The Impact of Information, Communication Technology and Innovation on SMEs in Pakistan

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ABSTRACT

Information and communication technology plays an important role in developing innovation at the organization level, not only for big companies but also for micro, small and medium enterprises while also facilitating the growth and advancement of organizations. The aim of this study is to examine the impact of innovation on SMEs between information and communication technologies with a sample of 364 SMEs in Pakistan. The findings indicate that information and communication technology have a positive and significant effect on the innovation activities of small and medium-sized enterprises (SMEs) in Pakistan.

Keywords: Innovation, SMEs, Information & Communication Technologies.

JEL Classification: D8, O3, D83

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1. INTRODUCTION

Information and communication technologies (ICT) discuss the telecommunications technologies which provide access to information. It is analogous to information technology, but it relies on networking systems. This encompasses the internet, radio networks, mobile phones, and other forms of communication (Bouh & Unlu, 2022; Ratheeswari, 2018). Among other factors, the market uncertainty of this century drives firms to make important changes to their practices so that they can deal with the conditions of a modern economic landscape because of the more complex and demanding competition of competing industries (Moshin, Bashir, & Latif, 2013).

Accordingly, in a world that is becoming increasingly volatile, forms especially SMEs have a burden to preserve or strengthen their competitive edge and numerous companies have seen innovation as a key policy that can deliver the competitive benefits needed not only to protect their present competition but also to thrive (Aksoy, 2017). In the new millennium industries, the use, and understanding of information and communication technology is critical because, on the one hand, it contributes to a higher degree of process innovation (Hsu, Liu, Tsou, & Chen, 2019). On the other side, implementations of IT or apps handling specialist companies like the Decision Support System for Resource Planning (ERP) (DSS), the CRM, allow the enterprise to be more innovative and knowledgeable (Moshin et al., 2013). In this respect, different scholars, and business and IT experts consider that the SMEs managers and owners not only increase the competitiveness level of their business organizations but also reduce risk and insecurity regarding
the business environment as well as help the strategic planning (Dibrell & Miller, 2002; Khaliq et al., 2022). Moreover, all business practices of innovations should have the fundamental support for information technology and networking for small and medium-sized businesses to reach a higher degree of innovation (Dibrell, Davis & Craig, 2008; Nazar et al., 2022; Hameed et al., 2019; Arain et al., 2019). Also, Fernando and Wah (2017) determined in their report found that information and communications technologies would have a major beneficial impact on innovation processes when used properly and effectively through changing traditional activities in the organization. Meanwhile, Bharadwaj (2000) also found that businesses with a significant investment in information and communication technologies have reached a higher degree of competition and growth than firms that have not invested in it.

With the current state of knowledge, our research makes several important contributions to the existing literature. The first thing this study does is explain how ICT is employed in various areas and how it affects the innovation of small and medium-sized enterprises (SMEs) in Pakistan, which hasn't been done previously. Second, several researches have been done in advanced countries like the United Kingdom and the United States. Studies like this are important, but their conclusions shouldn't be taken at face value when applied to developing economies like Pakistan. Third, there is a lack of research into the effects of ICT on innovation at the small and medium-sized enterprise (SME) level in Pakistan. Therefore, this study provides an overview of the influence of existing information and communication systems and the scope of progress in developing nations, such as Pakistan. In the second part, we discussed the literature review, the few observational experiences, and the research hypotheses, in the third part the methods, samples, and variables concerned are presented. The analyses are presented and explained in the fourth section and the conclusion is in the last section.

2. LITERATURE REVIEW
The idea of the information and communication technologies was not studied in brief in the literature by either scholars, researchers, or practitioners within the industry, though it is a very significant part of the proficiency of the organization and the organization work, mostly in SMEs (Kashmeeri et al., 2022; Moshin et al., 2013; Meo et al., 2020; Suki et al., 2022; Chowdhury et al., 2021). Furthermore, ICTs are one of the main elements which define the current century and have a fundamental role as a basis for adopting and implementing innovative practices, companies need to develop management and production methods so that they can compete globally and in the competitive market. According to Kroh, Luetjen, Globocnik, and Schultz (2018), the effect of this typically greatly improves the creativity of innovative goods and procedures that lead to customer satisfaction promotion and encourages demand for the organization's other products through the efforts of the information and communication technologies. Also, Karadal and Saygin (2011) argued that the implementation and adoption of IT have important positive consequences for the output of innovative products and thus innovation, which enables businesses to use IT to generate new ideas and to incorporate them in manufacturing processes to deliver the product that they need.
Sunday and Vera (2018) considered the degree to which companies intend to optimize the everyday practices of innovation, the ICTs shall firstly be adopted and enforced, and, on appeal, the information and communication technology programs should be compatible with all activities of corporate innovation. Therefore, in addition to the two complementary variables, there are sufficient literature arguments that demonstrate the presence of empirical evidence for the connection between the ICT’s as well as for effective and valuable use of information and communication technologies capabilities, which can rise businesses for creation and use (Moshin et al., 2013; Islam et al.2020; Chaudhary et al.,2022; Ali et al.,2021; Saif et al.,2022; Awan et al.,2022). Likewise, Ismail and Mamat (2012) determined that both the information and communications technologies are highly relevant as innovations for researchers, scholars, industry practitioners, politicians, administrators, and government agencies as well as enterprise programs. In the literature, theoretical and scientific studies are very popular, given that introduction and application of information and communication technologies offer an incentive for companies to develop their innovation practices efficiently and effectively, enabling them to obtain or increase their competitive edge (Tallon, Queiroz, Coltman, & Sharma, 2019). Nowadays, a large proportion of the businesses in many countries, primarily SMEs, devote a vast portion of their financial capital to purchasing or renewing information and communication technology, which function as a commercial practice as well as a corporate routine (Ismail & Mamat, 2012). In the areas of customer relationship management, enhanced manufacturing procedures, supply chain management, innovation, and other important practices of the organizations these firms regularly use information and communication technologies (Dehgani & Navimipour, 2019). In addition to significantly enhancing their competitiveness (Dehgani & Navimipour, 2019).

In this respect, a number of scholars, researchers, and business and computer scientists have used information and communication technologies in designing engineering practices as a fundamental aspect (Zheng, Hatakka, Sahay, & Andersson, 2018). However, in their everyday operational businesses have obtained improved results, and a higher degree of innovation in their goods and services. Most of the innovation efforts conducted by the companies often typically include developing new services, extending existing services, or providing improved process services to their clients and users, and ensuring that SMEs can achieve sustainability is largely dependent upon innovations and new business demands for new services (Muafi, 2020).

The adoption and introduction by businesses of good innovation practices will therefore considerably improve the competitive advantage of the SMEs (Pavic, Koh, Simpson, & Padmore, 2007). However, there are very few papers available in the literature concerning the innovation of both products and services in information and communication technologies, so it is important for academics and scholars as well as business and computer scientists to work on these issues (Nambisan, 2013). So, to provide analytical data and to consider the implementation by organizations of the information and communication technology and their effect on the activities of the innovation from the early seventies, had already regarded the introduction of the ICT as the root of main improvements in all innovation-related practices.
Furthermore, theory and scientific literature expose that the use of ICT dramatically improves the reply of companies to business and customer demands in less time. Externally, using IT firms not only improves delivery times for goods and services but also generates a range of benefits both in designing and modifying products and services offered to their clients and users. Internally, the ICT’s can substantially rise both product and service capacity and the time management efficiency of their growth, reduce prototypes, cut costs and boost innovation quality, and help to enhance cooperation with partners and suppliers (Toapanta, Gallegos, & Solís, 2020). Thus, based on the information discussed earlier, the following hypothesis can be suggested at this point.

H: The implementation of high information and communication technologies increases the degree of innovation.

3. RESEARCH METHODOLOGY

Pakistan has a total population of 6561 manufacturing SMEs which is engaged in exports. However, 364 manufacturing enterprises were chosen based on the table of samples (Morgan, 2012). The selection process resulted in an allocation with a 96 percent confidence level and a sampling variance of ± 4 percent for a total of 420 firms, with an individually interviewed survey conducted from June to December 2019 for the managers and the owners of chosen organizations.

3.1. Variables

3.1.1. Innovation

The definition of innovation in the literature covers both technical innovation and innovation in management practices Azar and Ciabuschi (2017), given that technological innovation leads to improvements in product typology as well as the implementation of new production methods Azar and Ciabuschi (2017), and the changes in the organizational framework of the enterprise and the administration process contribute to innovation in management structures.

To evaluate the innovation, information was asked to see if the organization made inventions for the last two years in products and services (changes or enhancements to the current products and services, as well as promotion of new products and services), process (changes or modifications to the production processes and the services, and the procurement of the new things), and the systems administration (leadership and the management, purchasing and supplies and commercial sales).

As a result, some organizations that have given innovations were questioned to rate their level of significance (1 is the least important, to 5 is to be very important), meanwhile, from the manager's point of view, the contextual approach to the interpretation of innovation is a most suitable tool for the case of the small medium enterprises (Garcia et al., 2009). Additionally, the general innovation was designed based on these answers by taking the arithmetical average of the seven innovation questions, generating a scalar variable of 1 to 5.
3.1.2. The information and communication technologies

To determine the extent of use of the ICT, survey managers of the small medium enterprises were asked if their organization had the following facilities (1 for yes and 0 for No):

1. Having the Email Address?
2. Having the Web Page?
3. Having the shopping and electronic sales by using the Internet?
4. Have your online banking?
5. Have you the internet marketing?
6. Have you Corporate Internet?

Variable ICT is created by the response obtained by applying the relevant questions to a nominal variable along with values ranging from 0 to 6. This method of configuring the variable is shown in the studies of Garcia et al. (2009).

Size. The total number of workers at businesses in 2019 was used to determine this measure.

Age. The number of years after the establishment or start of economic practice. One confirmatory factor analysis using the maximum likelihood approach was used to determine the efficiency and validity of entrepreneurship orientation (Brown, 2006). Cronbach's alpha and the composite reliability index were used to assess the theoretical model's reliability (Padilla & Divers, 2016). Furthermore, we considered the robust statistical, which gives better statistical change to the proposed data (Kitchenham, Madeyski, & Budgen, 2017). Table 1 displays the AFC findings, which demonstrate that the scale for assessing innovation seems to have a good fit (S-BX2 = 18.95, df = 11, p = 0.006, NFI = 0.993, NNFI = 0.995, CFI = 0.997, and RMSEA = 0.031).

Moreover, all the items that are associated with the factors are significant the value (p <0.01), and the size of all the standardized factor loading surpass the values of 0.60 (Bagozzi & Yi, 1988), the value of Cronbach's alpha and the IFC have higher from 0.70 and extracted the variance index (IVE) value has higher from 0.50 (Fornell & Larker, 1981), which indicates the presence of the reliability and the validity convergent, thus explaining the reliability of the measurement scale of innovation described by (Hair et al., 1995).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Indicator</th>
<th>Factor loading</th>
<th>t-value</th>
<th>Cronbach Alpha</th>
<th>IFC</th>
<th>IVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product_Innovation</td>
<td>IP1</td>
<td>0.735***</td>
<td>1.000a</td>
<td>0.700</td>
<td>0.703</td>
<td>0.548</td>
</tr>
<tr>
<td></td>
<td>IP2</td>
<td>0.723***</td>
<td>21.359</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process_Innovation</td>
<td>IR1</td>
<td>0.801***</td>
<td>1.000a</td>
<td>0.752</td>
<td>0.763</td>
<td>0.510</td>
</tr>
<tr>
<td></td>
<td>IR2</td>
<td>0.665***</td>
<td>16.079</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Management_System_Innovation</td>
<td>IS1</td>
<td>0.752***</td>
<td>1.000</td>
<td>0.799</td>
<td>0.801</td>
<td>0.554</td>
</tr>
<tr>
<td></td>
<td>IS2</td>
<td>0.767***</td>
<td>26.569</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>IS3</td>
<td>0.713***</td>
<td>24.084</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: “X2 (df=11) = 18.95; p <0.007; NFI= 0.993; NNFI = 0.995; CFI = 0.997; RMSEA = 0.031, a=Parameter constrained to this value in the identification process***= p<0.01”.
The proof for the theoretical model's discriminant validity is interpreted in two forms, as shown in Table 2. The first one is the confidence interval test suggested by Anderson and Gerbing (1988), which specifies that with a confidentiality range of 95%, no individual components of latent factors of the correlation matrix possess the value of 1.0. The second one, the proposed variance measure, is attained by Fornell and Larcker (1981), which means that each pair of the structures has less of an extracted variance as compared to the corresponding IVE. As a consequence of the outcomes of both experiments, it is possible to assume that the theoretical model has clear proof of the discriminant validity.

### Table 2: Discriminant Validity of the model

<table>
<thead>
<tr>
<th>Variables</th>
<th>Product Innovation</th>
<th>Process Innovation</th>
<th>Management System Innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product_Innovation</td>
<td>0.566</td>
<td>0.265</td>
<td>0.215</td>
</tr>
<tr>
<td>Process_Innovation</td>
<td>0.460-0.568</td>
<td>0.503</td>
<td>0.242</td>
</tr>
<tr>
<td>Management_Systems_Innovation</td>
<td>0.410-0.509</td>
<td>0.440-0.544</td>
<td>0.577</td>
</tr>
</tbody>
</table>

Note: "The diagonal represents the index of variance extracted (IVE), whereas the above part is the correlation box. Below is the diagonal, estimate the correlation of the factors along with a 95% confidence Interval".

### 4. RESULTS AND DISCUSSIONS

We exercised a linear regression model by the MCO in the below model to examine the impact of the ICTs on the stage of innovation in the small medium enterprises:

\[ Innovation_i = \beta_0 + \beta_1 TICs_i + \beta_2 Size + \beta_3 Age + \epsilon_i \]

### Table 3: Innovation, Information, and Communication Technologies of Pakistan SMEs

<table>
<thead>
<tr>
<th>Variables</th>
<th>Innovation Activities</th>
<th>General Innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>TICs</td>
<td>Product Innovation</td>
<td>0.302***</td>
</tr>
<tr>
<td></td>
<td>Process Innovation</td>
<td>0.262***</td>
</tr>
<tr>
<td></td>
<td>Management Innovation</td>
<td>0.259***</td>
</tr>
<tr>
<td></td>
<td>System Innovation</td>
<td>0.325***</td>
</tr>
<tr>
<td>Size</td>
<td>0.005</td>
<td>0.039</td>
</tr>
<tr>
<td></td>
<td>(-0.163)</td>
<td>(1.054)</td>
</tr>
<tr>
<td>Age</td>
<td>-0.032</td>
<td>-0.032</td>
</tr>
<tr>
<td></td>
<td>(-0.803)</td>
<td>(-0.849)</td>
</tr>
<tr>
<td>F</td>
<td>20.169***</td>
<td>16.490***</td>
</tr>
<tr>
<td>R2</td>
<td>0.087</td>
<td>0.071</td>
</tr>
</tbody>
</table>

Note: "p≤0.1; ** = p≤0.5; *** = p≤0.1"

Table 3 summarizes the findings on the relation between ICT and innovation. The results suggest that the rise in use of the ICT in industries has a significant and positive and important innovation for SMEs in Pakistan, as confirmed in the working hypothesis. Nevertheless, age and size were not statistically significant variables that impacted SMEs' innovation level. The validity is
evaluated by R2 modified which is 0.103 and the value of F is 24.535 \((p < 0.01)\). The independent variables have the factor of variance inflation near 1 (VIF), so multicollinearity is removed. Similarly, the table below indicates that the usage of the information and communication technology in Pakistani SMEs has a favorable and important impact on the innovation in product areas \((\text{standardized} = 0.302 \text{ and } p < 0.01)\), but age and the size don’t impact the degree of the innovation in the products because significant variables have not been shown. The validity of this model is often compared to the R2 with a value of 0.087 and a value of F is 20.169 \((p < 0.01)\). This value has an F value. The explanatory variables have close to 1 \((1.037)\) inflation (VIF) component, so multicollinearity does not exist. It is also found that the increased usage of information and communication technology in small and medium-sized Pakistan has a positive and significant effect on these forms of innovation, with a standardized coefficient in both cases \(=0.259\) and \(p<0.01\). However, age and size had little impact on process innovation or management processes, so these factors did not produce statistically significant effects. The model's validity is contrasted with the modified R2 which is 0.071 and a value of F 16.489 \((p <0.01)\). There is no multi-linearity in the independent variable for the VIF value is similar to 1 \((1.038)\).

5. CONCLUSION AND POLICY IMPLICATIONS

It has been concluded that SMEs implementing information and communication technology in Pakistan will lead to an improvement in innovation with the same overall outcome, which is also evaluated here in this Article, for each of the three innovation activities. On the other hand, it is seen that age and the size of the organization have no impact on the process of innovation of SMEs in Pakistan and that statistically significant results have not been given to these variables. Thus, to succeed in today's increasingly globalized, competitive environment, it is concluded that the growth of innovation in the operational management and Pakistani SMEs is necessary. The investments needed for significant change and increased usage of information and communication technologies within the enterprise are important. In pursuit of major innovations and to handle this type of improving the productivity of the companying and reducing risks and uncertainties created in the market climate of today, managers and owners of Pakistan's small and medium-sized enterprises must develop, expand, and increase the usage of the information and communication technologies.

SME managers must learn about the real worth and importance in their enterprises of using and applying reliable and efficient communication and information technologies, as results of the research demonstrate that email \((84.5 \text{ percent})\) and electronic banking \((63.9 \text{ percent})\) are the most widely used tools of IT and communications technology. Although less than half of the businesses use the website, Internet shopping/sales, corporate intranet, and online marketing. In terms of the average technology employed, the progress in information and communications systems by Pakistani SMEs is half \((3.1\%)\); 12 percent develop the six technologies, and 15.7 percent do not use technology. Therefore, major obstacles that Pakistani SMEs must overcome include the high cost of technology, uncertainty about the benefits and effects on a company, a lack of internal knowledge and reliance on outside consultants, system unreliability, and technical
unsustainability. It is important to think about public policy that supports small and medium-sized firms. Training programs for employees, managers, and business owners need to fully explain the importance of using information and communication technology and how it affects the level of innovation in the industry.

This study has some limitations. The first is the use of measuring the ICT scale as well as innovation since information and communications networks are measured explicitly and innovation is determined with three variables or dimensions. The second one is that it was only used as a small element in ICT and advances made by qualitative variables. In other words, quantitative variables must be used for analysis to validate the same findings. The third drawback is that the results can be different only for the managers and the owners of the micro, small and medium-sized firms, when applying to a different sample, for example to the customers and the suppliers, thus, future research can include them to find out if their results are identical. The fourth and final limitation relates to firms operating as only 3 to 250 employees were surveyed in Pakistan. Thus, in future studies, companies with less than 3 employees are required to verify the information. Finally, future research should explore in more depth what effects it will have on small business innovation if a different scale were used for calculating the information and communication technology. If other factors were applied to calculate innovation, what outcomes will be achieved? In future studies, these and other questions could be addressed.

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