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Role of Information Technology Capabilities on Product Innovation Performance: Mediating Role of Corporate Entrepreneurship

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ABSTRACT

Despite the surplus studies demonstrating the significance of information technology capabilities in business growth with innovation, the knowledge of the approaches through which such benefits can be attained and their connections, expertise, and influence to other organizational and managerial aspects are yet limited.

Purpose: To fill the research gap by studying the relationship between Information technology capabilities and business innovation within corporate entrepreneurial activities and also examining the mediating effect of Corporate Entrepreneurship, its sustainable approach at managerial level and contribution in market research towards emerging demands of IT. This study is also focusing on the skills, processes, and modifications to achieve such goals; also the implications for the managers dealing with product innovations in dynamic organizations.

Design: Selected design for this study is descriptive in nature following a quantitative approach with stratified random sampling technique. The data is collected from 315 IT executive and managers from the population of 50 manufacturing firms in Karachi, Pakistan.

Findings: Using data collected from the concerned population in the dynamic business environment, Researcher found the corporate entrepreneurship partially mediating the correlation between product innovation performance and information technology capabilities in an organization. These variables being studied are the observed elements of organizational progress and success; and their impacts on innovation, growth, and success are recognized and attested with the help of hypothesis testing in this research.

Significance: This study is providing guide and support to organizations and policymakers incorporate entrepreneurial activities at different firms and managerial levels. Furthermore, this research study fills the existing gap by incorporating corporate entrepreneurship (CE) at the organizational level and contributes to the more robust development, understanding and involvement of IT to improve the overall business value.

Keywords: Information Technology capabilities (IT Cap), product innovation performance (PIP), Corporate Entrepreneurship (CE).

1. INTRODUCTION

Introducing a new service in market keeping in view the requirement of the customers can be said as product innovation (Damanpour,1991), in normal circumstances

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or business environment and specifically in changing and dynamic business environment, product innovation can ensure the organization's success by providing competitiveness because product life cycles in today's world are shortened due to swift technological changes and phenomena of globalization (Damanpour, 1991). Innovation in product or service with the passage of time is vital for the survival of a business in changing the economy. In the current intensive competitive environment, dynamic and unique business innovations are required for growth and competition with other organizations (Malaquias, Malaquias, & Hwang, 2016). For ready reference and practical example, Procter & Gamble, having diversified and wide needs and requirements from consumer population and that too from all over the world having different cultures and preferences considers it as a critical challenge to meet within a cost effective limits and quick response as well. Procter & Gamble considers its competitiveness by meeting the diversified demands of customers with innovation and new products in time in multiple markets throughout the world (Teresko, 2004). Product innovation is considered as most important and vital factor for the performance and standing of the organization because of its impact on every aspect of the expansion of the organization's products and services (Tang, Chen &Jin, 2015), especially when considering the new markets of the world into account to capitalize the opportunities for more profit generation. Product innovation performance can be said the level to which an organization has successfully achieved its level of profits and increase in sales along with meeting its target revenues from the new product or service introduction to the market (Crossan & Apaydin, 2010). It is an important and critical indicator of product innovation performance.

Currently, the available literature of this topic advocates the possibility of a significant relationship of IT capabilities on any organization's product innovation and growth (Weerawardena, Mort, Salunke, Knight, & Liesch, 2015). IT Capabilities is overall representative of all the abilities of the organization to move and implement the IT resources to increase the productivity of other related resources that matters for the value addition of the organization that's why it can be said an organizational level construct which helps in the improvement of other performance indicating resources of the organization (Pavlou & El Sawy, 2010). Though there is wide level research done on

IT Capabilities on Product innovation but the methodology by which IT Capabilities factor exploit the product innovation performance is not clearly explained and perceived. The knowledge and awareness about the such methods by which IT Capabilities enhance the product innovation and progress is expected to increase if research focus remains on the processes that impact the independent variable i.e. product innovation performance, especially in changing environment around the word for businesses (Tan, Zhan, Ji, Ye, & Chang, 2015).

Current studies of corporate entrepreneurship (CE) are focusing on the mechanism and processes examination by which IT Capabilities are affecting product innovation and progress. Some studies are also done on individual behaviors' an organization, whether relatively far from the constructs of entrepreneurship but having their role in an organization's overall efforts for new businesses through joint ventures, new product/services innovations and revitalizations of the existing products or services for the advancement of the organization to a new direction by capitalizing its underlying resources (Bhatt, Emdad, Roberts & Grover, 2010). Corporate Entrepreneurship and related activities are considered to be important for organizations productivity, profitability and growth by playing their role in new ideas for the organization (Chen, Wang, Nevo, Benitez-Amado & Kou, 2015). Furthermore, organizational corporate entrepreneurial activities are vulnerable and highly influenced by external environmental changes with respect to the organization or its products (Pavlou & El Sawy, 2010).

1.1. Relationship Between Variables

1.1.1. Corporate Entrepreneurship and Information Technology Capabilities:

Considering the first relationship between the two variables i.e. Corporate Entrepreneurship and Information Technology Capabilities, contemporary research in the same field proposed Information Technology as a prerequisite for Corporate Entrepreneurship activities. For validating the said relationship, this research study will elaborate how Information Technology based capabilities influence the Corporate Entrepreneurship in upcoming different ways, i.e., support for generating and sharing the important information, enhancing the communication system, and revamping and revitalizing the business structure and their inter-related parts to result into a collective

output (Tang, Chen, & Jin, 2015). Subject Information Technology capabilities interact to above mentioned activities to collectively result in positive output for Corporate Entrepreneurship. To reemphasize, it is vital for Corporate Entrepreneurship to be effective that, organization must have the capability to assimilate data, able to put data into analysis form and generating output for organization (Zahra, 1991), keep in view the market competitors, business industry keep on changing its trends due to customers' needs, subject data will help the organization to innovate product accordingly (Nambisan, 2013).

1.1.2. Product Innovation and Corporate Entrepreneurship:

In addition to the above, to be an effective supplement for innovation activities, Corporate Entrepreneurship can be effective only when all units of business adopt and integrate the activities. To make productive decisions about entrepreneurial innovations and successfully capitalization of the market opportunities, an organization is highly dependent upon them in time and provision of information about the business environment (Smolnik, Urbach, Fjermestad, Jacks, Palvia, Schilhavy & Wang, 2011). An organization can distribute the collected data to the various business processing units after collection and analysis of information generated by the reliable and dependable Information Technology infrastructure, which includes, Research & Development, Processing, and supply chain; Hence, the efficiency of new product innovation can be enhanced. E.g., for enhancing autonomic decision making and smart business software can reduce the time of data collection and interpretation, hence, market demands can be met more efficiently (Chaudhuri, Dayal, & Narasayya, 2011).

1.1.3. Product Innovations and IT Capabilities:

At the organizational level, it is also suggested that communication sources at different levels also play an important role for successful entrepreneurial innovations making another relationship with IT capabilities. Organizational hold on strengthened Information Technology Capabilities can enhance and support the communication and IT sharing system with the organization among employees, business departments and units performing different functions can also be uplifted between the partners of the subject business. In engineering product, customers' requirements and product innovation with

collective efforts with the help of Information Technology based communication systems in the organization (Pavlou & El Sawy, 2010). Among organizations collaboration systems developed by Information Technology along with communication methods play a critical role to deliver the newly developed product to the customers or market. A similar system has been observed in Oracle, which utilizes the Oracle Partner Network (OPN) for managing business models and co-partner organizations at different levels to support and enhance the business development strategies (Chatterji & Fabrizio, 2014).

1.2. Study

It is examined that both variables are relying on IT capabilities for the better performance of an organization. Organizations are expected to market the newly developed products from multiple markets in a more effective way because of available flexible Information Technology system that contributes by providing readiness through business application solutions, and timely access to the related information (Wang, Chen, Nevo, Jin, Tang & Chow, 2013). Additionally, by better identification of resources at organization's disposal and with the provision of identifiable organizational business activities and methods, the organizational capability to timely and rightly allocate the respective resources to the innovated products can be fortified (Liu & Atuahene-Gima, 2018). So it can be derived that Information Technology capabilities help in providing a foundation and a platform that enables and enhances the flow of information in ultimately innovation processes and operations to innovate and launch the product and also for revitalizing the organizational business processes and structures.

Despite the currently available literature that is showing a significant impact of IT Capabilities on Product Innovation Performance of an organization, the research based knowledge about the mechanism that processes that result into such positive gains and the vulnerabilities from the environment is very limited (Chen, Wang, Nevo, Benitez-Amado, & Kou, 2015). This research study will help to provide the in-depth and clear concept of the IT-based innovation association by examining the role of corporate entrepreneurship on IT-based innovation in products or services along with the consideration of the dynamic business environment. Corporate Entrepreneurship framework is capable of developing the link of Information Technology capabilities with

Product innovation performance as a process or mechanism that works within this phase, at the same time it will also consider the business environment outside the organization for better judgment of the relationship (Heavey, Simsek, Roche & Kelly, 2009). The subject research study will also be helpful for the organizations to develop the value of the IT-based studies and literature by providing the theoretical framework and model that advocates and justifies the effect of product innovation performance on IT capabilities of the organization through medicating effect of corporate entrepreneurship variable. Conclusively, it can be said that this research study will help to enhance the practice mechanism of the managers by providing them a better understanding of IT capabilities for organization's survival in the future competitive environment and ultimately making better decisions in investment flow to practically enhance and implement IT capabilities in the organization.

1.3. Research Question

What is the relationship between Information Technology capabilities & product innovation performance? How does the corporate entrepreneurship mediate the association amid Information Technology capabilities and product innovation performance?

1.4. Research Objectives

- To find the role of IT Capabilities (IT Cap) in Product Innovation Performance (PIP).
- To find the role of Corporate Entrepreneurship amid IT Capabilities (IT Cap) and Product Innovation Performance (PIP)

1.5. Proposed Hypotheses of the Research

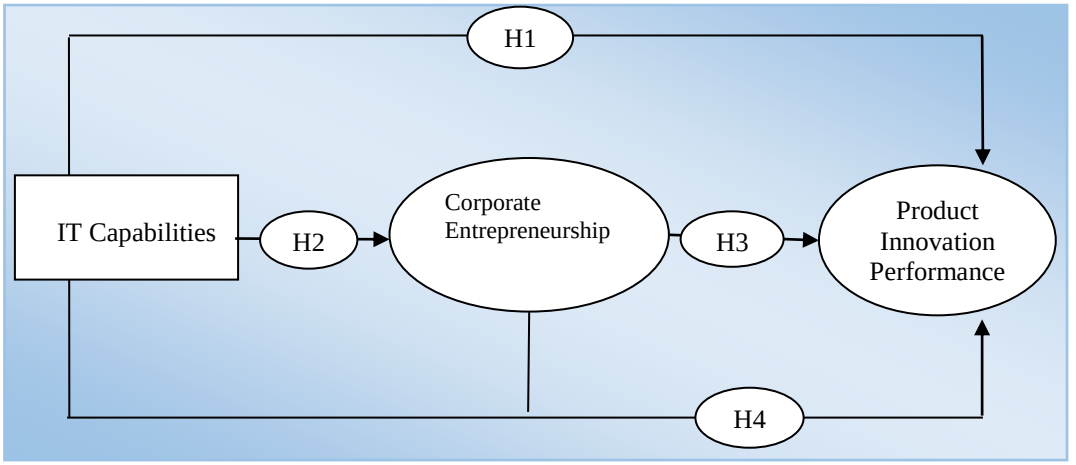
H_1: IT capabilities are having a significant impact on product innovation performance

H_2: IT capabilities have a significant impact on corporate entrepreneurship

H_3: Corporate entrepreneurship has a significant impact on product innovation performance

H4: Corporate entrepreneurship significantly mediates the association between Information Technology capabilities and product innovation performance.

1.6. Conceptual Framework



2. RESEARCH METHODOLOGY

1.7. Population Frame

The researcher is to collect data from the concerned audience only otherwise the authenticity of the research is challenged. That's why data is collected from sample members of this population through questionnaire or interviews etc that is later generalized on overall sample population (Malhotra, Baalbaki &Bechwati, 2010). The population of the study will be the 50 manufacturing firms working inside Karachi, Pakistan. The data will be collected from 315 IT executive and managers of the organizations in different sectors.

1.8. Research Sample Size

On sample size, there is no consensus found among researchers so far (Sekaran, 2010), the suggested sample size of at least 30 for multivariate analysis of each variable included in the research. There is another recommended input size regarding sample i.e. 250 and also considered to be an appropriate one (Anderson, 2010). There are also some studies which recommend sample selection based on a confidence interval and confidence level of the population.

Here, a sample size selected for this study was 428 responses from IT executives and managers of the organizations while only 315 responses were found suitable for analysis after removing some partially filled questionnaires. The rate of response

remained 77% approximately.

1.9. Sampling Technique

The sampling technique used for the study is stratified random sampling due to the usefulness of a sample population that best represents the entire population being studied and also ensures the presence of the key subgroup i.e. manufacturing firms within the population.

1.10. Instrument Development

The research instrument is taken from the research (Chen, Wang, Nevo, Benitez-Amado, & Kou, 2015) due to the similarity of variables and reliability of caronbach alphas, the selected research instrument (questionnaire) contains 41 items under all the variables constructs and other related items used in the study. The instrument (questionnaire) is five points Likert scale based. Instrument scale comprises of the questions based on formulates in the study which is mentioned ahead. In the instrument, 5 points Likert scale is: 1 for "strongly disagree", 2 for "disagree", 3 for "neutral", 4 for "agree" and 5 for "strongly agree". The subject instrument is divided into several parts namely; demographics, IT Capabilities, Corporate Entrepreneurship and Product Innovation performance.

1.10.1. IT Capabilities Scale

The scale that has been used to measure Information Technology (IT) Capabilities, the scale for this study contains four sub-areas, First, IT Infrastructure Capabilities consists on 4 items (Bhatt, Emdad, Roberts, & Grover, 2010). Second, IT Integration comprises of 3 items (Rai & Tang, 2010). Third and fourth are having 6 items under each head (Kearns & Lederer, 2003)(Bharadwaj, 2000). Each item is based on 5 points "Likert Scale" from 1 to 5, 1 showing "strongly disagree" and 5 indicating "strongly agree". This instrument measure was developed by Cameron and Quinn in 2006.

1.10.2. Corporate Entrepreneurship Scale

Corporate Entrepreneurship Scale was developed by (Heavey, Simsek, Roche, & Kelly, 2009), which consists of three major areas namely, New product development, Business venturing, and Self Renewal. These areas contain five, four and three items on

Likert scale 5 respectively.

1.10.3. Product Innovation Performance Scale

To measure Product Innovation Performance, (Rai & Tang, 2010) five-component model was used, this scale of Product Innovation Performance has been used by researchers to assess the present performance of the form in innovation of products along with (Forés & Camisón, 2016) four-component model to assess the past performance of the organization in product innovation. Instrument (Questionnaire) is attached as "Appendix A" with the study.

1.10.4. Data Analysis Method

Data in this research study was analyzed using quantitative research methods. "Statistical Package for Social Sciences (SPSS)" version 20 is used to conduct the subject analysis. Following analysis comprise on cross tab presentation of demographics, checking of reliability, the normality of data, correlation, matrix correlation, regression and mediation testing.

1.10.5. Statistical Method: Testing For Mediation

This study used hierarchal regression analysis as a statistical tool to examine the relationships among hypothesized variables. According to (Baron & Kenny, 1986), to verify the mediation role between hypothesized variables, the following specifications should be met:

a. The independent variable significantly affects the dependent variable in the absence of the mediator.
b. The independent variable significantly affects the mediator.
c. The mediator has a significant unique effect on the dependent variable.
d. The effect of the independent variable on the dependent variable shrinks upon the addition of the mediator to the model.

Following is the econometric model of the study:

$$Y\ (DV) = \alpha + \beta 1\ (IV) + \varepsilon \ldots\ldots\ldots\ldots\ldots\ldots \text{(i)}$$
$$Y\ (M) = \alpha + \beta 1\ (IV) + \varepsilon \ldots\ldots\ldots\ldots\ldots\ldots \text{(ii)}$$
$$Y\ (DV) = \alpha + \beta 1\ (M) + \varepsilon \ldots\ldots\ldots\ldots\ldots\ldots \text{(iii)}$$
$$Y\ (DV) = \alpha + \beta 1\ (IV) + \beta 2\ (M) + \varepsilon \ldots\ldots \text{(iv)}$$

$PIP = \alpha+\beta1\ (IT\ Cap) + \varepsilon$ …… …… (i)

$CE = \alpha+\beta1\ (IT\ Cap) + \varepsilon$ ……..…… (ii)

$PIP = \alpha+\beta1\ (CE) + \varepsilon$ ……(iii)

$PIP = \alpha+\beta1\ (IT\ Cap) + \beta1\ (CE) + \varepsilon$……(iv)

Where,

PIP = Product Innovation Performance
CE = Corporate Entrepreneurship
IT Cap = IT Capabilities
ε = error terms
M = Mediator
DV = Dependent variable
IV = Independent variable

3. RESULTS

1.11. Data Interpretation, Analysis and Presentation

Analysis tools of descriptive statistics, regression and correlation were applied to the collected data through SPSS v 20.

Table 1: Gender

	Frequency	Percent	Valid Percent	Cumulative Percent
Male	195	61.9	61.9	61.9
Female	120	38.1	38.1	100.0
Total	315	100.0	100.0	

Table 1 shows the demographical data of “Gender”; i.e. a number of exact male and female respondents who contributed their input in this survey of the research study. Out of total strength i.e. 315 of respondents, 195 were Male and 120 were female. This constitutes 61.9% and 38.1% of male and female respondents respectively.

Table 2: Age

Years	Frequency	Percent	Valid Percent	Cumulative Percent
18-28	254	80.6	80.6	80.6
29-39	57	18.1	18.1	98.7
40 and above	4.0	1.3	1.3	100.0
Total	315	100.0	100.0	

Table 2 depicts the demographical data of ages and frequency distribution of the respondents. Out of total 315 respondents 254 represents age bracket of 18-28 making 80.6% of the total sample, 57 respondents were from age bracket of 29-39 which is 18.1% of the total sample and only 4 respondents were from the age bracket of 40 and above which comprises of 1.3% of total respondents.

Table 3: Qualifications				
Qualification	**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Under Graduates	288	91.4	91.4	91.4
Graduates	27	8.6	8.6	100.0
Total	315	100.0	100.0	

Table 3 contains the demographical data of the respondent's qualifications. Out of 315 sample, 288 participants were of the Under-graduate level and 27 were Graduates, which is 91.4% and 8.6% of the total sample size respectively.

Table 4: Management Level				
Management Level	**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Low Level (Supervisors)	286	90.8	90.8	90.8
Middle Level (Executives)	26	8.3	8.3	99.0
Top Level (Administrators)	3.0	1.0	1.0	100.0
Total	315	100.0	100.0	

The above captioned table contains the data regarding the management level of the participants. Low level managers are found 286 of the total selection of 315 representing 90.8% result. The middle-level managers were found 26 of the total sample 315 with the percentage of 8.3%. Top level managers are found 3 of the total 315 selection with 1% result.

Table 5: Crosstab Age*Gender			
	Gender		
Age (Years)	**Male**	**Female**	**Total**
18-28	164	90	254
29-39	29	28	57
40 and above	2	2	4
Total	**195**	**120**	**315**

The above table is showing data on age and gender cross tabulation form. The male and female participants were 164 and 90 respectively in 18 - 28 years age slab. The slab containing 29 - 39 years of age limit was having 29 and 28 male and female respondents respectively. However, only 2 males and 2 females were from the age bracket of 40 and above years out of a total sample size of 315.

Table 6: Crosstab Age*Qualification

	Qualification		
Age	**Graduates**	**Undergraduates**	**Total**
18-28 years	235	19	254
29-39 years	49	8	57
40 and above years	4	0	4
Total	**288**	**27**	**315**

The above table is showing data in age and qualification cross tabulation form. The Graduate and Undergraduate participants were 235 and 19 respectively in 18 - 28 years age slab. The slab containing 29 - 39 years of age limit was having 49 and 8 Graduate and Undergraduate qualification level. However, only 4 Graduates and 0 Undergraduate were found in the age bracket of 40 and above years out of total sample size of 315.

Table 7: Crosstab Age* Management Level

	Management Level			
Age	**Low Level**	**Middle Level**	**Top Level**	**Total**
18-28 years	233	22	0	255
29-39 years	53	4	0	57
40 and above years	0	0	3	3
Total	**286**	**26**	**3**	**315**

The above demographical data table is showing data on age and management level cross tabulation form. The Lower, Middle and Top level participants were 233, 22 and 19 respectively in 18 - 28 years age bracket. The age bracket containing 29 - 39 years limit was having 53, 04 and 0 participants in Lower, Middle and Top level of management. However, only 03 participants responded in the survey from the top level in 40 and above age bracket, no middle and lower management position found in this age bracket to the survey of 315 sample size.

Table 8: Crosstab Gender*Qualification			
	Qualification		
Gender	**Graduates**	**Under Graduates**	**Total**
Male	179	16	195
Female	109	11	120
Total	**288**	**27**	**315**

The above captioned table shows gender and graduates and undergraduates cross tabulation. The male participants with graduate's status were found 179 and under graduate's status were found 16 respectively. The female participants with graduate's status were found 109 and under graduate's status were found 11 respectively of the total sample 315.

Table 9: Crosstab Gender*Management Level					
		Management Level			Total
		Low Level (Supervisors)	Middle Level (Executives)	Top Level (Administrators)	
Gender	Male	174	18	3	195
	Female	112	8	0	120
Total		**286**	**26**	**3**	**315**

The above captioned table shows gender and management level. The male participants with low-level management were found 174, middle level was found 18 and the top level was found 3. In female participants with low level management were found 112, middle level was found 8 and the top level was found 0 respectively out of total 315 participants.

Table 10: Reliability Statistics		
Variables	**Cronbach'sα**	**N of Items**
IT Capabilities	.980	19
Corporate Entrepreneurship	.987	13
Product Innovation Performance	.689	9

Inter item reliability's coefficient (i.e. Cronbach's alpha), that was used for the above mentioned variables. According to (Sekaran, 2003), Cronbach's Alpha should range from less than 0.6 to remove an item from the questionnaire. Therefore, the above mentioned ranges of Cronbach's Alpha show that there was no need of deleting an item from the research instrument used in the study.

1.12. Correlation

1.12.1. Matrix Correlation:

Table 11: Matrix-Correlation			
Variables	**1**	**2**	**3**
1. IT Capabilities	1		
2. Corporate Entrepreneurship	**.886****	1	
3. Product Innovation Performance	**.941****	**.863****	1

****P<.01**

To check the relationship amid predictor, mediator and response variables, the Pearson Correlation was conducted on the data. The result of correlation amid IT capabilities and corporate entrepreneurship depicts ($r = 0.886$, $p < 0.05$) which shows considerable positive association with each other. "Pearson Correlation" amid IT capabilities and product innovation performance depict ($r = .941$, $p<.05$) that shows significant positive association with one another. The relationship between corporate entrepreneurship and product innovation performance signifies ($r = 0.863$, $p < 0.05$) that shows significant positive association with one another.

1.12.2. Regression Analysis:

Following are the key assumptions of data for multiple regression analysis

- It should be normally distributed
- It contains little or nomultico-linearity
- It has no auto-correlation
- There exists homoscedasticity

Following analysis were used by the researcher to check the above mentioned assumptions for regression

1.12.3. Normality Calculation of Data:

"Kolmogorov-Smirnov (KS-test)" and "Shapiro-Wilk test" are used to measure the normality of data. The hypotheses of the KS-test and Shapiro-Wilk test are mentioned below.

H_0: P > .05 (normal distribution of data)

H_1: P < .05 (abnormal distribution of data)

The test statistics of KS-test and Shapiro Wilk test are as follows:

Table 12: Normality Tests						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
IT Capabilities	.189	314	.274	.922	314	.267
Corporate Entrepreneurship	.285	314	.548	.838	314	.678
Product Innovation Performance	.166	314	.247	.875	314	.639
a. “Lilliefors” Significance Correction						

The significant value for normal data should more than P>.05 (Fasano & Franceschini, 1987). As all the computed values for aforesaid variables are above .05 that indicates the data is normally distributed, for that null hypothesis is accepted.

1.12.4. Homoscedasticity Assessment of Data:

A tool of inferential statistics“Levene's test” is applied to assess variances for a calculated variable in multiple groups. Same Levene statistics were used to check the equality of variance. If P > 0.05 this indicates equivalence invariance of the population or it can be named as homoscedasticity and if P < 0.05 it represents the unequal variance of the population or heteroscedasticity of data (Howard, 1960).

H_0: P > .05 (Data is equal or homoscedasticity)

H_1: P< .05 (Data is unequal or heteroscedasticity)

Table 13: Leven Statistics		
Variables	F	Sig
IT Capabilities	0.73	.788
Corporate Entrepreneurship	1.89	.174
Product Innovation Performance	1.43	.237

In the above captioned table the significance values of IT capabilities, corporate entrepreneurship and product innovation performance shows P > 0.788, 0.174 and 0237 respectively which also indicates the existence of homoscedasticity in population data.

1.12.5. Durbin Watson Test:

“Durbin-Watson test” is used to check the autocorrelation in data, which is also the third assumption of regression. The value of the Durbin Watson test lie from 0 to 4, this value equal to 2 or less than 2 means no autocorrelation in data (Montgomery, Peck & Vining, 2001). The hypothesis for “Durbin-Watson” statistics are as follows:

H_0: $\mu > 2$ (Autocorrelation exists in data)

H_1: $\mu \leq 2$ (No autocorrelation exists in data)

Table14: Durbin-Watson Statistics	
Models	**Durbin-Watson**
IT Capabilities----PIP	1.13
IT Capabilities----CE	1.89

Durbin-Watson test results are shown in the above table. Both the results are having a value less than 2 i.e. 1.13 and 1.89 respectively. According to (Montgomery, Peck & Vining, 2001) value of 2 or less is proof of no autocorrelation that's why alternate hypothesis should be accepted that no autocorrelation exists in data.

1.12.6. Multicollinearity:

Multicollinearity which is also called co-linearity is a test to find the high correlation among multiple variables in a multiple regression model, meaning that with a non-trivial degree of accuracy one can be linearly defined from the others. Multicollinearity will be perfect when the correlation between two independent variables will be equal to 1 or -1.

Table 15: Co-linearity Statistics		
Model	**Collinearity Statistics**	
	Tolerance	**VIF**
(Constant)		
IT Capabilities	.937	1.067
DV: PIP		

As per (O'Brien & Robert, 2007) if the tolerance value is below 0.20 this shows the multicollinearity issue in the data. However, in the above table, the results of independent variable show value of 0.937 that is more than 0.20 which is the proof of no multicollinearity in data.

Table 16: Collinearity Statistics		
Model	**Collinearity Statistics**	
	Tolerance	**Vif**
(Constant)		
It Capabilities	.871	2.149
Dv: Ce		

According to (O'Brien & Robert, 2007) if the tolerance value is less than 0.20 this shows the multicollinearity issue in the data. However, in the above table, the results of independent variable show value of 0.937 that is more than 0.20 which is the proof of no multicollinearity in the data.

1.13. Testing For Mediation

Hypothesized relationship between the variables was tested by regression analysis. Test results are as follows:

1.13.1. Testing Mediation Conditions:

First: "The independent variable significantly affects the dependent variable in the absence of the mediator." Regression analysis was used in the research study to analyze the effect of an independent variable on the dependent variable.

$$Y = \alpha+\beta1X1+\varepsilon\text{----------} \quad (1)$$

Where

- Y is (D.V) dependent variable
- α is a constant
- X is factors other than variables affecting (I.V) independent variable
- β is the regression coefficient that might be negatively or positively affecting (D.V) dependent and (I.V) independent variables.

$$PIP = \alpha + \beta1ITC + \varepsilon\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

Where

- PIP= Product Innovation Performance (D.V)
- ITC= IT Capabilities (I.V)

IT Capabilities and Product Innovation Performance:

Table 17: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.941	.885	.885	.153

a. Predictors: (Constant), IT capabilities

R is the regression coefficient and in the above table "R" = .941 or 94.1% that means relationship exists between independent and dependent variables. In above table R

Square is the coefficient of determination having the value "R2" = .885 that illustrating the 88.5% of the variation in product innovation performance is elucidated by IT capabilities.

Table 18: ANOVA					
Model	**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Regression	56.567	1	56.567	2409.01	.000
Residual	7.350	313	.023		
Total	63.916	314			

- Predictors: (Constant), IT Capabilities
- Dependent Variable: Product innovation performance

In ANOVA-table, the value of "F" is 2409.01 and $P \leq 0.05$ in case of significant value that is evidence of regression model to be valid, significant and well.

Table 19: Coefficients'					
	Unstandardized Coefficients		**Standardized Coefficients**		
Model	**B**	**Std. Error**	**Beta**	**T**	**Sig.**
(Constant)	1.714	.053		32.302	.000
IT Capabilities	.582	.012	.941	49.080	.000
a. D.V: Product Innovation Performance					

$\beta 1 = .941$in above table means that an increase of 1% in IT capabilities increases product innovation performance variable by 94.1% keeping other variables constant. The value of T is 49.08 and is significant at a value of 0.000. Rests support the hypothesis that: IT capabilities are having a significant and positive impact on product innovation performance.

Second: "The independent variable significantly affects the mediator." Regression analysis was used in the research study to analyze the effect of an independent variable on the dependent variable.

$$Y = \alpha+\beta 1X1+\varepsilon \text{ ---------- (1)}$$

Where

- Y is (D.V) dependent variable
- α is a constant

- X is factors other than variables affecting (I.V) independent variable
- β is the regression coefficient that might be negatively or positively affecting (D.V) dependent and (I.V) independent variables.

$$CE = \alpha + \beta 1ITC + \varepsilon \text{ ---------- (2)}$$

Where

- CE= Corporate Entrepreneurship (Mediator)
- ITC= IT Capabilities (I.V)

IT Capabilities and Corporate Entrepreneurship:

Table 20: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.886	.785	.784	.203

a. Predictors: (Constant), IT capabilities

R is the regression coefficient and in the above table "R" = .886 or 88.6% that means relationship exists between independent and dependent variables. In the table, "R Square" is the coefficient of determination having the value "R2" = .786 illustrating the 78.6% of the variation in corporate entrepreneurship, also described by IT capabilities.

Table 21: ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	47.098	1	47.098	1141.08	.000
Residual	12.919	313	.041		
Total	60.016	314			

- Predictors: (Constant), IT Capabilities
- Dependent Variable: Corporate Entrepreneurship

In ANOVA table value of "F" is 1141.08 and $P \leq 0.05$ in case of significant value that is evidence of regression model to be valid and significant.

Table 22: Coefficients[a]

	Unstandardized Coefficients		Standardized Coefficients		
Model	**B**	**Std. Error**	**Beta**	**T**	**Sig.**
(Constant)	1.983	.070		28.187	.000
IT Capabilities	.531	.016	.886	33.780	.000

a. D.V: Corporate Entrepreneurship

β1 = .886in above table means that an increase of 1% in IT capabilities increase corporate entrepreneurship variable by 88.6% keeping other variables constant. The value of T is 33.78 and is significant at a value of 0.000. Rests support the hypothesis that: IT capabilities have a significant and positive impact on corporate entrepreneurship.

Third: "The mediator has a significant unique effect on the dependent variable." Regression analysis is used in the research to analyze the effect of the independent variable on the dependent variable.

$$Y = \alpha+\beta1X1+\varepsilon \text{ ---------- (1)}$$

Where

- Y is (D.V) dependent variable
- α is a constant
- X is factors other than variables affecting (I.V) independent variable
- β is the regression coefficient that might be negatively or positively affecting (D.V) dependent and (I.V) independent variables.

$$PIP = \alpha + \beta1CE + \varepsilon \text{ ---------- (2)}$$

Where

- CE= Corporate Entrepreneurship (Mediator)
- PIP= Product Innovation Performance (D.V)
- Corporate Entrepreneurship and PIP:

Table 23: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.863	.746	.745	.228

a. Predictors: (Constant), CE

R is the regression coefficient and in the above table "R" = .863 or 86.3% that means relationship exists between independent and dependent variables. In the above table, R Square is the coefficient of determination having the value "R2" = .746 illustrating the 74.6% of the variation in Product Innovation Performance, also described by Corporate Entrepreneurship.

Table 24: ANOVA					
Model	**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Regression	47.650	1	47.65	916.91	.000
Residual	16.226	313	.052		
Total	63.916	314			

- Predictors: (Constant), CE
- Dependent Variable: PIP

In ANOVA table value of "F" is 916.91 and $P \leq 0.05$ in case of significant value that is evidence of regression model to be valid and significant.

Table 25: Coefficients'					
	Unstandardized Coefficients		**Standardized Coefficients**		
Model	**B**	**Std. Error**	**Beta**	**T**	**Sig.**
(Constant)	.428	.128		3.340	.000
Corporate Entrepreneurship	.891	.029	.863	30.281	.000
a. D.V: PIP					

β1 = .863in above table means that an increase of 1% in Corporate Entrepreneurship increases Product Innovation Performance variable by 86.3% keeping other variables constant. The value of T is 30.28 and is significant at a value of 0.000. Rests support the hypothesis: Corporate Entrepreneurship has a significant and positive impact on Product Innovation Performance.

Fourth: "The effect of the independent variable on the dependent variable shrinks upon the addition of the mediator to the model." Following is the regression model

$$Y = \alpha+\beta1X1+ \beta2X2+\varepsilon \text{ ----------} \quad (1)$$

$$PIP = \alpha + \beta1ITC+ \beta1CE+\varepsilon \text{ ----------} \quad (2)$$

Where

- PIP= Product innovation performance (D.V)
- ITC= IT Capabilities (I.V)
- CE = Corporate Entrepreneurship (Mediator)

IT Capabilities (I.V) and Product Innovation Performance (D.V) with Inclusion of Corporate Entrepreneurship (Mediator):

Table 26: Coefficients'						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.714	.053		32.30	.000
	IT Capabilities	.582	.012	.941	49.08	.000
2	(Constant)	1.429	.098		14.55	.000
	IT Capabilities	.506	.025	.817	20.11	.000
	Corporate Entrepreneurship	.144	.042	.140	3.438	.001
a. D.V: PIP						

The table shows the analysis result between IV's (Information Technology capabilities) and DV (Product Innovation Performance) with the inclusion of corporate entrepreneurship as a (Mediator). "Beta weights" of IT capabilities reduces from (.941 to .817) and proved significant in first and second steps. As per (Barons and Kenny, 1986) study, Perfect mediation holds if the independent variable has no effect on the dependent variable when the mediator is controlled. That is complete mediation or full mediation exists if the independent variable exerts its total influence through the mediating variable. Partial mediation is given if the independent variable exerts some of its influence on the dependent variable through the mediating variable, and it also exerts some of its influence directly on the dependent variable and not through mediating variable.

As a direct influence on dependent variable has already been proven in the absence of mediator in the second hypothesis, while here the relationship is becoming smaller and significant between independent and dependent variables through a mediator, hence that is the indication of partial mediation. IT capabilities values in the second step are found to be significant at $P < 0.000$ that is greater than $P < 0.05$ for that alternate hypothesis will be considered that is corporate entrepreneurship partially mediates amid of Information Technology capabilities and product innovation performance.

4. DISCUSSION

Aforementioned literature in previous sections regarding IT value in business has narrowly studied the roles of IT capabilities in producing concrete outcomes for organizations e.g. improved productivity, lower labors cost and enhanced innovation

performance (Bhatt, Emdad, Roberts & Grover, 2010). Recently, practitioners have also observed the direct impact of IT in corporations' better innovation performance (Smolnik, Urbach, Fjermestad, Jacks, Palvia, Schilhavy & Wang, 2011). According to a recent survey of Gartner, developing new products and services have been ranked Number four among CIOs' major business priorities, earlier which was at number 10 in ranking since past 5 years (Nambisan, 2013). With the emerging business values of IT and various advanced applications in deployment, International survey practitioners have shifted their perspective towards the importance of IT (Giudice & Straub, 2011) as a significant enabler of organizational innovation. However, this research is motivated to enlighten this perspective as the connection between Information Technology and the firm's innovation with roles of IT in product innovation is unclear yet. Our observations added to the business value of Information Technology by explaining the roles of IT capabilities and its impact on product innovation, specifically, how the IT capabilities enable the CE activities which are equally important in the improvement of product innovation performance.

This specific study was undertaken in order to verify and asses the connection between Information Technology Capabilities and Product Innovation Performance with the mediating role of Corporate Entrepreneurship. Previously no such work in selected population has been done. The variables being studied in this research are the observed elements of organizational progress and success and have been studied by different researches. In this current study, the impact of variables on innovation, growth, and success was recognized and attested by hypothesis testing. Data collection is made from the project teams of the manufacturing companies which consisted of females and males respondent both. Demographic analysis shows that the number of male respondents was higher than female respondents. Accordingly, 61.9% of males and 38.1% of females contributed to the study. Respondents of the study are examined based on the diversity and cross-tabulation of age, qualifications and management level.

The research instrument is taken from the research (Chen, Wang, Nevo, Benitez-Amado, & Kou, 2015) due to the similarity of variables and reliability of caronbach alpha, the selected research instrument (questionnaire) contained 41 items under all the

variables constructs and other related items used in the study. The measured range of Cronbach's Alpha also verified the reliability of all three variables from the research instrument used in the study i.e. Information Technology Capabilities, Corporate Entrepreneurship and Product Innovation Performance. The data was collected from supervisors, executives and administrators from low, middle and top management levels of the manufacturing firms respectively.

The statistical analysis shows that hypothesis one, two and three i.e."IT capabilities are having significant effect on product innovation performance" resulted in significant relationship, "IT capabilities have significant effect on corporate entrepreneurship" and "Corporate entrepreneurship has significant effect on product innovation performance" respectively are having significant association among independent and dependent variables. However, last and mediation hypothesis i.e. "Corporate entrepreneurship significantly mediates the relationship between IT capabilities and product innovation performance" indicated partial mediation by Corporate Entrepreneurship between Information Technology Capabilities and Product Innovation Performance on collected data.

Regression analysis disclosed that the hypothesis mentioned in the previous sections of this study tends to be true and supports the study. The theories expressed in the second section have been demonstrated as it reports the partial mediation effect of corporate entrepreneurship between product innovation performance (PIP) and information technology capabilities (IT Cap) relationship.

Details of Proposed Hypotheses of the Study are as follows:

H_1: IT capabilities are having a significant impact on product innovation performance

Testing the first hypothesis witnessed the connection between Product Innovation Performance (PIP) as D.V and IT Capabilities (ITC) as I.V. While testing the hypothesis the value deducted for regression coefficient was R2= 0.885, displaying that 88.5% of the variation in product innovation performance are elucidated by IT capabilities. The value of F=2409.01 and $P \leq 0.05$ is the evidence of regression model to be valid, significant and well. The ".941" value of β1 also showed that an increase of 1% in IT capabilities increases product innovation performance variable by 94.1% keeping

other variables constant. This hypothesis has approved to be true and determines the positive relationship between PIP and ITC.

H_2: IT capabilities have significant effect on corporate entrepreneurship

This hypothesis has been proved to be accurate by testing and revealing the significance and positive effect of IT Capabilities (ITC) as I.V. on Corporate Entrepreneurship (CE) as Mediator. While testing the hypothesis the value of the coefficient of determination"R2" = .786 showed that 78.6% of the variation in corporate entrepreneurship is explained by IT capabilities. The value of F=1141.08 and $P \leq 0.05$ is the evidence of regression model to be valid, significant and well. The ".886" value of β1 also showed that an increase of 1% in IT capabilities increase corporate entrepreneurship variable by 88.6% keeping other variables constant.

H_3: Corporate entrepreneurship has significant impact on product innovation performance

Testing the third hypothesis also witnessed this connection between Corporate Entrepreneurship as Mediator and Product Innovation Performance as D.V. While testing the hypothesis the value deducted for regression coefficient was R2= 0.746, displaying that 74.6% of the variation in Product Innovation Performance are explained by Corporate Entrepreneurship. The value of F=916.91 and $P \leq 0.05$ is the evidence of regression model to be valid, significant and well. The ".863" value of β1 also showed that an increase of 1% in Corporate Entrepreneurship increases Product Innovation Performance variable by 86.3% keeping other variables constant. Rests support the hypothesis about Corporate Entrepreneurship having a significant and positive impact on Product Innovation Performance.

H4: Corporate entrepreneurship significantly mediates the association between Information Technology capabilities and product innovation performance.

Testing the fourth hypothesis witnessed the connection between IV's (Information Technology capabilities) and DV (Product Innovation Performance) including corporate entrepreneurship as a (Mediator). "Beta weights" of IT capabilities reduces from (.941 to .817) and proved significant in first and second steps. IT capabilities values are significant at $P < 0.000$ that is greater than $P < 0.05$ for that alternate hypothesis will be

considered that is corporate entrepreneurship partially mediates amid of Information Technology capabilities and product innovation performance.

By and large, our results suggest that the value of IT largely depends on its ability to enable and improve CE activities. With enhanced IT-enabled CE, firms can benefit from improved new product development processes (Chuang & Huang, 2016) and more effective business venturing and self-renewal efforts, which in turn improve product innovation performance (Saidi, Toumi, & Zaidi, 2017). In light of these results, managers should strive to channel IT capabilities toward important entrepreneurial activities. To achieve this objective, experts should interact closely with business executives who oversee and sponsor CE activities to achieve close alignment between IT and their firm's business strategy. Hence, more efforts need to be paid to form a shared deep understanding among both business and IT departments about the promise of IT in supporting corporate entrepreneurial activities, such as the development of new products, new ventures, and new markets or channels.

5. CONCLUSION

This research study provides sufficient evidence that the instrument used is having similar findings as conducted in Chinese culture. This also indicates that more multicultural measures can be tested and applied in the Pakistani organizations to improve the performance and overall contribution to the country's economy. There are numerous implications for the managers working in dynamic organizations dealing with product innovation performance. By testing the supposed hypothesis empirically, it is proposed that in Pakistani setups managers can use the IT Capabilities for new product development as an information provider by enhancing and modifying the currently available capabilities. The findings reveal that competitive intensity strengthens the positive influence of IT capabilities on CE activities and the firms that operate under highly competitive conditions should focus their efforts on the development and maintenance of their IT capabilities to maximize the entrepreneurial return on IT investment.

There is tough competition prevailing in the market for organizations to survive

and such innovating products are examined to better address the customer's needs and wants along with their long run retention with the organizational products and services. Corporate Entrepreneurial practices are also found to play a significant role in presence of IT-based generated information for innovation or products and services for the organization. Conclusively, this research tested and proved the positive relationships between information technology capabilities (IT Cap), Corporate Entrepreneurship (CE) and product innovation performance (PIP) contributing to the overall business value of Information Technology with vigorous entrepreneurship and competitive innovation.

The study is theoretically grounded on a survey of 50 manufacturing firms in Karachi and few constraints are yet to be discussed. First, the data collection was made by firms of the Karachi only. It raises the likelihood of ineffective application in other cities of Pakistan. Second, the data was gathered from manufacturing firms only so it is suggested to examine the impact of Information Technology capabilities on corporate entrepreneurship activities and product innovation in other industries too to test relevancy and reliability. Finally, a survey is performed to get data from key informants based on their occupational level in this study. As per set guidelines, respondents were supposed to provide useful information. So, researchers should reconsider to examine the model using multi informant design.

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