

*Full Length Research Paper*

# The relationship between information system (IS) innovation and innovation among Iranian small and medium enterprises (SMEs)

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Information system (IS) innovation is one of the most important types of innovation. IS innovations frequently demand the fashioning and incorporation of new roles, responsibilities, relationships, lines of authority, control mechanisms, work processes and work flows-in short, new organizational designs. The survival and growth of business enterprises increasingly depends on their ability to respond to globalization and rapidly changing in market demands, technologies and consumer expectations. Small and Medium enterprises (SMEs) constitute 94% of Iranian firms. According to Iran statistic website the value added of 94% of Iranian firms is just about 10% of the whole value added in country. This study assumes the lag of IS and innovation is the reason of uncompetitive nature of Iranian SMEs. This paper reports on the results of a study that examined Information system (IS) innovation among a sample of 86 managers of small and medium-sized enterprises (SMEs) in Iran. As the survey results show that the most information resource is clients, customers and acquisition of external knowledge has a positive and significant effect on innovation. Iranian SMEs are not collaborating with universities and higher education institutions; they do not see university as a main source of information.

**Keywords:** IS innovation, innovation, SMEs.

## INTRODUCTION

Small and medium enterprises (SMEs) are integral sources of revenue, employment and product innovation for the economic growth of a country. SMEs are generally characterized by a smaller workforce and lower turnover. Information system and Communication Technologies can help SMEs create business opportunities and combat pressures from competition (Levy and Powell, 2005; Kotelnikov, 2007). This study focuses on SMEs because they are important to economic development in developing countries such as Iran. A commitment to innovation has long been considered to be important to

the success of entrepreneurial ventures and small firms (Fiol, 1996). Research has shown that innovation stimulates ventures' growth (Wolff and Pett, 2006) and also provides a key source of competitive advantage in the absence of scale economies (Lewis et al., 2002). Considered from the resource-based view of the firm (Barney, 1991), successful innovation may be dependent on the presence of other organization-specific skills and capabilities. For example, substantial evidence has begun to accumulate that suggests that appropriate strategic employment of IS (Figure 1) may be essential in translating strategies (for example, innovation) into enhanced firm performance (Ray et al., 2005; Sakaguchi et al., 2004). A direct linkage between IS and firm performance was established by Powell and Dent-Micallef (1997). There are many good reasons for paying attention to SMEs. They constitute the 94% of Iranian firms (amar.org), they are a main source of employment,

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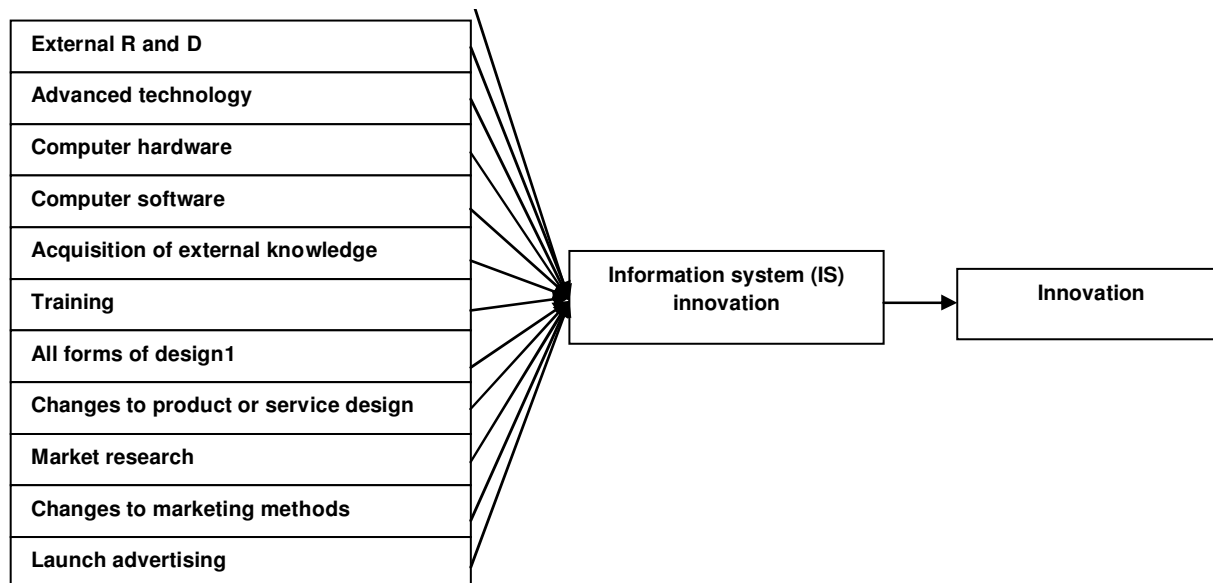


Figure 1. Research model.

and they are flexible. Iran defines SMEs as independent businesses that employ less than 250 people (Iranian Commission, 2003). SMEs can be split up in micro, SMEs. The research will be conducted in the Sistan and Baluchestan region of Iran. The lag in innovation among the region firms relative to those of other countries in eastern countries could result in reduced competitive capacity of the Sistan and Baluchestan firms. Iranian manufacturing and services are not able to compete with others in the world and this study assumes the lag of IS and innovation is the reason of uncompetitive nature of Iranian firms.

## REVIEW OF LITERATURE

### Innovation and its importance for organizations

New technologies had a great impact on all aspects of innovation and are a pre-requisite for any successful organization. That does not necessarily mean that product innovation lead many leading organizations to achieve success according to how they run their business, not by inventing a better product or service. To achieve success over a long period of time, all organizations need to embrace innovation. An interesting point about innovation was found in Windrum (2006) "Innovation begets further innovation". He argued that through organizational innovation, managers gain a more specific view of the different activities of the firm, and see the potential creative opportunities that arise through breaking down 'departmental silos' and creating novel synergistic activities. McAdam and McConvery (2004) concluded that SMEs exhibit resistance to innovation.

Weak management commitment, which can be a signal that the organizational culture does not support innovation. Employees and innovators often question the value of a strategy that embraces innovation (Storey, 2000). Some of this resistance has been found to be consistent with a direct management style, in some cases further compounded by an owner-manager relationship (Mosey et al., 2002). Several studies have emphasized the role of employee resistance to innovation based on issues such as poor communication, existing corporate norms, weak human resources practices and lack of commitment of top management (Zwick, 2002; Osterman, 2000; Kane et al., 1999).

A result of organizational cultures being unreceptive to innovation is the risk of failure to seize new approaches to pursuing market opportunities (Roper and Hofmann, 1993). Adoption of innovation requires employee commitment and effort (Acemoglu and Pishke, 1999). Constraints arising from weak management support are an innovation choke point because innovation can disrupt established routines and schedules (Shanteau and Rohrbaugh, 2000). Baldwin and Lin (2002) recognized that resistance to change, some of which results from inadequate training or poor employee skills, is an important organizational challenge. Hausman (2005) pointed out that small business managers often lack the types of education and training that have been linked with a successful innovation strategy. Freel (2000) also emphasized that firms are constrained in their ability to attract, train and retrain managers who are qualified to effectively incorporate innovation into business strategy. The firm's external environment includes a variety of influences, such as global competition, government policy and economic uncertainty. These challenges require that

firms effectively communicate to managers the importance of innovation as a core firm strategy that will help maintain market competitiveness (Frishammar and Horte, 2005). Porter (1985) noted that competitive pressures often force firms to adopt new technologies so as to become differentiated from competitors or gain a cost advantage. Katila and Shane (2005), Souitaris (2002) Khan and Manopichetwattana (1989) found a positive relationship between external economic uncertainty and the rate of innovation; firms in more turbulent external environments have higher potential for innovation, because turbulent environments trigger firms to incorporate innovation into their business strategy in order to remain competitive and ultimately survive (Miller 1987). Information about a firm's external environment, such as market opportunities, changes in technology, and government policy, impact managers' adoption of innovation as a strategy to better meet customer needs and to help make the firm more competitive. Information about technology, markets and government policy initiatives can reinforce the importance and potential advantages of becoming more innovative (Galia and Legros, 2004). Lack of information, however, can become another obstacle to innovation (Frenkel, 2003; Hadjimanolis, 1999), and uncertainty about government policy, especially in European countries, can become a significant barrier to innovation. Piatier (1984) found that lack of government assistance was the third most important barrier to innovation in European countries.

### **Information system (IS) role for organizations**

Miles et al. (1978) based his work on the idea that IS can enhance an organization's ability to respond to these demands, adapting its product and service offerings. Developments in information technology increasingly offer organizations the opportunity to adopt or create new innovative products, work processes and market strategies (Sambamurthy and Zmud, 2000). These IS capabilities are formulated in both technologies and human resources and provide the ability to employ resources in ways that enable delivery of new products and services (Bharadwaj, 2000). Attention of IS vendors has moved recently to SMEs offering them a vast range of solutions, which were formerly adopted by large firms only (Ramdani and Kawalek, 2007b). Most small firms still under-utilise the potential value of IS innovations by only restricting them to administrative tasks (Brock, 2000). The United Kingdom Department of Trade and Industry (DTI) literature claims that IS adoption and implementation is crucial to the survival and growth of the economy in general and small business sector in particular (Martin and Matlay, 2001). Without a better understanding of the complex processes and the differentiating factors that affect IS adoption level, the drive of IS adoption and development will not success-

fully contribute to SMEs' competitiveness (Martin and Matlay, 2001). Lack of (or substantially less sophisticated) information system management (Kagan et al., 1990); Frequent concentration of information-gathering responsibilities into one or two individuals, rather than the specialization of scanning activities among top executives (Hambrick, 1981); Lower levels of resource available for information-gathering; and quantity and quality of available environmental information (Pearce et al., 1982).

New technologies provide SMEs with opportunities that are largely unexploited (Brock, 2000; Corso et al., 2001). It is hard nowadays to imagine SMEs operating without some use of IS. However, SMEs differ in the level of IS usage (Blackburn and McClure, 1998). Southern and Tilley (2000) identifies three categories of small firms with different attitude to IS: SMEs with low-end IS use, medium-level IS users and high-end IS users. According to Brock (2000), there are various research streams influencing research concerning IS adoption in small firms ranging from computer science, behavioral science, decision science, organizational science, social science and management science to economic and political science. He classified the key research streams that have developed over time to four main groups which are:

- 1). Adoption research: research interested in the determinants of organizational adoption of IS [for example: Thong and Yap (1995) Fink (1998)].
- 2). Implementation research: research interested in the post-adoption processes [for example: Cooper and Zmud (1990) Saga and Zmud (1994)].
- 3). Strategic management research: research interested in the potential strategic value of IS for organizations [for example: Sethi and King (1994); Elliot and Melhuish (1995)].
- 4). Impact research: research interested in the various effects of an IS on the operations of individuals, work groups or the whole organization [for example: Delone and McLean (1992) Hitt and Brynjolfsson (1996)]. Furthermore, Southern and Tilley (2000) identifies three alternative research perspectives:

- i). Technological: this type of work has arguably dominated the field and has generally used an IS perspective and mainly concerned with examining factors leading to IS success within a firm [for example: Naylor and Williams (1994); Cragg and King (1993); Raymond and Pare (1992)].
- ii). Organizational: work in this category is concerned with understanding the small firm's strategic approach to using IS and the capabilities and structures of SMEs to use the technology [for example: Doherty and King (1998); Swatz and Boaden (1997); Thong and Yap (1995)].
- iii). Small firms: this approach aims to develop an understanding of the domain from the perspective of the owner/manager of a small firm [for example: Blackburn

**Table 1.** Proportion of enterprises in the population covered by the survey.

	Number of employees		
	1_10	10_100	101_1000
Manufacturing and services	1_10	10_100	101_1000
Percentages of all respondents	28.6	57.1	14.3

and McClure (1998); Fuller (1996); Fuller and Southern (1999)].

Another classification of research in IS implementation in SMEs has been introduced by Premkumar (2003). The five major domains in his framework are individual, task, innovation/ technology, organization and environment. He explains that the domains can be considered as different layers of the environment that influences the design and use of information technology. He argues that the core of the framework includes individuals and task because the primary purpose of IS in an organization is to enable people to complete work-related tasks. At the next layer, technology domain provides the tools and information to aid the individual in his or her task. Technology is implemented in an organization, which is presented as a different layer. The overarching layer represents the external environment.

### Research questions

- 1) Which type of Innovation-active is dominated on SMEs?
- 2) Is there any relationship between dimension of information system innovation and innovation?
- 3) What are the most important dimensions of information system innovation from point view of owner of SMEs?
- 4) What is the most important information resource from point view of owner of SMEs?

### Description of sampling

Data for this study were collected by questionnaires of information system and innovation that contained 18 items. From the 86 distributed questionnaires that was respondent by management of SEMs of the Sistan and Baluchestan province of Iran, 50 were completed and returned for the response rate 58.13%. Cronbach  $\alpha$  for this scale was 0.91. Data analysis was carried out by using the statistical program packages SPSS. Innovation takes place through a wide variety of business practices, and a range of indicators can be used to measure its level within the enterprise or in the economy as a whole. These include the levels of effort employed (measured through resources allocated to innovation) and of achievement (the introduction of new or improved products and processes). This section reports on the types and levels of innovation activity over the three-year period 2008 to 2010. Innovation activity is defined here as where enterprises were engaged in any of the following:

- 1). Introduction of a new or significantly improved product (goods or

service) or process.

2). Engagement in innovation projects not yet complete or abandoned.

3). Expenditure in areas such as internal research and development, training, acquisition of external knowledge, or machinery and equipment linked to innovation activities.

The proportion of enterprises (Table 1) having participated in some innovation-related activity (64%) shows that SMEs recognize the need to assign resources to innovation. Around 17.6% of SMEs report abandoned projects. The Pearson correlation for the study variable is given in Table 3. IS Innovation and dimensions were correlated with innovation? Dimensions of is innovation were significantly related to innovation and the results of Table 3 illustrates that there are positive relationship between some items. The Table 4 is illustrating model summery of regression of constraining factors innovate and innovate. As seen, the signification predictor (Acquisition of external knowledge) has determined 16.8% variance of innovation. As it was expected to predict creating depending on IS innovation and dimensions, p-variable regression was applied and IS innovation as predictor variable and innovation as depended variable were analyzed. Data of Table 5 illustrated that IS innovation and its dimensions predicts on the innovation. Eventually each increase or decrease in dimensions of IS innovation reason same change in innovation. As seen, acquisition of external knowledge has satisfied the entrance criterion or the regression and entered as a first important predictor (Beta=0.410). Another result provides that acquisition of external knowledge have a positive and significant effect on the innovation propensity.

### Information sources of innovation

Respondents were asked to rank a number of potential information sources on a scale from 'no relationship' to 'high importance'. The mean and standard deviation of each category (information source) is shown in Table 6. Internal from within the enterprise itself or other enterprises within the enterprise group. Market from suppliers, customers, clients, consultants, competitors, commercial laboratories or research and development enterprises. Institutional from the public sector such as government research organizations and universities or private research institutes and other from conferences, trade fairs and exhibitions; scientific journals, trade/technical publications; professional and industry associations; technical industry or service standards. The results show that client or customers were cited as the most important source of information by Sistan and Baluchestan SMEs and it is followed by suppliers of equipments. Universities and other higher education institutes were seen as the least important source of information.

### Analysis

The results were initially summarized using statistics to provide a better understanding of the respondents and characteristics of the responding companies (Table 7).

**Table 2.** Innovation-active enterprises: by type of activity, 2008 to 2010 percentages.

Innovation -activities	64
Product(good/service) innovator	50
Process innovator	64
Abandoned activities	17.6

**Table 3.** Person correlation coefficient between IS innovation and innovation (n=50).

Variable	Innovate
Internal R and D	0.351
External R and D	0.184
Advanced Technology	0.402
Computer hardware	0.131
Computer software	0.086
Acquisition of external knowledge	0.410
Training	0.344
All forms of design	0.187
Changes to product or service design	0.186
Market research	0.187
Changes to marketing methods	0.280
Launch advertising	0.188
IS innovate ion	0.375

Correlation is significant at the 0.05 level (2-tailed).

From the 86 distributed questionnaires, 50 were completed and returned for the response rate 58.13 and 80% of Sistan and Baluchestan SMEs operate at a regional level, about 44% at Iran level and 0% worldwide. Just under a quarter (20%) of businesses reported any exports for the years 2008 to 2010. Innovation takes place through a wide variety of business practices, and a range of indicators can be used to measure its level within the enterprise or in the economy as a whole. These include internal R and D, External R and D, Acquisition of machinery equipment and software and hardware, acquisition of external knowledge, training and all forms of design, changes to product or service design, market research and changes to marketing methods, launch advertising. According to Table 2. Overall, 64% of enterprises were classed as being innovation-active during 2008 to 2010. The proportion of enterprises having participated in some innovation-related activity (64%) shows that firms recognize the need to assign resources to innovation. The most commonly reported activities were in advanced technology, followed by internal R and D and computer hardware.

The internationalization of Rand D seems to be a useful instrument to mitigate the effects of innovation often faced by SMEs (Tiwari and Buse, 2007). During 2008 to 2010, acquisition of external knowledge. As the range of technologies necessitated for innovation has spread out

and technologies have become more complex, companies can no longer cover all relevant disciplines. Many key developments draw on a wide range of scientific and commercial knowledge, so that the need for co-operation among participants in different fields of expertise has become greater in order to reduce uncertainty, share costs and knowledge and bring innovative products and services to the market (OECD, 2000). The results of the survey on Sistan and Baluchestan province of Iran shows that in Iranian SMEs the most frequent partners for co-operation were suppliers (76% of enterprises with co-operation agreements) and other business in their enterprise (72%). Around 44% of collaborators included universities amongst their partners. Information system was reported as the least important to innovation. Innovation is not wholly about the development or use of technology or other forms of product (goods and services) and process change. Enterprises can also change their organizational structure, marketing strategy, corporate strategy and advanced management techniques to make the more competitive. 63.6% of Iranian SMEs made changes to their management strategy during 2008 to 2010. As would be expected, great proportion of SMEs engaged in one or more of these changes. Advanced management techniques was most commonly reported, with the introduction implementing new organizational structures being least frequent? Table 8 is designed to examine in what extent the findings of the survey is related to information system innovation.

## CONCLUSION

Successful firms adopt IS as part of a system or cluster of mutually reinforcing organizational changes. IS use is correlated with workers skills suggesting that firms that use high levels of IS also employ more knowledge workers. IS use is also found to be correlated with organizational innovations in production and efficiency practices, HRM practices and product/service quality related practices, supporting the view that IS and organizational changes are complements. This paper examines IS innovation and innovation, among a sample of 86 Iranian manufacturing SMEs located in the Sistan and Baluchestan province of Iran. The Sistan and Baluchestan province economic situation is interesting due to the need to increase the investment in innovation by manufacturing SMEs. This need is because recent regional Gross Domestic Product has not been growth in compare with three years ago. In the selected case (Sistan and Baluchestan SMEs), an in-depth study of IS innovation were done through distributing questionnaire. This study addressed analyzing innovation practices in SMEs of Iran. The survey results indicate that innovation is also becoming increasingly popular among SMEs. After all, SMEs often lack resources to develop and commercialize new product in house and as a result are

**Table 4.** Model summary of regression of IS innovation and innovation (n=50).

R	R square	Adjusted R square	Std. Error of the estimate	F Change
0.410 <sup>a</sup>	0.168	0.150	0.358	9.49

a. Predictors: (constant), q (acquisition of external knowledge).

**Table 5.** Regression analysis to predict constraining factors innovates on the innovate (n=50).

Predictor Variable	B	Std. error	Beta	T	Sig
(Constant)	0.379	0.68		5.704	0.00
Acquisition of external knowledge	0.321	0.104	0.410	3.081	0.003

a. Dependent variable: q (innovation).

**Table 6.** Ranks of Information resources.

Variable	Mean rank
Within your enterprise group	6.84
Suppliers of equipment	7.92
Clients or customers	8.36
Competitors or other enterprises within your industry	7.34
Consultants, commercial labs or private R and D institutes	5.24
Universities or other higher education institutes	4.40
Government or public research institutes	5.22
Conferences, trade fairs and exhibitions	3.92
Scientific journals and trade/technical publications	5.24
Professional and industry associations	5.10
Technical, industry or service standards	6.42

**Table 7.** Test statistics<sup>a</sup>.

N	Chi-square	df	Asymp sig
50	146.532	10	0.000

a. Friedman test.

more often inclined to collaborate with other enterprises in their own business. Innovation activity is most important type of activity (64%) from point view of owner of SMEs. Around 17.6% of SMEs report abandoned projects.

The survey results indicate that Iranian SMEs prefer to engage more in acquisition of external knowledge, followed by a considerable investment in advanced technology and external R and D. According to Morton (1971) Zaltman et al. (1973) Organizations facilitate innovation through project teams or R and D departments. But there is evidence that Iranian SMEs do not concentrate on R and D investment as one of the main innovation activities. Enterprises engage with external sources of technology

and other innovation-related knowledge and information. Enterprises reported market and internal sources as most important for information on innovation. This suggests that enterprises tend to rely on their own experience and knowledge coupled with information from customers and clients, suppliers. The survey results show that Iranian SMEs are not collaborating with universities and higher education institutions nevertheless our expectation is based on the literature. It could be argued that the long-term solution to fostering innovation within information technology (IT) lies not with industry but the school system and higher education. Van de Ven (1986) argues that as individuals have access to more information about available innovations and are more globally informed

**Table 8.** The degree of importance of different points of IS innovation on Sistan and Baluchestan province.

Important points in IS development/innovation according to literature	Evidence of the survey
Reducing cost as a driving force of IS innovation	Reported as the forth important factor
Creating new or different products that no one else produces as a driving force to IS innovation	Reported as important by 47% of SMEs
Better products than competitors as a driving force to IS innovation	Reported as the most important factor by 64% of SMEs
Locking suppliers or customers in to the organization's products or services as a driving force to IS innovation (improving flexibility of production)	Reported as least important motivational factor to innovation
See university as a main partner for enterprises	Reported as the sixth important partner Between seven partners that are defined in the survey
See university as a main source of information for enterprises	Reported as the tenth source of information among the twelfth information sources
See R and D department as one of the main departments in organization	Reported as the ninth important activity in the enterprises among thirteenth defined activity
Complexity of the software development process ( lack of information on technology) as a constrain to IS innovation	Reported as an important barrier by less than of half
Lack of adequate resources(financial resources) as a barrier to IS innovation	Reported as the second important constraint to innovation
Poor project management skills and Shortage of IT skills and lack of senior manager (lack of qualified personnel) as a barrier to IS innovation	Reported as important factor by half of the firms

about the implications of innovative ideas, they are better able to relate the "parts to the whole." In general, individuals with a broader awareness of the consequences and implications of innovative ideas facilitate the process of organizational innovation. But according to the survey SMEs in Sistan and Baluchestan do not concern to one of the most important factors in IS innovation.

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