largely at traditional process mainly carried out using manual tools (Alaghbandrad *et al*.,2018). Many processes that could be automated are still paper based. Information management as a key activity in project success is still based on using traditional methods (Ahmed *et al*., 2007). Collection, creation, exchange sand storing of information within the organization are on pen and paper as hard copy. Project data exchange and communication between SMCs and other participants, especially in projects that are geographically distributed is based on paper, face to face meeting and personal contact by telephone (Afsharipour *et al*., 2016). Documents are still captured as hard copy which is difficult to access and quite often requires vast areas of expensive storage space and more often than not, is the only copy of the document that exists (Anumba and Ruikar, 2002).

Despite increasing Internet usage for financial transactions in the country by SHETAB (National Network for Online Money Transaction in Iran), the traditional system issued by SMCs for buying or selling goods and services (Iran´s Ministry of ICT, 2019). Transferring money by hand, payment by cash or cheque and physical transaction are traditional methods used by most SMCs. These methods have increasingly become inactive, incorrect and obsolete resulting in distrust between participants in a market environment (Grau *et al.,* 2009). Traditional business methods are arduous leading to slow information exchange resulting in delay and errors (Alaghbandrad *et al*., 2018). It is time and cost consuming (Alshawi and Ingirige, 2003). In general, traditional business risks have led to enormous failures in SMCs and those who are affected the most are those harbouring the impression that there is quick money to be made. There is a need for changing business process within SMCs in Iran construction industry (Shafaghi, 2017).

Today, powerful clients, suppliers and competitors are instrumental in maintaining a competitive position within

the market (Ahuja *et al*., 2009). They are substituting new methods to do business efficiently and to increase their market share. In this environment, SMCs cannot fall behind others. As a key member of the project team, they have to complete the projects in the least amount of time and at the least cost, while delivering high quality results. It leads to the need to update the business method sand in order to increase their efficiency in the market. On the other hand, Iran government forces business in the construction industry to implement new technologies such as e-commerce for greater efficiency in their current business process (Iran´s Ministry of Road and Urban Development, 2018).

There are some differences among SMCs in the construction industry and SMEs due to different characteristics of the business. SMCs in the construction industry typically work outside (Shafaghi, 2017). They use construction materials such as drywall, asphalt, brick, cement, concrete and various binding applications to build physical structures where the projects are discontinued. So, the labor force is not fixed. SMCs work for private individuals or businesses as well as government employers on projects for hire. According to Alaghbandrad *et al*. (2018) SMCs typically head up the construction process and subcontract certain elements of the construction process to specialists such as drywall hangers, roofers, plumbers and electricians.

SMEs employ workers in an office or factory. Employees typically work in a particular division or on a manufacturing assembly line. SMEs involve manual labor and automated processes used to turn raw materials into finished goods for sale. Manufacturing is the first step in the conventional distribution channel that outlines the flow of products from initial development through sale to the end customer. Manufacturers typically sell to distributors, who sell to retailers, who sell to consumers.

Since this research is all about the development of e-readiness assessment model for SMCs, one might argue that there is already e-readiness assessment tools developed for SME, so what is the justification to develop another one specifically for the SMC. There are differences between SMCs with SMEs in other industries is a reason to investigate the SMCs' characteristics in more detail. In this context, it is necessary to see the differences between the two entities.

SMCs have a similar business objective such as survival, which is a function of the scarcity of work, low barriers to enter the market and constant struggle for survival with limited resources. Their main priority is to successfully complete their current project, make a profit and seek the next project to survive. Therefore, the SMCs prefer to choose the cheapest and most convenient alternative to business.

No preference on the types of construction work accepted because of the strong need to survive, the SMCs have no specific policy or preference on tendering and accepting projects. With the large number of SMCs and limited project opportunities, competition to secure the project is notably strong. SMCs are almost exclusively selected based on the lowest price instead of the best technical solution.

The owner of the SMCs has a hands-on approach to the operations of the company. They are involved in tendering, planning, scheduling, resourcing, purchasing and managing. These directors are close friends and relatives that have known the company's owner for a period of time and trust the owner to take full charge of the company's operations. The owner is involved in every decision-making aspect. This characteristic is suspected to be a constraint on the use of new technology of SMCs because the owner is driven by the low-cost requirement and has no long term strategies. The SMCs have a small number of employees. A small number of the technical staff works as project managers, site supervisors and site engineers.

The SMCs do not directly employ their own site labour; instead, they rely on the extensive use of sub-contractors, and most labourers are unskilled. It is not economical for SMCs to have their own labour because of the limited number and locations of projects, there is no guarantee of continued work, and the new project may be in a different area. The construction industry is highly fragmented with a clear separation among the contractors; sub-contractors and workforce on site.These characteristics of SMCs cause the difference with SMEs in adopting new technologies such as ICT and e-commerce in business practices.

2.3 Benefits of ICT and E-commerce to business organizations

The e-commerce is now the drivers of business systems and a decisive factor in business models, supplying applications to replace administrative systems in all disciplines and organizations, and providing a range of platforms to launch new products and services. It is clear that productivity is of prime importance as an outcome of e-commerce use and provides a significant commercial advantage. Using ICT systems, synchronization between organizational aspects increases productivity and meets customers' and the market's requirements. Further, e-commerce facilitates interactive communications between the sellers and buyers. Therefore, in a comparison of traditional and e-commerce business models, e-commerce enhances both the situation of an entity advertising its products and services, and a marketing environment where there are many sellers and buyers.

E-commerce as a new technology improves productivity in SMCs through maximizing public services and minimizing costs (Alaghbandrad *et al*., 2018). A means of maximizing sales and minimizing costs is to maintain clients' loyalty, and e-commerce offers this by the use of clear information to elicit trust and customer satisfaction (Laudon and Laudon, 2000). Productivity growth helps small and medium size businesses to be more profitable and active amongst the construction sector to boost the country's economy (Ruikar, 2006). Before e-commerce, larger contractors alone had the resources to expand internationally. E-commerce is now an attractive and cost-

effective means for startups or smaller firms to access new clients. E-commerce business models offer competitive advantages for SMCs (Alaghbandrad *et al*., 2018). A key factor in e-commerce adoption is the removal of geographical boundaries.

E-commerce across international borders simplifies trading between producers in one country and suppliers, dealers or agents elsewhere (Abassi, 2007). Internet trading allows 24-hour access of products or services, eliminating communications delays and leading to higher business transaction speed (Laudon and Laudon, 2000). Information is downloadable, conditions of sale clear and the transaction may be fully automated at the seller's warehouse with shipping information, clients' confirmations, and payment history readily available.

Productivity with e-commerce is enhanced within all organizations, private and public, through maximizing public services and minimizing costs (Alaghbandrad *et al*., 2018). A means of maximizing sales and minimizing costs is to maintain clients' loyalty, and e-commerce offers this by the use of clear information to elicit trust and customer satisfaction (Laudon and Laudon, 2000). The following section discusses the relevant benefits of e-commerce for enhancing organizational productivity and performance of small and medium businesses in the construction industry.

2.4 E-commerce in small and medium sized contractors

A report by Housing and Building Research Center (HBRC, 2018) stated that large size companies in construction sector had nearly reached full Internet adoption and use of web pages. Al-Qirim (2008) identified that e-commerce adoption in small businesses occurs differently than adoption in large enterprises. According to Chong and Pervan (2007), e-commerce adoption in companies strongly depends on the size and characteristics of the organization.

HBRC also reported 65% small and medium size enterprises (SMEs) connected to the Internet were engaged in Internet based sales, and 29% were actively placing orders for goods and services. The report shows that only 5% of SMCs have adopted e-commerce and 32% have implemented the Internet. All companies with 100 or more employees were using computers, and of these 91% have access to the Internet, and 58% have a website. Statistics show there is a big difference between large and small companies in e-commerce adoption in Iran construction industry. Despite all of the advantages in e-commerce implementation, SMCs are behind other Small and Medium Enterprises (SMEs) in e-commerce adoption. Figure 1 compares the rate of e-commerce adoption in SMCs and SMEs in the Iran construction industry.

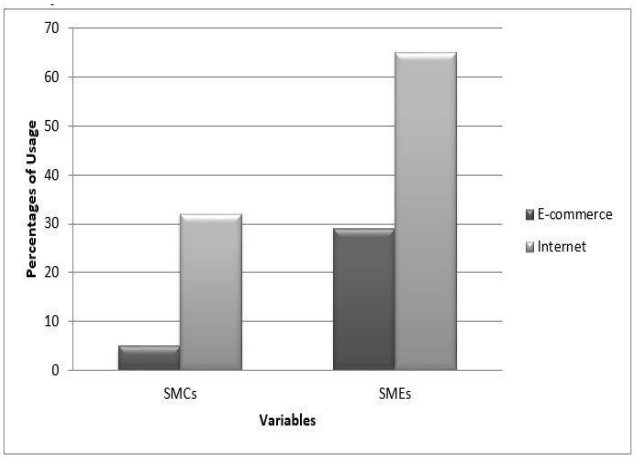

Fig. 1. Internet and E-commerce Implementation in SMCs and SMEs (HBRC, 2018)

Despite an appropriate level of awareness, there is a low rate of willingness to adopt e-commerce in SMCs. Ghorishi (2009) stated small and medium size companies are usually facing some barriers in e-commerce adoption. According to Housing and Building Research Centre (HBRC, 2018), Iranian SMCs have not been successful in e-commerce adoption due to some obstacles for e-commerce adoption in small and medium businesses.

2.5 Barriers for E-commerce adoption by SMCs

There are some barriers in small and medium size business that inhibit the adoption of e-commerce (Hourali *et al*, 2008). This section reviewed effecting barriers in e-commerce adoption by small and medium size businesses Implementation of the technology in an organization and in business processes requires the assessment of issues in a broader context. According to Mousavi (2017) technology adoption without addressing socioeconomic dimensions in the organization (e.g. Business needs, culture, learning requirement, and incentives) can cause problems.

Table 3
Barriers of E-commerce Adoption in SMCs

Category	Barrier	Sub Barrier
Organizational Barriers	Human Resources	Awareness and Commitment
		Level of E-commerce Knowledge
		Cultural Issues
	Financial Issues	Financial Resources for Investment
	IT Infrastructure	Availability of the Internet
		Web presence (existence of Website or Email)
		Level of Automation
		Technical Support Staff
		Availability Software and Hardware
Environmental Barriers	Government and Industry Support	Financial Support
		Technical Support
		Taxes and Tariffs
		Legal Issues
	Business Partners' Readiness	Client Readiness
		Competitor Readiness
		Supplier Readiness

Cultural resistance has resulted in organizational change by e-commerce (Tan *et al*., 2009). Successful use of e-commerce mainly depends upon an organization's structure and efficient management (Kreindler *et al*., 2004). The human element is still the most crucial factor in e-commerce (Gloor, 2000).

Da Costa (2001) stated that the information technology implementation changes the structure of jobs and other organizational practices. These usually arise in an ad hoc and unsystematic way as a problem of changing the organization, business structure (Kothari *et al*., 2005).

The result is often tension and failure in technology adoption. According to Hourali *et al.* (2008), the process by which a firm adopts and implements technological innovations is influenced by the organizational context, and the environmental context.

2.6 Proposed model for assessment of SMCs' e-readiness

E-readiness of SMCs is related to the level of e-commerce adoption by them. SMCs for achieving to a good level of e-readiness must remove the above mentioned barriers and also pay attention to the factors influencing IT adoption. Therefore, assessment model of SMCs should be determined with regarding these barriers and also the factors affect e-commerce adoption in SMCs.The initial theoretical model for this research is predominantly based on a combination of factors from ten e-readiness assessment models in SMEs and characteristics of SMCs to formulate a unified model. This paper consider the mentioned barriers and the factors influencing e-commerce adoption in SMCs in four(4) main indicators which are human resource, financial investment, IT infrastructure, Industry environment and twenty (20) related criteria.

In this paper, we propose an assessment preliminary model of ESME with regarding the four mentioned dimensions which are as follows (as shown in figure 2):

a. Human resources mean people in the organization. It refers to an assessment readiness of the relevant human resource factors to uptake e-commerce. This study categorized people in SMCs in two categories including: The staff and decision makers (Top management).
b. Infrastructure is defined as a foundation or underlying base for SMCs. In this research, IT infrastructure refers to the current level of planning or implementation ICT features such as hardware, software, information security, communication media, ICT skilled staff employment and ability to incorporate e-commerce in the organization.
c. Financial Investment refers to an assessment of the financial investment for e-commerce adoption within the SMCs. Limited financial resources is one of the SMCs' characteristics' main components. It can be considered an important barrier of e-commerce adoption. The financial structure of the companies indicates that financial ability of organizations is a factor which affects e-commerce adoption. Major concern in Small businesses is the initial financial investment for adoption of e-commerce.
d. Industry environment refer to two directions, including: Government and industry leadership that refers to the government and industry leadership supports in the development, presence, technical level and cost structure of the organization, and stakeholders refer to clients, competitor, consultants and suppliers' ability to engage in e-commerce.

The key indicators extracted from the data analysis for e-readiness assessment in SMCs in Iran construction industry are as follows:

1. Information Technology Infrastructure (IT)
2. Human Resources (HR)
3. Industry Environment (IE) and
4. Financial Issues (FI).

The e-readiness assessment initial theoretical model developed. The four identified indicators predicated for the theoretical model were used as nodes for extracting criteria from the findings classified separately. Each of these criteria is accompanied by a selective reporting of some noteworthy responses from the participants.
The general discussion particularly focused on reviewing e-commerce adoption in SMCs and the initial model's factors that affected the readiness assessment of SMCs to adopt e-commerce identified by literature in this study. At the beginning of the discussion, four indicators affecting on readiness for e-commerce adoption in SMCs were listed such as: IT Infrastructure, Human Resource, Financial Resources and Industry Environment. The majority of the experts believed that Culture Issues and Owner or Top Management Attitude should be considered as two main factors in the theoretical model. In the second step of discussion, experts discussed the e-readiness criteria were presented in the initial theoretical model for e-readiness assessment of SMCs in detail.

IT Infrastructure (IT)

Technological resources underpin all ICT activity as the infrastructure is a fundamental requirement for firms wanting to move their business online. However, the decision to adopt these technology applications is a consequence of awareness, commitment and a business plan underpinning investment in technology. Similarly, skills and knowledge are required to advise management on their ICT investments (Hourali *et al*., 2008).
According to all experts, the implementation of e-commerce within a SMC requires a new acquisition of infrastructure since the currently available infrastructure could only satisfy the minimum system requirement for e-commerce adoption. The experts argued that it is should be supported smooth running of the hardware and software and network, justifying the upgrade systems and creating the website as initial requirements for e-commerce implementation successfully. Other than that, adequate infrastructure must also be present, and is especially important when it involves communicating e-commerce with business partners and acquiring technical support and adequate network Bandwidth. Therefore, an adequate IT infrastructure features as other e-commerce readiness indicator. Table 4 lists all measurement items used for information technology infrastructure in this research.

Table 4
Measurement Items of IT Infrastructure

Item	Criterion	Source
IT1	Website Availability for Business Promotion	Hourali *et al*. (2008); Ruikar (2006)
IT2	Current Use of Internet	Molla,Lincker (2005);Morgan *et al*. (2006)
IT3	Existing Hardware, Software and Security	Nabavi *et al*., (2009)
IT4	Number of Computers Connected to the Internet	CID (2000); Nabavi *et al*. (2009)
IT5	Bandwidth of Access to the Internet	Ruikar (2006)

Human Resources (HR)

ICT innovation is a decisive factor in improving employee competency and the reverse is also true (Fathian *et al*., 2008). An investment in employee ICT-based skills and knowledge accelerates the introduction of e-commerce as the level of technological awareness and understanding increases in the firm.

All experts admitted that the introduction of e-commerce software in the industry is ad-hoc and the software providers themselves had a limited competency in delivering advanced training which became one of the factors justifying the need to send the staff abroad, and to engage an externally hired e-commerce Administrator. Meanwhile, the on-job training was conducted right after the formal training by using the currently running the implementation. In the on-job training, the trainees are guided and assisted personally by the Administrator. The on-job training targeted improving IT skills and confidence level and is conducted in a step by step approach, starting with a low risk activity. Table 5 lists all measurement items used for human resource in this research.

Table 5
Measurement Items of Human Resource

Item	Criterion	Source
HR1	Staff Awareness	Ramayah *et al*. (2010)
HR2	Staff Adequate IT Knowledge	Ramayah *et al*. (2010)
HR3	Commitment of Staff to Training	Hourali *et al.* (2008)
HR4	Commitment of Staff to Use E-commerce	Ruikar (2006); iQ Net (2000)

Financial resources (FI)

This indicator seeks to understand the investment towards online operations for the firm. E-readiness could encompass a range of factors that provide underpinning for internal financial and administrative processes, and external communications and data transfers with suppliers, government, clients and all enquirers. Table 6 lists all measurement items used for financial investment in this research.

Table 6
Measurement Items of Financial Investment

Item	Criterion	Source
FI1	Financial Investment for the Systems' Setup and Upgrade	Hourali *et al*. (2008); Kurnia *et al.* (2008)
FI2	Financial Investment for Employ IT Staff	Rizk (2004)
FI3	Financial Investment for Utilizing Advisors from Outside	Rizak (2004); Molla *et al.* (2010)
FI4	Financial Investment to Maintain the Systems	Interview
FI5	Financial Investment to Train of Staff	Interview

Industry Environment (IE)

Relative to Iran construction industry, a firm's IT infrastructure and the technological competency of its staff reflect its ability to compete when others may have access to larger markets or are using e-commerce to become more cost-effective. In this section, the competitiveness of the participants' firms within construction industry is explored. The experts stated that the competitive forces within the construction industry were instrumental in decision-making, with the majority agreeing that industry practice in adopting e-commerce influences an organization's decision to innovate. The strongest influences for the industry members were competition, the support of government and industry leaders, the readiness of suppliers and clients.

The majority of participants accepted that e-commerce can provide competitive advantage, and would adopt online services once it was established in construction industry and when they were convinced it was financially acceptable. Participants commented on Industry Environment some eleven times during the discussion, and this reflected their attention to market conditions. Table 7 lists all measurement items used for industry environment in this research.

Table 7
Measurement Items of Industry Environment

Item	Criterion	Source
IE1	Technical, Financial and Training Support	Molla *et al*. (2005); Croom *et al*. (2005)
IE2	Legal and Regulations Framework at Level of Taxes and Tariff	Kurnia *et al*.(2008)
IE3	Pressure by Stakeholders	Interview
IE4	The Current Use of Website by Stockholders	Hourali *et al*.(2008); Zakaria *et al*.(2011)
IE5	The Current Use Online Transaction System by Stockholders	Hourali *et al*. (2008)

Cultural Issues (CI)

Culture refers to the organization's values, beliefs, practices, rituals, and customs. Almost all experts noted that SMCs leaders need to know their own business culture and level of organizational learning before promoting new technologies to their employees. The effort should be made to understand the background of the employees who are involved in the learning process involved in adopting new technologies in the business operations. Instead of that, the cultural differences in cross-countries can also present an obstacle to e-commerce adoption.

The experts suggested considering some identified factors related to cultural perspectives, such as: resistance to change, cultural issues relating to local workforce, and technology advancement, which might be too important for owners and top managers of SMCs. Table 8 lists all measurement items used for cultural issues in this research.

Table 8
Measurement Items of Cultural Issues

Item	Criterion	Source
CI1	Resistance to Change	Interview
CI2	Level of Trust with E-commerce	Arslan and Kivrak (2007)

Owners and Top Management Attitude (OMA)

Owners and Top Management Attitude refer to an organization leaders and their organization's decision to adopt e-commerce is impacted by the executive's attitude and personality. This criterion emphasized by experts in this study to consider as one of the main indicators in the theoretical model.

It appears that the owners and top management attitude has a significant role in the readiness of SMCs for e-commerce adoption. The analysis of the expert's group discussion showed the extent to which owners or top managers influence the decision to adopt e-commerce in SMCs. They stated that any decisions about organizational change regarding technology adoption will only be made by executives.

However, several factors were suggested by experts in the discussion, but all of the experts agreed to this matter that e-commerce adoption requires to owners or top management attitude. Table 9 lists all measurement items used for owners and top management attitude in this research.

Table 9
Measurement Items of Owners and Top Management Attitude

Item	Criterion	Source
OMA1	Owner/ Top Management Awareness	Ramayah *et al.* (2010)
OMA2	Managers' Adequate IT Knowledge	Interview
OMA3	Commitment with Plan the Policy and Strategies for E-commerce Development	Hourali *et al.* (2008)
OMA4	Commitment to allocate Adequate Resources in Term Time, Budget for Adopting, Training and Developing E-commerce	Interview

The analysis of the data from interviews with experts found that the factors motivate and/or barriers affecting e-readiness of SMCs. Table 10 presents the findings from the overall participants' comments and suggestions in this research.

Table 10
Factors Affecting E-readiness of SMCs

Factors	Impact on e-readiness	Frequency during the interviews
HR1: **Staff Awareness**	Motivator	14
HR2: **Staff Adequate IT Knowledge**	Motivator	15
HR3: **Commitment to Training**	Motivator	15
HR4: **Commitment to use**	Motivator	13
IE1:**Technical, Financial and Training Support**	Motivator	10
IE2:**Legal and Regulations Framework at Level of Taxes and Tariff**	Barrier	9
IE3:**Pressure by Stakeholders**	Motivator	9
IE4:**The Current Use of Website by Stockholders**	Motivator	11
IE5: **The Current Use Online Transaction System by Stockholders**	Motivator	11
FI1**: Financial Investment for the Systems' Setup and Upgrade**	Motivator	14
FI2**: Financial Investment for Employ IT Staff**	Motivator	15
FI3**: Financial Investment for Utilizing Advisors from Outside**	Motivator	10
FI4: **Financial Investment to Maintain the Systems**	Motivator	12
FI5: Financial Investment to Train of Staff	Motivator	11
OMA1**: Owner/ Top Management Awareness**	Motivator	13
OMA2**: Managers' Adequate IT Knowledge**	Motivator	11
OMA3**: Commitment with Plan the Policy and Strategies for E-commerce Development**	Motivator	12
OMA4**: Commitment to allocate Adequate Resources in Term Time, Budget for Adopting, Training and Developing E-commerce**	Motivator	13
CI1**: Resistance to Change**	Barrier	12
CI2: Level of Trust with e-commerce	Barrier	11
IT1**:Website Availability for Business Promotion**	Motivator	13
IT2**:Curent Use of Internet**	Motivator	9
IT3**:Existing Hardware, Software and Security**	Barrier	11
IT4**:Number of Computers Connected to the Internet**	Motivator	11
IT5: Bandwidth of Access to the Internet	Barrier	15

The Revised Theoretical Model

The changes made to the initial theoretical model and the relationships posited between constructs in light of the results of the interviews analysis is clearly highlighted in the comparative illustration of the initial and revised research model. Figure 2 presents the theoretical model after it was modified in this chapter.

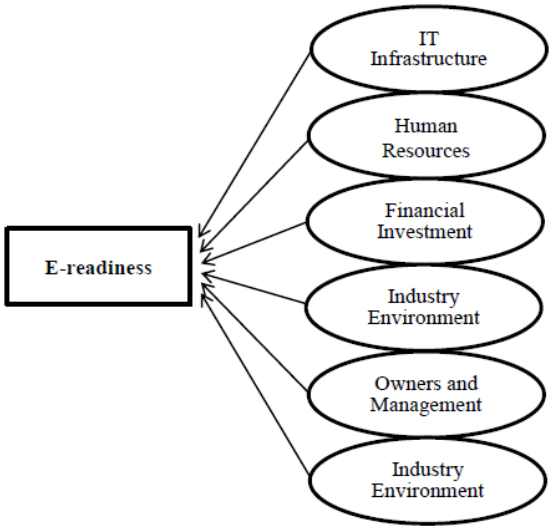

Fig. 2. Revised Theoretical Model after Considering the Qualitative Results

The revised model can be depicted in further detail with relationships between the indicators and criteria to show the factors' relationship that will be tested using Structural Equation Modeling. Figure 3 summarizes the indicators with their criteria and their proposed hypotheses showing how indicators influence the readiness for e-commerce adoption in a SMC in Iran construction industry.

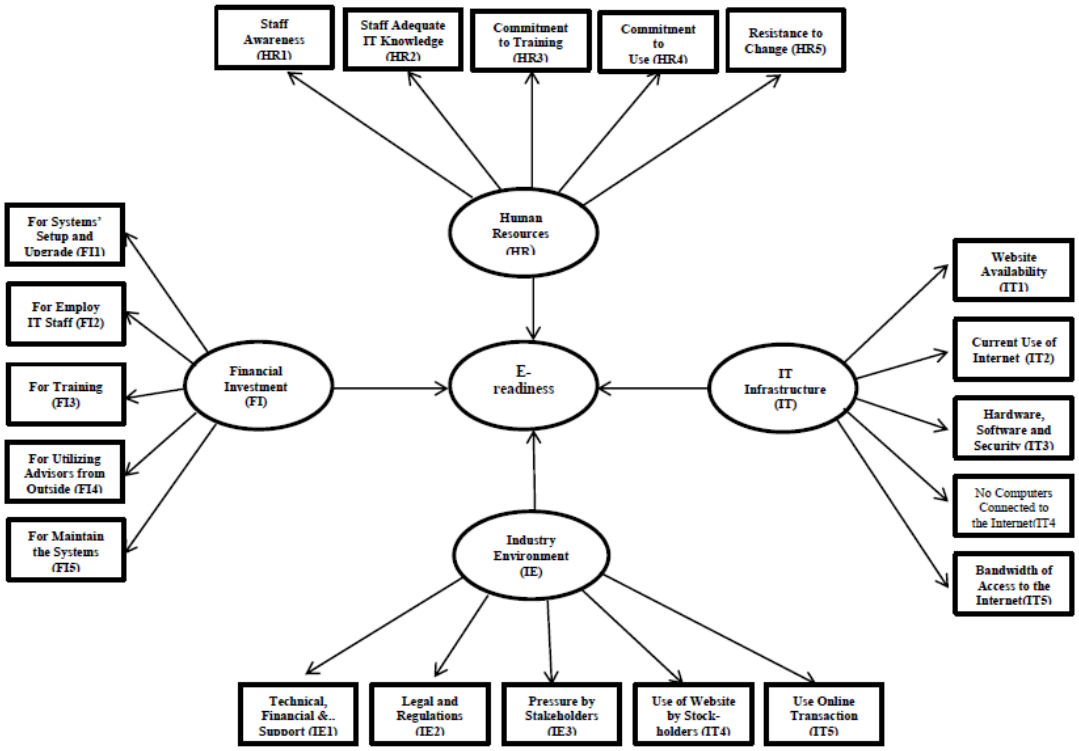

Fig. 3. Revised Theoretical Model with Indicators and Criteria

3 **Research Methodology**

In this research the concept of e-readiness and its assessment models for Iranian SMCs is introduced. The proposed e-readiness assessment model for SMCs is based on study of barriers and factors influencing e-commerce adoption in SMCs. For validating the model, itinvolve the literature review as being pertinent to the topic under investigation by exploring, appraising, and synthesizing relevant literature related to the Iran construction industry, SMCs and e-commerce with specific focus on the concept, methodology and factors of

available models for e-readiness assessment in micro and SMEs developed in developing countries. As a result, from the literature review, an initial theoretical model which consists of e-readiness indicators and SMCs' barriers in e-commerce adoption is proposed. The initial theoretical model which consists of 4 indicators is fed with 20 criteria accordingly, which beforehand are identified and justified after the data collection and analysis are completed.

To achieve the determining the most appropriate assessing factors for SMCs e-readiness, data is collected by focus group discussion. The analysis of focus group data must take account of the group dynamics that have generated remarks. The amount of analysis and the level of detail and rigor ultimately depend on the purpose for which the research is carried out and the cost-benefit of carrying out an analysis at a given level. Aside from the few occasions when only a short summary of focus group discussions was required, all analytic techniques for focus group data require transcription of the interview as a first step. The qualitative analytic technique is used in this research for analysis of data.

A classification system for major indicators and criteria is developed, and material in the transcript related to each indicator is identified. The feedback from the respondents is arranged and coded for common themes to facilitate analysis and comparison with the literature. Content analysis of transcribed and other textual data, describes a systematic searching for words and concepts that match a coding structure (categories) established from the research problem or research questions. The transcribed data are subjected to further iterations until no more meaning can be derived from the texts. Categories are then searched for themes that may be used to show trends or conclusions from the categorizations (Creswell, 2009). These processes result in findings and conclusions that address the research problem or answer the research questions.

Many steps were taken to ensure reliability of the collected data. First, the researchers checked transcripts to make sure that they did not contain any mistakes made during the transcription. Second, the researchers checked the data to ensure that the meanings of the codes were free from shift or drift in definition. Third, a cross-checking of results was also made. For the purpose of testing the validity of the data, the researchers used rich and detailed descriptions to convey the findings of the research. After analysis the data in this section, two indicators were added to the theoretical model and criteria increased to 25. The modified theoretical model required to test for validity, reliability and the relationship among the components of the model.

To achieve the confirmation and validation of factors was determined; Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were conducted to ensure that all the constructs in the model possessed convergent validity, construct validity, and discriminate validity and factorial validity (Byrne 2010, Hair *et al*., 2006). A SEM procedure tested the full structural model and the interrelationships between the constructs. A sample size over 200 is required for such research, but the small sample size (n=183) in this research was overcome with Bayesian analysis when testing the full measurement model in SEM (Byrne, 2010).

SEM software package called Analysis of Moment Structures (AMOS), version 19, was used in this research study to explore statistical relationships between the test items of each factor and among the factors of independent variables and the dependent variable. In SEM, relationships between indicators and criteria are validated by using confirmatory factor analysis (CFA), also known as measurement model, and relationships between constructs are tested using the structural model (Hair *et al*., 2006).

4 Research Results

A short process of data preparation involving item parceling, normality testing and reliability testing is conducted. The first major step of data analysis is the preparation of the survey measurements to ensure validity of the measures to minimize the potential for measurement error for the third step. For this purpose, a range of statistical tests with EFA and CFA was conducted to ensure that all the indicators in the model possessed construct validity: convergent validity, discriminate validity and factorial validity. This is followed by SEM analysis to test the full structural model and the interrelationships between the indicators in the model.

A normality test is one of the first measures required to ensure that the data collected is usable and representative of the target population. Normality is a key assumption of multivariate data analysis (Hair *et al.*, 2006, Byrne, 2010) and it measures whether the data is normally distributed across the population sample and there are no excessively high or low scores from a few respondents which can then skew the overall result. The results of the normality test are displayed in Table 11 below.

Table 11
Results of Normal Distribution Test

Variable	N	Skewness	Kurtosis	Variable	N	Skewness	Kurtosis
Age	183	0.522	-0.771	IT4	183	-1.156	0.870
Education	183	-1.631	1.746	IT5	183	-0.734	1.617
Experience	183	0.624	-0.272	OMA1	183	-0.367	0.434
Net Years	183	0.684	-1.059	OMA2	183	-0.790	1.361

Net Week	183	0.866	1.335	OMA3	183	-0.769	-0.590
EC Purchase	183	1.574	0.751	OMA4	183	-1.104	-0.389
HR1	183	-1.338	-0.062	CI1	183	-1.215	-0.749
HR2	183	-1.178	2.997	CI2	183	-0.462	0.839
HR3	183	-0.959	-0.810	FI1	183	-0.586	-0.140
HR4	183	-1.076	1.259	FI2	183	-1.208	2.177
IT1	183	-1.786	0.886	FI3	183	-0.485	-0.413
IT2	183	-0.749	0.585	FI4	183	0.438	-0.649
IT3	183	-1.156	0.966	FI5	183	-1.181	-0.050

Table 10 demonstrates that all values for the items fall within the range of the rigorous level of -2 to +2 for Skewness and/or Kurtosis. Only two items (HR2) and (FI2) are outside the -2 to +2 range for Skewness and/or Kurtosis. However, they meet the more lenient -3 to +3 range for Kurtosis (Hair *et a*l., 2006). Therefore, all variables can be considered to be normally distributed.

Reliability Testing

A reliability test is a vital test in the process of data preparation as it ensures the accuracy of the measurement used in the survey (Straub *et al*., 2004). The measures of reliability tested by Cronbach's alpha are shown in Table 12 below:

Table 12
Reliability of Indicators within the Instrument

Indicator	Criterion	Cronbach's Alpha
Human Resources(HR)	**HR1:**Staff Awareness **HR2:**Staff Adequate IT Knowledge **HR3:** Commitment to Training **HR4:** Commitment to use	.81
Industry Environment(IE)	**IE1:**Technical, Financial and Training Support **IE2:**Legal and Regulations Framework at Level of Taxes and Tariff **IE3:**Pressure by Stakeholders **IE4:**The Current Use of Website by Stockholders **IE5:** The Current Use Online Transaction System by Stockholders	.86
Financial Investment (FI)	**FI1**: Financial Investment for the Systems' Setup and Upgrade **FI2**: Financial Investment for Employ IT Staff **FI3**: Financial Investment for Utilizing Advisors from Outside **FI4**Financial Investment to Maintain the Systems **FI5**: Financial Investment to Train of Staff	.80
Owner/ Top Management Attitude (OMA)	**OMA1**: Owner/ Top Management Awareness **OMA2**: Managers' Adequate IT Knowledge **OMA3**: Commitment with Plan the Policy and Strategies for E-commerce Development **OMA4**: Commitment to allocate Adequate Resources in Term Time, Budget for Adopting, Training and Developing E-commerce	.92
Cultural Issues (CI)	**CI1**: Resistance to Change **CI2**: Level of Trust with e-commerce	.73
IT Infrastructure (IT)	**IT1**:Website Availability for Business Promotion **IT2**:Curent Use of Internet **IT3**:Existing Hardware, Software and Security **IT4**:Number of Computers Connected to the Internet **IT5**:Bandwidthof Access to the Internet	.78

Convergent Validity

A convergent validity test was used to ensure that a theoretical construct is a one-dimensional construct representing only one dimension that it is meant to signify and is not a multidimensional factor that is spread over more than one dimension (Sharma, 2010). EFA is also conducted to understand whether a theoretical construct is a unit or multi-dimensional item (Sharma, 2010). EFA is used when no specific model structure has been determined by the researcher. The total number of factors as well as the variables loaded upon those factors is not

predetermined, but is instead determined by the researcher from the results of the initial EFA.

The EFA was performed to understand whether each theoretical construct is a unit or multi-dimensional item. Three factors successfully passed the EFA and remained as they are with their items: Cultural Issues (CI), Financial Investment (FI), and IT Infrastructure (IT). However, three other factors did not pass the EFA and each one divided into two factors. Human Resource (HR) was split into two factors: 1) Staff Readiness (SR), and 2) Staff Commitment (SC). Also, Industry Environment (IE) was split into two factors: 1) Industry Support (IS), and 2) Industry Readiness (IR). Lastly, The Owners or Management Attitude (OMA) was divided into two factors: 1) Owners or Management Commitment (OMC), and 2) Owners and Management Knowledge (OMK). Figure 4 shows the restructured model after EFA.

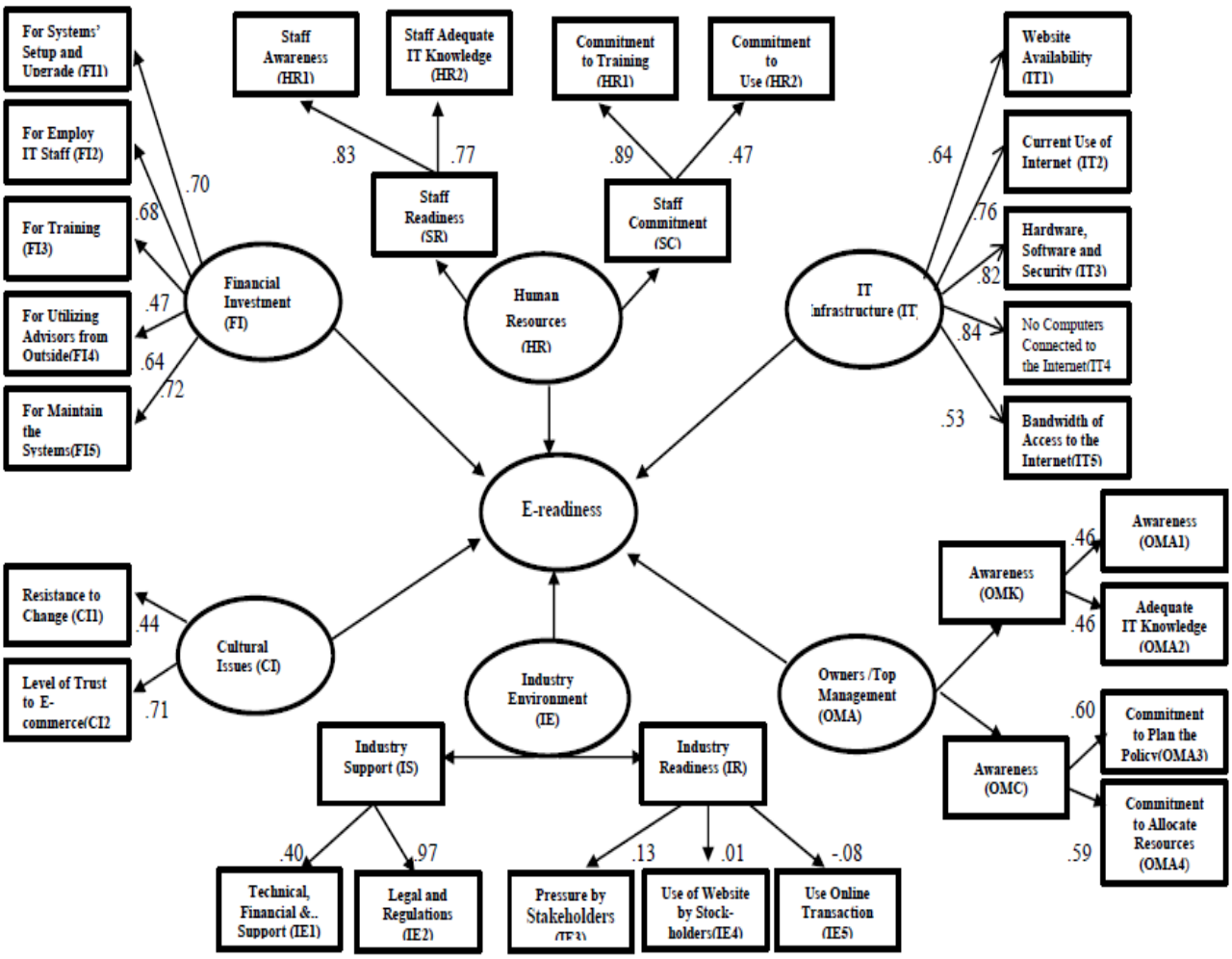

Fig. 4. The Model after EFA

Confirmatory Factor Analysis (CFA)

CFA is used to confirm a specific factor structure developed from previous literature on the subject. When conducting confirmatory factor analysis, the number of factors as well as the variables loaded on each factor is determined before using the model structure for analysis.

The following Table 13 summarizes the standardized coefficients. High standardized coefficients were found in all cases, with significant results also being indicated in all cases. These results strongly support the factor structure as determined through the exploratory factor analyses.

Table 13
Human Resources (HR): CFA Factor Loadings

STD YX Standardization

	Estimate	S.E.	Est./S.E.	P-Value
Factor 1				
HR1	0.810	0.041	19.595	0.000
HR2	0.768	0.046	16.770	0.000
Factor 2				
HR3	0.737	0.084	8.726	0.000
HR4	0.818	0.086	9.500	

The following Table 14 presents the factor loadings associated with this analysis. In all cases, both the unstandardized as well as the standardized factor loadings were found to be high, indicating good model-fit.

Table 14
Industry Environment (IE): CFA Factor Loadings

STD YX Standardization

	Estimate	S.E.	Est./S.E.	P-Value
Factor 1				
IE1	0.676	0.075	8.987	0.000
IE2	0.810	0.073	11.164	0.000
Factor 2				
IE3	0.699	0.064	10.986	0.000
IE4	0.842	0.051	16.483	0.000

The following Table 15 presents the results of the factor loadings associated with this analysis.

Table 15
Owners or Management Attitude (OMA): CFA Factor Loadings

STD YX Standardization

	Estimate	S.E.	Est./S.E.	P-Value
Factor 1				
OMA1	0.449	0.104	4.316	0.000
OMA2	0.490	0.129	3.796	0.000
Factor 2				
OMA3	0.928	0.012	79.678	0.000
OMA4	0.927	0.011	78.668	0.000

The following Table 16 presents the factor loadings associated with this analysis. Factor loadings were found to be higher in all cases, indicating good model-fit and an appropriate factor structure.

Table 16
Cultural Issues (CI): CFA Factor Loadings

STD YX Standardization

	Estimate	S.E.	Est./S.E.	P-Value
Factor 1				
CA1	.842	.061	13.779	.000
CA2	.843	.039	21.893	.000

The following Table 17 presents the factor loadings associated with this analysis. Factor loadings were found to be high in all cases, indicating good model-fit.

Table 17
Financial Investment (FI): CFA Factor Loadings

STD YX Standardization

	Estimate	S.E.	Est./S.E.	P-Value
Factor 1				
FI1	0.440	0.096	4.593	0.000
FI2	0.713	0.083	8.593	0.000
FI3	0.411	0.099	4.160	0.000
FI4	0.742	0.083	8.955	0.000
FI5	0.400	0.099	4.044	0.000

The following Table 18 presents the standardized factor loadings associated with this model. In all cases, factor loadings were found to be high, indicating good model-fit.

Table 18
IT Infrastructure (IT): CFA: Factor Loadings

STD YX Standardization

	Estimate	S.E.	Est./S.E.	P-Value
Factor 1				
IT1	0.705	0.112	6.307	0.000
IT2	0.682	0.110	6.184	0.000
IT3	0.472	0.101	4.677	0.000
IT4	0.644	0.108	4.966	0.000
IT5	0.694	0.111	6.343	0.000

EFA and CFA with various statistical measures were used to rigorously test convergent validity. CFA results successfully confirmed the EFA results. The following Figure 5 shows the summary of factors with their items.

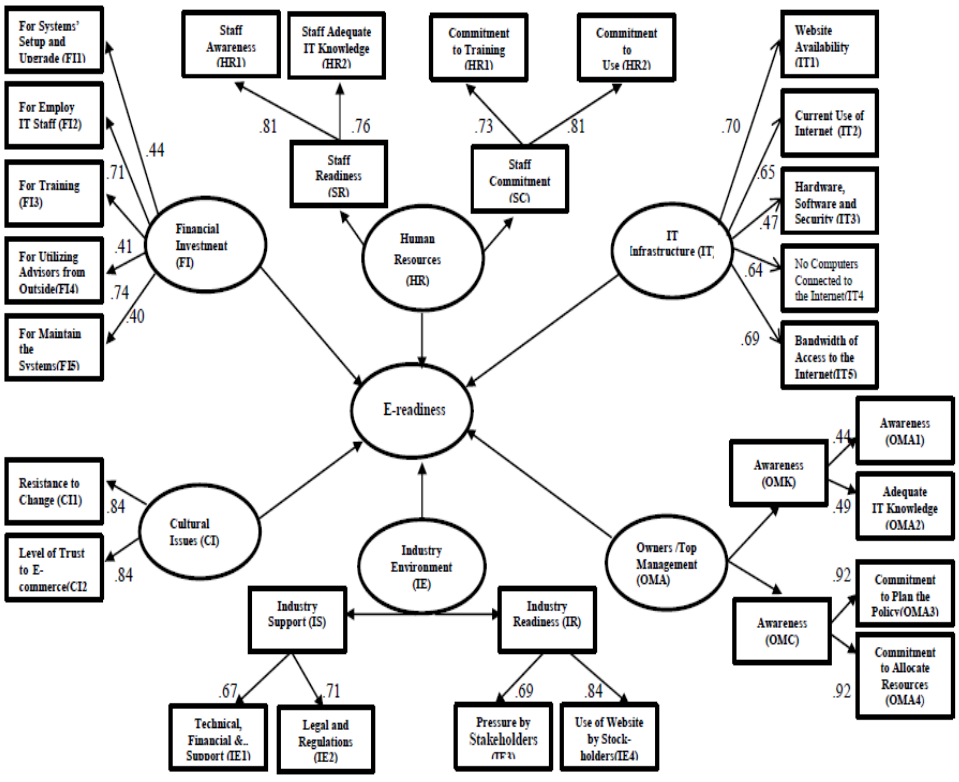

Fig. 5. The Model after CFA

Factorial Validity

Factorial validity is a test of whether or not a set of latent variables represents an underlying pattern in the data (Straub *et al*., 2004). This was achieved by performing CFA with the measurement model, including all the factors that hold both convergent and discriminate validity. The CFA was then conducted on the measurement model. Maximum likelihood estimation was also used in this analysis. Table 19 summarizes the final measurement model made up of 5 indicators and 20 criteria with their factor loading.

Table19
Factor Loading for Each Item

		STDYX Standardization			
The 5 Indicators	Items	Estimate	S.E.	Est./S.E.	P-Value
Cultural Issues (CI)	CI1	0.846	0.036	23.514	0.000
	CI2	0.915	0.029	32.061	0.000
Owners or Top Management Attitude (OMA)	OMA1	0.774	0.067	11.600	0.000
	OMA2	0.779	0.066	11.855	0.000
	OMA3	0.815	0.061	13.320	0.000
	OMA4	0.871	0.064	13.519	0.000
Human Resource (HR)	HR1	0.666	0.061	10.899	0.000
	HR2	0.515	0.105	3.964	0.000
	HR3	0.518	0.132	2.414	0.000
	HR4	0.652	0.078	0.077	0.000
IT Infrastructure (IT)	IT1	0.741	0.17	4.356	0.000
	IT2	0.940	0.047	19.929	0.000
	IT3	0.916	0.042	21.660	0.000
	IT4	0.753	0.062	12.230	0.000
	IT5	0.588	0.083	7.114	0.000
Financial Investment (FI)	FI1	0.519	0.081	6.368	0.000
	FI2	0.599	0.105	5.703	0.000
	FI3	0.651	0.093	7.020	0.000
	FI4	0.838	0.061	13.755	0.000
	FI5	0.537	0.091	5.913	0.000

With regard to model-fit, the chi-square test of model-fit did achieve significance, $\chi 2$ (147)= 153.3, p= 0.344. RMSEA was found to be 0.020, while its 90% confidence interval was found to range from zero to 0.050. The probability that RMSEA was below .05 was found to be 0.947. CFI was found to have a value of 0.985, while TLI had a value of 0.981. Finally, WRMR was found to have a value of 0.554. Overall, these results indicate excellent model-fit. These Goodness-of-fit indices illustrate that the measurement model fits the data well. It also indicates that the values of the estimated parameters are valid and replicable with another sample and the validity of the model is not merely a result of chance (Carlson & Mulaik 1993). In light of the favorable results of this process, no items were dropped from the model. Figure 6 represents the new modified measurement model that was used to determine the reliability of the instrument along with its indicators.

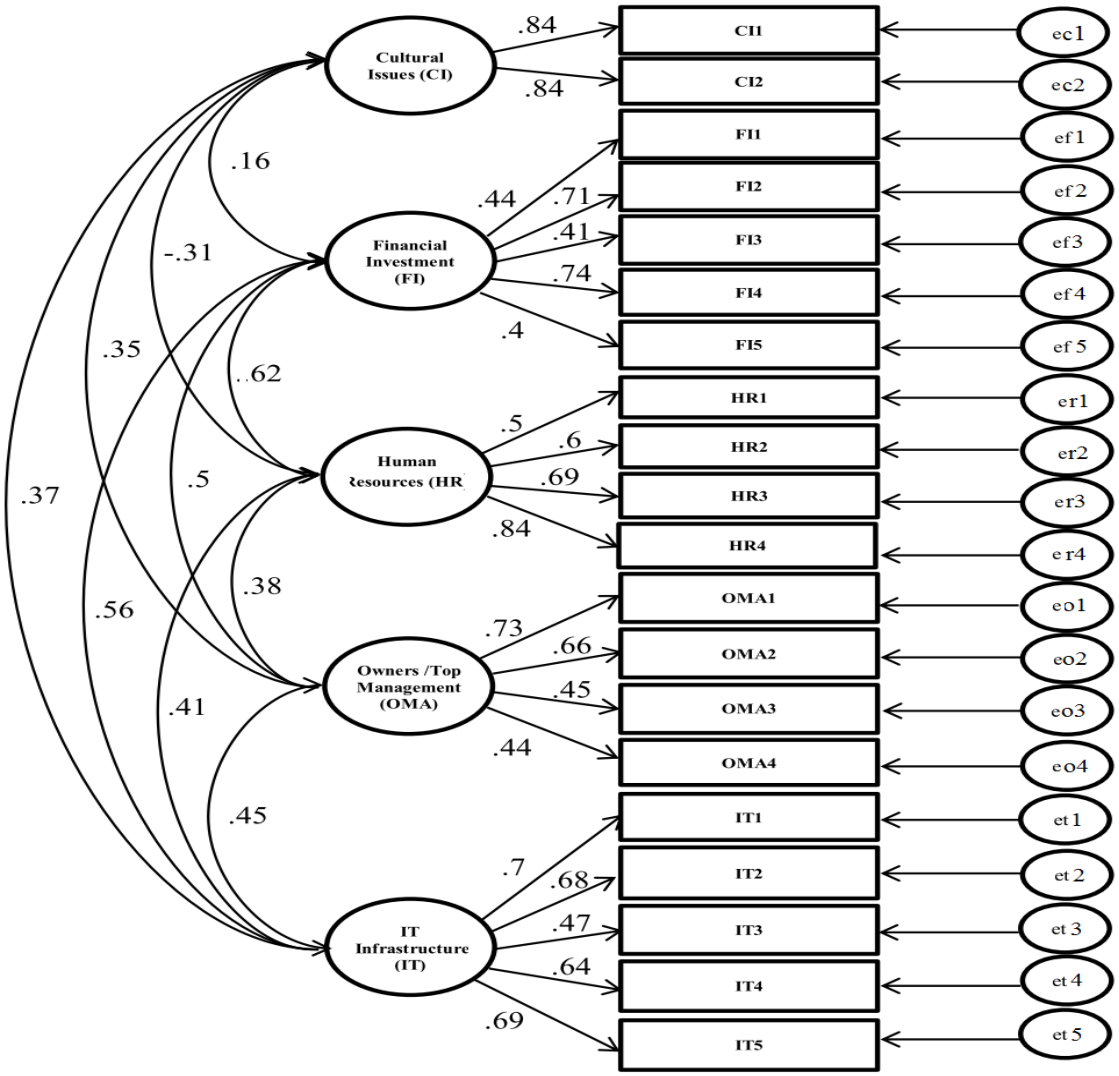

Fig. 6. The Final Measurement Model for E-readiness Assessment of SMCs in Iran Construction Industry

Using CFA on the factors that hold both convergent and discriminate validity, a factorial validity was performed to test whether or not a set of latent variables represents an underlying pattern in the data. The results indicated a good model fit, thus no items were dropped from the model.

This research was initiated by reviewing the literature to form knowledge of the current issues in the Iran construction industry, SMCs, e-commerce and e-readiness and subsequently identify the research problems and form the research aims and objectives. It was identified that e-commerce adoption problems are among contributing factors of the inefficiency of SMCs' readiness is identified as a potential solution. A research gap however, arose on evaluating the readiness of SMCs to implement e-commerce, where an evaluation model that is specific for SMCs to implement e-commerce in the Iran construction industry is absent. This led to the formation of research aim and interrelated objectives. The research aim was to propose a mechanism for electronic e-commerce adoption by small and medium contractors in the Iran construction industry. For achieving to this aim a theoretical model was developed to assess SMCs readiness for e-commerce adoption successfully.

5 Discussion

According to the study findings, the major five dimensions that should be considered for assessing of SMCs consequently are Information technology infrastructure, human resources, cultural issues, owners and top management and finally, financial investment. As a result a number of changes were made to the initial theoretical model, in terms of the structure and its criteria. The model still maintains its major indicators and two

indicators were added to suit the model for SMCs. The initial theoretical model was evaluated by experts in general discussion. The strangeness and weakness were discussed in the first part of the group discussion. The overall impact of the four indicators listed for e-readiness assessment in the initial theoretical model was generally agreed upon by experts. However, the experts believed that the model should more focus on Human Resources as a key indicator of e-readiness in small and medium size contractors. They suggested that "Culture" and "Owner and Top managers Attitude" to be considered as independent factors in the initial theoretical model.

The experts also believed that these factors to be categorized by the high level of importance in compared to other e-readiness assessment indicators. Nevertheless, the listed indicators were maintained in the theoretical model and were tested in the next phase of data collection. It was in order to see whether or not they are appropriate to remain or be removed from the model. In addition, two indicators and some related criteria were added by experts, which were more appropriate for assessing e-readiness of SMCs in the Iran construction industry. Finally, based on the comments and suggestions from experts, the refined model was derived, particularly for SMCs to use as a guideline in assessing e-readiness in their organization. At the beginning of the discussion, four indicators affecting on readiness for e-commerce adoption in SMCs were listed such as: IT Infrastructure, Human Resource, Financial Resources and Industry Environment. The majority of the experts believed that Culture Issues and Owner or Top Management Attitude should be considered as two main factors in the theoretical model. In the second step of discussion, experts discussed the e-readiness criteria were presented in the initial theoretical model for e-readiness assessment of SMCs in detail. The next section will discuss the findings gathered in Phase Two. The findings from Phase One were analyzed and the initial theoretical model was revised. The Phase Two (Questionnaire Survey) was commenced once the Phase One of data collection completed. This field study employed a quantitative approach for collecting data. Out of 600 surveys distributed, 201 surveys were returned; however, only 183 responses were included in the data analysis while the remaining 18 surveys were incomplete; hence, they were discarded. Thus, the final response retain this study was 30.5%. The overall use able response rate in this study seems relatively low, but it was higher than the researcher's initial anticipation drawn from the responses reported in previous studies in the same domain. The responses ate achieved in this study is reasonably higher than that of in earlier studies. Therefore, the final response rate in this study can be considered relatively better than the previous studies mentioned above.

6 Conclusion

E-readiness of a small and medium contractors is defined here as the ability of an SMC to successfully adopt, use and benefit from information and communication technologies (ICT) such as e-commerce.

In this paper, the final validated model outlines five indicators in which consist of 20 readiness criteria. Each of the criteria describes e-commerce adoption requirement that SMCs needs to develop the capability in order to implement e-commerce. The model is generic in construction nature where the users can determine the capability of their organization by comparing each of the readiness criteria with their current state of e- commerce implementation. If SMC satisfies the readiness criteria, the status could be said to match the readiness for that particular criteria. The methods used in determining the organizational status are quantitative in nature, allowing evaluation through the use of observations, document review, etc. The result of the readiness assessment would outline the readiness gap between the current states of SMC as compared to e-commerce implementation requirement sorted accordingly to the readiness criteria. Although the use of the model within the context of this research is limited to inter organizational application by the SMCs, it could also be expanded for a wider use. The appropriate level of e-readiness among SMC is crucial to minimize e-commerce misunderstandings and failure when e-commerce is adopted. To enable the extended use, further modifications of the model are required to suit the needs of the multidisciplinary nature of other small and medium businesses.

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