



IT-BASED INNOVATION AND NEW PRODUCT DEVELOPMENT PERFORMANCE IN YEMEN: THE MODERATING ROLE OF INTELLECTUAL PROPERTY

Abdulwahab Jandab¹; Noor Azman Ali^{2*}, Akram Abdulsamad³, Abdulrahman M. Al-Sharif⁴

¹Doctoral Candidate, Faculty of Economics and Management, UPM, Malaysia; a.jandab@yahoo.com

^{2*}Associate Professor, Faculty of Economics and Management, UPM, Malaysia; nazman@upm.edu.my

³Doctoral Candidate, Faculty of Economics and Management, UPM, Malaysia; akram.upm.edu@gmail.com

⁴Doctoral Candidate, Faculty of Economics and Management, UPM, Malaysia; alsharif1981@gmail.com

Information of Article

Article history:

Received: 10 Aug 2019

Revised: 29 Oct 2019

Accepted: 30 Oct 2019

Available online: 3 Nov 2019

Keywords:

IT-based Innovation,
New Product Development
Performance,
Intellectual Property,
DOI Theory,
SMEs in Yemen

ABSTRACT

This study seeks to investigate the relationship between IT-based innovation (ITI) and new product development performance (NPDP) in the context of Diffusion of Innovation (DOI) theory, as well as aims to examine the moderation effect of intellectual property (IP) on this relationship. Quantitative data were acquired for firms that are presently members of the federation of Yemen chambers of commerce and industry. Survey outcomes of 700 Yemeni foods processing SMEs provide considerable results for this study. SmartPLS-3 was used with the purpose of analyzing returned responses, validate the study model, and test the hypotheses. Results indicate that there is a positive direct relationship between ITI and NPDP, as well as, the results show an insignificant moderating effect of IP in the relationship between ITI and NPDP. This study contributes to the body of knowledge on the role of IT-based innovation in the performance of new product development. It further examined the moderating effects of IP on the relationship between IT-based innovation and new product development performance. The study was conducted in Yemen, a non-western and developing context. The practical implications of the findings to top management and practitioners are presented. The benefits of this study can be enjoyed by SMEs in the Yemeni food processing sector and the nation at large.

1. Introduction

At the least since the 1930s, technological advancements and innovations have been perceived for their focal significance for the success and growth of the economic. Through late decades, IP and intellectual property rights (IPRs) (e.g. trade secret, patents, copyrights and trade mark) have captured growing awareness, and IP has turned into a critical competitive advantage source in numerous industries at micro level, for the most part because of different developments at macro level. This has prompted to a raised significance of IP management to innovations that depend on IT which the research in this field still has been increasing since the late 1990s.

Moreover, the nature of strategy and strategic issue has been changed due to structural changes that have occurred in the economies of developing countries. These changes have also served to highlight the IP importance and its management (Namvar et al, 2010). Mansfield (1995) has argued that an initial support for the organization of international technology transfers influenced by the IP-related notion. Within an organization, usually, IP includes patents, copyrights, trademarks, and knowhow, etc., (Pisano and Teece, 2007). This term also includes R&D expenses and employees within an organization for the new product development performance.

The existing theory on DOI, on other side, shows the importance of innovation as the most determining factor of company performance because it facilitates the creation of a competitive environment (Salim & Sulaiman, 2011). One of the most complex issues in this field is the implementation of DBMS projects, as it is representative of the most popular and complex practices. This study shows the importance of using DOI theory's attributes that needs to be considered in the adoption of DBMS, which is an IT-based innovation for a company. Using the attributes represented in the DOI theory, the negative and positive effects of NPDP will be defined and analyzed empirically. It also examines whether IP moderates the association between ITI and NPDP in the context of SMEs of Yemeni food processing sector.

The aim of this study is to investigate the relationship between IT-based innovation and new product development performance in the context of SMEs among Yemeni food processing sector, as well as it aims to examine the moderation effect of intellectual property on this relationship. The remaining sections of this research are designed as follows: Section 2 shows the literature review related the research constructs; Section 3 displays research model and hypotheses development; Section 4 focuses on research methodology and design; Section 5 presents data analysis and Section 6 represents discussion and conclusion which includes future research directions.

2. Literature Review

2.1 IT-based Innovation (ITI)

Over last two decades, a significant phase in IT's revolution has been seen. Turning business direction also has done through IT's development. Innovation can be considered as one of the exceptional purposes concerning IT. In fact, IT has been looked as a major power for process, product or service innovation as well presenting new capabilities which were regarded as fiction material earlier.

Many researchers have noted that a key issue that should be addressed by scientific research is investigating the factors that influence the successful adoption and use of innovations in companies, and some of such factors include robotic systems, flexible manufacturing systems and management information systems (Uğurlu and Kurt, 2016). From this point forth, it is important to define the range of critical factors that contribute to the success of organizations in terms of implementing information technologies. Knowledge of the factors will contribute to the realization process of utility of information systems as well as the improvement of company performance. With accordance to Watad (2011), the innovation to be accepted as IT-based must encloses a considerable integration of IT applications. Consequently, companies require analyzing the chances and risks presented by new technology and involve them to the particular domain of the company. Nonetheless, organizational groups are probable to have different judgments on the effect of the new technology and how it is handled by the company.

The newest IT-based innovations link to knowledge management and knowledge systems. The motivation behind knowledge management is to create knowledge through adding value to organization's information and using human skill, which will improve organizational performance whether enhancing organization effectiveness or resources usage efficiently (Watad, 2011). With the goal of innovative organizations, they should to evolve the capacity to create and obtain new information, the capacity to apply it, and the capacity to interpret it into better methods of acting. Knowledge creation and deployment are pivotal parts of organizational learning, a prerequisite condition for innovation. Consequently, knowledge management endeavors ought to be moved forward as a nonstop exertion, which needs to be committed to learning (Sher and Lee, 2004). Constructing knowledge assets happens in several ways, such as, by means of documenting processes, streamlining standards, making skills, and model bases. While, deploying knowledge occurs by means of spreading information, training staff, rotating jobs, and employing web tools and online services. Consequently, competitive advantage source lies in the knowledge application rather than in the knowledge itself (Weck and Blomqvist, 2008).

Enterprises in the contemporary knowledge environment know well that they will pass away except if they tend to utilize value from their information or intellectual assets (Wassenaar and Katsma, 2004). Information system applications created as knowledge management applications or IT applications extend from the evolution of the systems of highly codified help desk to providing of video conference facilities to interchange thoughts among organizational members. Wassenaar and Katsma also refers that these systems are developed to catch, produce, refine, label and disseminate information utilized to promote organization productivity. Various advantages of this area are asserted in existing literature, for example raised productivity, innovative products and services creation and best practices and experience introduction through new software packages implementation like types of knowledge management systems. In agreement with this view, Sher and Lee's (2004) study has concurred that IT innovation's applications and recent technique encourage firms to introduce products and services with superior quality, in this manner firms should to attain profit and competitive advantage.

2.2 Intellectual Property (IP)

Teece (1998) has described IP as a part of property rights which increases the significance of knowledge assets. IP indicates to the intellect's creations such as symbols, images, names, inventions, and designs utilized in business in which via law a monopoly is passed to specific owners. Often, know-how assets are hard to duplicate; also, as physical assets, in individual country states, some know-how assets have assurance against burglary under their own IP laws. Thus, in developing countries, such laws normally encompass trademarks, patents, trade secrets, and copyright (Almasani et al., 2019; Dhar, 2019; Dhar et al, 2017; Namvar et al, 2010).

IP is not significant only in the new manufacturing activities like biotechnology and microelectronics but it stays critical in other industries such as chemicals, food and pharmaceuticals and is acquiring continued attention in most of mature businesses like steel and oil (Pisano and Teece, 2007). Moreover, the increasing development of IT has additionally intensified the significance of IP and has infused IP into new settings. For instance, it is not unusual to find the bases of successful of wholesalers and retailers engrossed in copyrighted programming and in IT backing logistics and order entry (Weck and Blomqvist, 2008).

In keeping with this context, Teece (1998) has stated that IP reinforcement is an imperative force to curb of the increasing imitation ease. At the time that the knowledge and information diffusion quicken, IP turns out to be more prominent. As IP can be exchanged, and can occasionally be originated around, it cannot anymore be violated with freedom from liability and without punishment.

2.3 New Product Development Performance (NPDP)

Particularly, the new product development rate is seen a critical element in a firm's success. At the same time, the home-based resources which can be authorized companies to vie effectively in global markets are no longer enough to assure firms' competitiveness (Hsu and Fang, 2009). As rivalry is now international, firms should employ knowledge from

multiple sources in different countries to create new products. This includes speedily recognizing changeable customer needs, improving more complicated products to get the satisfaction of customer's needs, and giving superior customer service, whilst utilizing the technology power in directing performance and dependability (Nezam et al. 2013).

In this study, performance is identified as new product development performance which composed of four measures are used to investigate in this study, namely, Financial performance, Time efficiency, Customer performance, and Product performance. A multi-item scale was employed to evaluate whether the new product fulfilled the financial, timeliness, and product development goals, and also customer satisfaction besides.

3. Research Model and Hypotheses Development

3.1 *IT-Based Innovation and New Product Development Performance*

It is suggested by several studies that innovation as a critical factor for organizational survival in the contemporary world, and also as a means through which organizations respond to a variety of environmental changes (Salim and Sulaiman, 2011; Uğurlu and Kurt, 2016). The innovation hypothesis can be summarized, by some researchers, as one possible mechanism through which exclusive organizational resources could help firms to gain a competitive advantage in the marketplace (Pisano and Teece, 2007). Adoption of an IT-based innovation is expected to result in organizational change that might affect the firm's performance (Rothwell, 1992). Further, Watad (2011) argued that IT-based innovation is close linked with knowledge management and knowledge systems which improve organizational performance whether by enhancing organization effectiveness or by resources usage efficiently. In the same vein, Sher and Lee's (2004) study has concurred that IT innovation's applications and recent technique encourage firms to introduce products and services with superior quality, in this manner firms should to attain profit and competitive advantage. Likewise, a study of Byrd and Marshall (1997) that was conducted on 40 insurance companies indicated to a positive link between IT innovation investments and organizational performance. Research also supports the argument that effective IT-based innovation serves as a key instrument for firm performance (Akça & Özer, 2014). Thus, it is argued that:

H1: IT-based innovation has a significant effect on new product development performance in SMEs of Yemeni food processing sector.

3.2 *Moderating Role of Intellectual Property*

When IP rights are effectively used, successful innovation can be achieved (Holgersson et al, 2018). With the strategic use of IP, innovative technologies stand a better chance of successfully reaching the marketplace. In addition, the importance of other IP tools in innovation cannot be well understood if IP is measured based on the patents as input and/or output of innovation. Therefore, it is important to look at IP in innovation from a broader perspective (Clarke et al., 2011). New businesses or existing ones can acquire new market territory without any rivalry if their improved or new unique product satisfies the expectations of customers; this is because such businesses are able to maintain their innovative advantage (Kalanje, 2005). Another significant role played by IP is in helping businesses to gain and maintain their innovation-based advantage (Namvar et al, 2010). Therefore, the benefits of innovation can only be enjoyed by organizations if they put the whole issues associated with IP into consideration from the beginning of the process of new product development. This is a fact, regardless of if the decision to innovate was taken as part and parcel of the overall business strategy, one-off development of a new idea, or in response to the trend in the marketplace (Hung & Chou, 2013). The role of IP in facilitating competitiveness of technology-based firms cannot be underestimated, regardless of if such firms are commercializing new or improved products or even providing service or product based on a new or improved technology (Kalanje, 2005). In the case of many technology-based firms, successful innovation enhances the efficiency of operations, or improves the performance of new product. The outcome of added value is an improvement in the profitability of the firm, and this is the basis of higher productivity (Pisano & Teece, 2007).

Many researchers have investigated the moderating effect of IP. For instance, the study of Barbua & Militarua (2019) showed that some IPs components (i.e. trademarks and patents) positively moderate the relationship between the innovation and firm performance; however some (i.e. trade secrets and copyrights) do not support such relationship. Also, in a study conducted by Hung & Chou, (2013), some components of IPs were investigated as moderating variables within the context of open innovation; the findings showed that the correlation between open innovation and firm performance in high tech manufacturers in Taiwan is positively influenced by investment in R&D. Similarly, in another study carried out by Clarke et al, (2011) in Australian companies, the components of intellectual capital were studied as the alternative moderating variable in the correlation between capital-employed efficiencies and performance, and the findings showed that intellectual capital components like such relationship is positively moderated by intellectual capital components. Thus, it is proposed that superior intellectual property might affects on the strength of the relationship between IT-based innovation and new product development performance. Hence, it can be argued:

H2: Intellectual property has a moderate effect on the relation between IT-based innovation and new product development performance in SMEs of Yemeni food processing sector

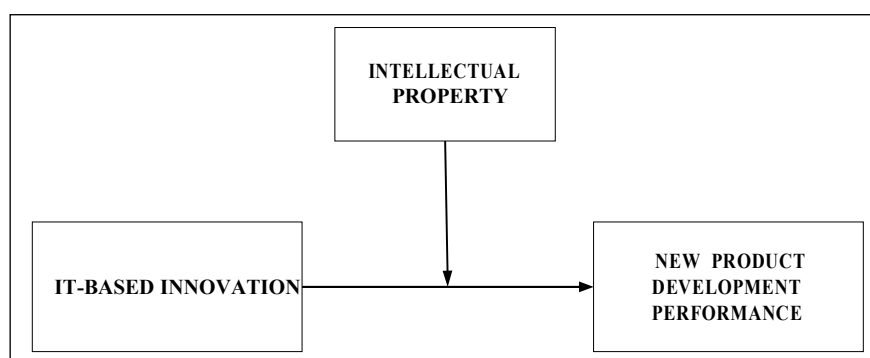


Fig. 1. Research Model

4. METHODOLOGY

4.1 Sampling

The population in this research is SMEs of food processing sector in Yemen that are presently members of the federation of Yemen chambers of commerce and industry. Through utilizing simple random sample approach, a survey-based methodology was conducted. The sample size in this research was 318 firms according to the formula of Krejcie and Morgan.

4.2 Measurement

Current study utilized three dimensions (compatibility (CM), relative advantage (RA) and complexity (CX)) to assess IT-based innovation (ITI). To measure Intellectual Property (IP), three factors identified (Trade secrets [importance and accessibility], Trademarks and Research & Development). Further, four dimensions namely, customer performance (CP), financial performance (FP), product performance (PP) and time efficiency (TE) also were used to measure new product development performance (NPDP).

4.3 Development of Survey Instrument

To fulfill the research objective, the questionnaire instrument containing 25 items was employed for collecting data. Further, five-point-Likert scale was considered to test to what extent a respondent can agree or disagree with the questionnaire's statements. Out of the 700 surveys distributed among SMEs of Yemeni food processing sector, 620 were returned. 16 cases were eliminated as statistically unreliable, 27 considered as outliers cases and 16 uncompleted questionnaires. As a result, 561 questionnaires were analyzed statistically by SmartPLS-3.

5. Data Analysis and Results

5.1 Measurement Model Assessment

The measurement model was confirmed and the structural model was subsequently examined. During the first phase, for this advancement, a few tests such as multicollinearity, outlier, and normality testing were achieved to evaluate preparatory presumption to operate SEM. In addition, to examine to what extent the suggested measurement model is reliable, other measures were tested (i.e. average variance extracted, cronbach's alpha, and composite reliability). Factor loadings are agreeable with a value more than 0.5 (Hair et al, 2017). In general, the results indicate to an acceptable level of goodness-of-fit of research model in which SRMR was 0.06 and such value was less than 0.08. Regarding the loading for all items of the study variables, the outer and cross loadings were examined to notice any problem before conducting convergent validity. For the convergent validity, AVE explains the general amount of variation caught via the construct, should be more than 0.5 (Hamid et al, 2017). The findings indicate that all AVE values are higher than 0.50. (Table 1). Fornell and Larcker criterion assessment, on other hand, was used as one of the tests for evaluating discriminant validity of the measurement model, and thus as shown in Table 2, the AVEs' square root are explained through the bolded values, where for each construct, the highest value among the associations between constructs (corresponding column and row) is the bolded one. With these, the constructs are strongly linked to their respective items compared to other constructs of the model, then proposing satisfactory discriminant validity (Hair et al, 2017). More so, Awang (2014) has stated that the correlations between predictor constructs have to be less than 0.85. The outcomes of the measurement model assessment have revealed that the model has obtained acceptable levels of constructs validity and reliability, which allows the researcher to proceed to the subsequent phase and evaluate the structural model.

Table 1: Reliability and Convergent Validity

Construct	Item	Statement	Loading	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Extracted (AVE)
ITI	ITI_R2	The disadvantages of my using the database system far outweigh the advantages. ^R	0.772	0.721	0.809	0.585
	ITI_R3	Using the database system improves my job performance.	0.754			
	ITI_R4	Generally, I find using the database system enhances my effectiveness at work.	0.769			
	ITI_C2	I think that using the database system fits well with the way I like to work.	0.913	0.810	0.899	0.749
	ITI_C3	Using the database system fits into my work style.	0.807			
	ITI_C4	Using the database system is completely compatible with my current situation.	0.873			
	ITI_X1	I have a difficult time understanding how the database system works. ^R	0.769	0.738	0.815	0.597
	ITI_X3	The challenges of learning how to use the database system overwhelm me. ^R	0.857			
	ITI_X4	I believe that the database system is simple to use.	0.682			
IP	IP2	The firm considers its trade secrets importance as high.	0.832	0.762	0.849	0.586
	IP3	The trade secrets in our firm are inaccessible.	0.731			
	IP4	Our trademarks are easily recognizable by consumers.	0.711			
	IP5	In our firm, research & development directly enhances the development of protected assets.	0.782			
NPDP	CP2	This new product generates high customer acceptance.	0.799	0.754	0.836	0.630
	CP3	Many customers buy this new product.	0.737			
	CP4	Our customers have a loyalty to the new product.	0.841			
	FP1	The overall profitability of our new product is high.	0.831	0.715	0.819	0.604
	FP2	Our new product generates a high investment return.	0.821			
	FP4	The sales of the new product are acceptable in general.	0.668			
	TE1	Our new product launched on time.	0.821	0.768	0.871	0.694
	TE3	We get our new products to market on schedule.	0.882			
	TE4	We perform better than our objectives on speed of new product development.	0.793			
	PP1	Compared to our competitors... The market share of our new product is higher.	0.803	0.795	0.825	0.611
	PP2	Development cycle is shorter.	0.789			
	PP3	The overall quality of our new products is higher.	0.752			

R: Reverse Coded

Table 2: Discriminant Validity

	IP	ITI_CM	ITI_CX	ITI_RA	NPDP_CP	NPDP_FP	NPDP_PP	NPDP_TE
IP	0.765							
ITI_CM	0.255	0.865						
ITI_CX	0.142	0.362	0.772					
ITI_RA	0.08	0.313	0.264	0.764				
NPDP_CP	0.323	0.18	0.058	0.151	0.793			
NPDP_FP	0.412	0.29	0.203	0.225	0.427	0.777		
NPDP_PP	0.459	0.235	0.122	0.162	0.454	0.496	0.781	
NPDP_TE	0.35	0.213	0.133	0.141	0.447	0.476	0.517	0.833

5.2 Structural Model Assessment

After evaluating of measurement model, the subsequent stage of structural equation modeling (SEM) analysis is the structural model assessment. In this way, according to Hair et al (2017), the procedure of structural model assessment can be done via few tests such as the beta values (β), the effect sizes (f^2), the coefficient of determination (R^2) and the corresponding t-values by means of a bootstrapping tool. To assess the structural model hypothesis testing, all the conditions mentioned above were tested. Consequently, structural model was established and examined by means of

utilizing the study's latent constructs by SmartPLS-3. The amount of variance of NPDP is represented by the coefficient of determination R^2 which is explained by ITI. The results show that the R^2 reached a good sufficient value for the model to attain an agreeable rate of explanatory power (0.326) which was treated as moderate effect (Hair et al, 2017). Further, f^2 for NPDP with predictor latent construct (ITI) was 0.09 and it considered as small size effect (Cohen, 1988).

5.2.1 Direct Hypotheses Testing

Table 3 provides the indication of the hypothesis tests. It was found that ITI is significantly predicting NPDP. Therefore, the given hypothesis (H1) is accepted. In sum, the study found that when the adoption of IT-based innovation increase within SMEs of Yemeni food processing sector, new product development performance will increase.

Table 3: Structural Path Analysis Results

Effect	Path	β	T-stat.	P-Value	Result
Direct	ITI \rightarrow NPDP	0.201	5.195	0.0000	Supported

5.2.2 Moderation Assessment

The moderator is known as a construct that can effect on the strength and/or direction of the correlation between the criterion and predictor constructs. In this study, the moderating construct is IP, and as such the moderating effect of IP on the relationship between ITI and NPDP is investigated. The strength of the moderating effect of intellectual property on the relationship between ITI and NPDP was estimated using the indicator method in PLS SEM. With a view to determine the effect size, the Cohen guidelines for determining the effect size was employed (Cohen, 1988). When using the indicator approach to define the moderating effect of a moderating construct, the product terms between the indicators of the predictor latent constructs and those of the latent moderator construct must be created. Findings showed that IP has no significant interactive effects on the relationship between ITI and NPDP. Table 4 also indicates that IP does not moderate the relationship between ITI and NPDP ($\beta=0.17$, $t=0.841$, $p < 0.4$).

Effect	Path	β	T-stat.	P-Value	Result
Moderating	(IP on ITI) Moderating Effect 1 \rightarrow NPDP	0.17	0.841	0.4	Not Supported

6. Discussion and Implications

The outcomes of this study showed a strong support for the proposed model. With this, ITI was found to impact NPDP which was significantly confirmed and that suggesting that NPDP of SMEs of Yemeni food processing sector is enhanced through their ITI. This impact is supported by previous innovation research (Akça and Özer, 2014; Sher and Lee's, 2004), specially, the study of Barbua and Militarua (2019) who found that innovation potential greatly affects firm performance. Moreover, Watad (2011) argued that ITI is closely linked with knowledge management and knowledge systems through which organizational performance is improved, whether by improving the effectiveness of the organization or by the efficient use of resources. Byrd and Marshall (1997) that was conducted on 40 insurance companies indicated to a positive link between IT innovation investments and organizational performance. This is explained by the fact that when SMEs of Yemeni food processing sector leveraged IT-based innovation as a competitive advantage, it would increase their performance of new product development. Conclusively, the role of IT-based innovation in the improvement of performance and long-term sustainability is crucial. Based on the existing literature, the importance of IT-based innovation in achieving better firm performance in terms of new product development has been highlighted.

The results of this study also showed insignificant moderating effects of IP in the relationship between ITI and NPDP in SMEs of Yemeni food processing sector. In other words, the interactions between IP and IT-based innovation have no effects on new product development performance. Thus, these results fail to strongly support the idea that intellectual property moderates the association between ITI and NPDP. This finding is contradicted by the results of previous relevant studies which examined the moderating effect of IP. Barbua and Militarua (2019) have examined the moderating effect of IPRs on the association between innovation and firm performance in manufacturing sector in Romania, and found that some IPRs components (i.e. trademarks and patents) positively moderate the relationship between the innovation and firm performance; however some (i.e. trade secrets and copyrights) do not support such relationship. Furthermore, Hung & Chou, (2013) have studied the moderating effect of some of IP's components in the context of the open innovation, and found that the more investment in internal R&D positively affects the relationship between open innovation and firm performance in high tech manufacturers in Taiwan.

A possible reason behind that may lie in the weakness of IP protection in Yemen, since the report of global competitiveness 2018 mentioned to low levels of IP protection and patent applications with 137 and 121 out of 144 countries respectively (World Economic Forum, 2018). Further, another possible cause may lie in the culture and awareness of Yemeni society in general and business organizations in particular, where IPRs are still absent during implementation (Alnaqeeb, 2016). In addition, laws protecting IPRs and patent applications are not only weak, but also presently being deactivated due to the current situation experienced by Yemen, as well as the failure to issue the implementing regulations for most of these laws was one of the reasons for the delay in their full implementation (Aldram et al., 2014).

7.1 Theoretical and Practical Implication and Further Direction

The proposed model based on existing theories seems to provide support for the DOI theory. Further, the variance explained by the proposed model of the current study for the NPDP achieved (33%) and attained a suitable level of explanatory power for ITI according to Hair et al. (2017). This study contributes to the body of knowledge on the role of IT-based innovation in the performance of new product development in a non-western and developing context. It also contributes to the literature by including the intellectual property as a moderator in the relationship between IT-based innovation and new product development performance. According to the relevant literature, the effect of such interaction has been scarce, specially, in Middle Eastern countries. In Yemeni context, this study provides the first test of the moderating role of intellectual property. Although the result found this interaction doesn't moderate the association between IT-based innovation and new product development performance, this study provides empirical evidence on this interaction matter from non-western, different, and phenomenal context (i.e. Yemen). All previous studies were conducted in USA, Taiwan, Australia, and Romania. None of them was conducted in Middle Eastern societies or developing countries, specifically in Yemen. This may justify the absence of the moderating impact of intellectual property in the relationship between IT-based innovation and new product development performance in this study because it was conducted in a completely different environment from previous studies environments. Therefore, future research should be conducted to investigate the moderating role of intellectual property in the relationship between IT-based innovation and new product development performance by conducting cross-cultural studies, and indeed a cross-cultural validation is required for greater generalization of the proposed model by using a considerable sample gathered elsewhere.

7. Conclusion

This study investigates the relationship between IT-based innovation and new product development performance in the context of DOI theory; as well as it examines the moderation effect of intellectual property on this relationship. In direct hypothesis testing, we found that there is a close relationship between IT-enabled innovation in SMEs of Yemeni food processing sector and their enhanced new product development performance. However, through the moderation assessment, intellectual property has no significant interactive effects in the relationship between IT-based innovation and new product development performance in SMEs of Yemeni food processing sector. This study suggests that executives should avoid perceiving technology resources as a commodity, but rather be aggressively engaged in understanding the important role of IT-based innovation within SMEs among the food processing sector. When the new IT is adopted as a complement for IT-based innovation and the development of new product can be positively influenced, and this influence will be reflected in the improved performance of SMEs of food processing industry and other sectors in Yemen. In order for government to address inefficiencies, it is important for to establish regulations for the protection of intellectual property. Due to the fact that firms as well as an entire economy can benefit from IT-based innovations, the government can enjoy more benefits when the operations of the market are stable and protected in terms of IP rights.

References

- Ab Hamid, M. R., Sami, W., & Sidek, M. M. (2017, September). Discriminant validity assessment: Use of Fornell & Larcker criterion versus HTMT criterion. In *Journal of Physics: Conference Series* (Vol. 890, No. 1, p. 012163). IOP Publishing. [\[Abstract\]](#)
- Akça, Y., & Özer, G. (2014). Diffusion of innovation theory and an implementation on enterprise resource planning systems. *International Journal of Business and Management*, 9(4), 92. [\[PDF\]](#)
- Aldram, O.; Hassan, S.; Salah, H.; and Al-Shamahy, L. (2014). Intellectual Property and the Constitution: Advocacy for the Incorporation of a Special Article on Intellectual Property Rights in the Yemeni Constitution. Published by Sailing Foundation for Creativity, Yemen.
- Almasani, A.A, Azam, S.M.F, Ahmed, S., Yusoff, S.K.B.M.D. (2019). The Mediation Effect of Audit Quality on the relationship between Auditor-Client Contracting Features and the Reliability of Financial Reports in Yemen, *International Journal of Business Society*, 3(10), 58-69. [\[PDF\]](#)
- Alnaqeeb, M. (2016). The Economic Importance of Industries based on Copyright. Paper Presented at a Workshop on Intellectual Property Protection, Ministry of Industry and Trade, Sana'a, Yemen.
- Awang, Z. (2014). Structural Equation Modeling Using AMOS. Penerbit Universiti Teknologi MARA, Malaysia 2012.
- Barbu, A., & Militaru, G. (2019). The Moderating Effect of Intellectual Property Rights on Relationship between Innovation and Company Performance in Manufacturing Sector. *Procedia Manufacturing*, 32(1), 1077-1084. [\[DOI\]](#)
- Byrd, T. A., & Marshall, T. E. (1997). Relating information technology investment to organizational performance: A causal model analysis. *Omega*, 25(1), 43-56. [\[DOI\]](#)
- Clarke, M., Seng, D., & Whiting, R. H. (2011). Intellectual capital and firm performance in Australia. *Journal of Intellectual Capital*, 12(4), 505-530. [\[DOI\]](#)
- Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences*. 2nd Ed. London: Routledge.
- Dhar, B. K., Rahouma, H. M., Masruki, R., & Absar, M. M. N. (2017). Impact of Islamic human resource practices on organizational performance through organizational commitment in the banking sector of Bangladesh. In 7th Islamic Economic System Conference, Sultanate of Oman. [\[PDF\]](#)
- Dhar, B.K. (2019). The Impact of Intellectual Capital on Organizational Performance in the Banking Sector of Bangladesh. *Universiti Sains Islam Malaysia*. [\[PDF\]](#)
- Hair, J., Hult, G., Ringle, C. and Sarstedt, M. (2017). *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*. 2nd Ed. London: Thousand Oaks: SAGE.
- Holgersson, M., Granstrand, O., & Bogers, M. (2018). The evolution of intellectual property strategy in innovation ecosystems: Uncovering complementary and substitute appropriability regimes. *Long Range Planning*, 51(2), 303-319. [\[DOI\]](#)
- Hsu, Y. H., & Fang, W. (2009). Intellectual capital and new product development performance: The mediating role of organizational learning capability. *Technological Forecasting and Social Change*, 76(5), 664-677. [\[DOI\]](#)
- Hung, K. P., & Chou, C. (2013). The impact of open innovation on firm performance: The moderating effects of internal R&D and environmental turbulence. *Technovation*, 33(10-11), 368-380. [\[DOI\]](#)
- Kalanje, C. (2005). Role of Intellectual Property in Innovation and New Product Development. Unpublished Manuscript, SMEs Division, WIPO. [\[PDF\]](#)

- Mansfield, E. (1995). Intellectual Property Protection, Direct Investment, and Technology Transfer: Germany, Japan, and the United States. International Finance Corporation discussion paper; no. IFD 27*IFC working paper series. Washington, D.C.: The World Bank. [\[Abstract\]](#)
- Namvar, M.; Mohammad, F.; Peyman, A.; and Mohammad, G. (2010). Exploring the impacts of intellectual property on intellectual capital and company performance: The case of Iranian computer and electronic organizations. *Management Decision*, 48(5), 676-697. [\[Abstract\]](#)
- Nezam, M.; Ataffar, A.; Isfahani, A. and Shahin, A. (2013). Human Capital and New Product Development Performance Efficiency - The Mediating Role of Organizational Learning Capability. *International Journal of Learning & Development*. 3(6), 40-58. [\[PDF\]](#)
- Pisano, G. and Teece, D. (2007). How to Capture Value from Innovation: Shaping Intellectual Property and Industry Architecture. Special Issue on Leading Through Innovation (50th Anniversary Issue). *California Management Review*, 50(1), 278-296. [\[Abstract\]](#)
- Rothwell, R. (1992). Successful Industrial Innovation: Critical Factors for the 1990. *R&D Management*, 22(3), 221-239. [\[DOI\]](#)
- Salim, I. and Sulaiman, M. (2011). Organizational learning, innovation and performance: a study of Malaysian small and medium sized enterprises. *International Journal of Business and Management*, 6(12), 119-1215. [\[DOI\]](#)
- Sher, P. and Lee, V. (2004). Information Technology as a Facilitator for Enhancing Dynamic Capabilities through Knowledge Management. *Information & Management*, 41(8), 933-945. [\[DOI\]](#)
- Teece, David J. (1998). Capturing value from knowledge assets: The new economy, markets for know-how, and intangible assets. *California management review*, 40 (3), 55-79. [\[DOI\]](#)
- Uğurlu, Özlem Y., and Kurt, M. (2016). The Impact of Organizational Learning Capability on Product Innovation Performance: Evidence from the Turkish Manufacturing Sector. *Emerging Markets Journal*, 6(1), 70-84. [\[PDF\]](#)
- Wassenaar, D.A., and Katsma, C.P. (2004). IT-based innovation in a digital economy: A social learning perspective, Proceedings of ICEC 2004, Delft, The Netherlands, October 25-27. [\[DOI\]](#)
- Watad, M. (2011). The organizational dynamics of knowledge and IT-enabled innovations, *Journal of Technology Research*, 2(1), 187-205. [\[PDF\]](#)
- Weck, M. and Blomqvist, K. (2008). The Role of Inter-Organizational Relationships in the Development of Patents: A Knowledge-based Approach, *Research Policy*, 37(8), 1329-1336. [\[DOI\]](#)
- World Economic Forum (2018). The Global Competitiveness Report 2018, Geneva. [\[PDF\]](#)