

INDUSTRY CLUSTER RESOURCES IMPACTING DUAL INNOVATIONS in PAKISTAN'S IT SECTOR: MEDIATING EFFECT OF KNOWLEDGE & LEARNING PROCESSES

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ABSTRACT

This research investigates as to how industry cluster resources orchestrate knowledge and learning processes which consequently through their mediating influence attain exploratory and exploitative innovations or organizational ambidexterity. Using survey research design, 655 questionnaires were analyzed from 348 firms in Pakistani IT sector using convenience sampling. Findings revealed that when based on strong theoretical recommendations, SECI perspective (socialization and externalization); knowledge management perspective (Knowledge transfer and application) and learning organization perspectives (intuition from 4I framework) are combined as knowledge and learning processes; the construct validities and reliabilities of the same as higher order construct were confirmed and found satisfactory through exploratory and confirmatory factor analyses. For hypotheses testing, Process Macro bootstrapping method was employed. Simple mediator model confirmed partial mediating influence of knowledge and learning processes on the pathway between industry cluster resources and organizational ambidexterity. Furthermore, findings of parallel multiple mediator model confirmed the individual mediating effects of knowledge management processes, knowledge creation/SECI processes, and intuition between antecedent and outcome variables. Overall, findings suggested that industry cluster resources increase the attainment of organizational ambidexterity, via combined effect of knowledge and learning processes by .2685 points. Future research may be carried out on various other combinations of variables from three perspectives in other industries, cultures and scenarios. Managers, leaders and policy makers should facilitate processes based on knowledge and learning perspectives for their employees instead of incorporating processes from either of the three perspectives.

Keywords: Organizational Ambidexterity; Industry Cluster Resources; Knowledge Management; SECI; Intuition; 4 I Framework and Learning Organization.

INTRODUCTION

To innovate either incrementally or radically for attaining competitive advantage in ever-changing marketplace is one of the most important objectives of the firm (Andriopoulos & Lewis, 2009; Crossan & Apaydin, 2010; Gibson & Birkinshaw, 2004; He & Wong, 2004; Li, Lin, & Tien, 2015; Li, C. R., Lin, & Huang, 2014; Li, Liu, Lin, & Ma, 2016; Luo, Zheng, & Liang, 2018; March, 1991; Tushman O'Reilly, 1996; 2013). How such innovation is orchestrated or which processes are responsible for such innovation, in the presence of antecedents acting on leadership, teams or individual level/industrial cluster resources (Birkinshaw & Gupta, 2013; Raisch, Birkinshaw, Probst, & Tushman, 2009) therefore becomes a vital focus of the firms.

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Facing scarcity of resources firms in Pakistan located within industrial clusters and knowledge parks not only compete and cooperate to manage and create knowledge but also learn from one another along with various other external and internal sources. Industrial cluster is an organizational form wherein a cluster of firms is situated within a closed area which enables them to procure and nurture professional and competent knowledge workforce which consequently enables them to lower their cost of investment for provision of services; enable them to create and manage knowledge, to refine services; enables them to learn knowledge from external and internal sources (Lai, Hsu, Lin, Chen & Lin, 2014). Thereby with all this, improvement in innovations with consequent refinement of services result (Casanueva, Castro & Galon, 2013; Connell & Voola, 2013; Tallman, Jenkins, Henry & Pinch, 2004; Yli-Renko, Autio, & Sapienza, 2001; Lai et al., 2014).

Innovations can be categorized into two types, exploratory and exploitative innovations which together make organizational ambidexterity (He & Wong, 2004; March, 1991; Tushman & O'Reilly, 1996). Exploratory innovations refer to entering into new services, product and market domains and it is built upon experimentation and acquisition of new knowledge and learning experiences. Exploitative innovations imply improvement of existing products, services and markets. It depends on reuse or negligible improvements of existing routines, refinement through experiences and local search (Baum, Li & Usher, 2000; Benner & Tushman, 2002).

With firms pursuing only exploratory innovation, they're likely to get into 'failure trap' where their new product can either fail or cannot take off because of lack of funds. With firms only pursuing exploitative innovations they're likely to get into 'success trap' which can fade only after a little time leaving the firm stagnant in market. Therefore, it has been suggested that firms should be pursuing dual innovations i.e. organizational ambidexterity to get competitive advantage (Birkinshaw & Gupta, 2013; He & Wong, 2004; Jensen, Bosch & Volberba, 2005 & 2006; March, 1991; Raisch et al., 2009; Tsai, 2001; Tushman & O'Reilly, 2013).

Having established that firms should be pursuing organizational ambidexterity with ample provision of resources present within industrial clusters; the next question arises as to how this can be achieved? Nosella, Canterllo & Fillipini (2012) recommended to explore the 'black box' of ambidexterity wherein mechanisms and processes leading to it should be studied and explored. Chang, Hughes & Hotho (2011) suggested to study mechanisms or processes leading to ambidexterity in presence of individual related antecedent variables. Recently several authors suggested to study mediating processes leading to organizational ambidexterity (Zacher & Rosing, 2015; Li, Lin, & Tein, 2015). Birasnav (2014) proposed to incorporate knowledge management and organizational learning processes for studying innovation. Kitapçı & Çelik (2014) proposed to look for processes that could attain dual innovations. Sok & O'Cass (2015) recommended that dual innovations should be incorporated for enhancing financial feasibility of the projects and therefore there is a need to study mediating processes for the same in the presence of competent professionals and teams.

O'Reilly & Tushman (2013) also stressed upon 'how' dual innovations could be orchestrated in the presence of relevant antecedents. Parida et al (2016) suggested for the need to study practices and patterns leading to ambidexterity. Zimmerman, Raisch & Birkinshaw (2015) proposed that little is known about processes that attain ambidexterity.

Thus, focal problem of this research is to explore the processes which could possibly orchestrate organizational ambidexterity for IT firms which are operating in industrial clusters of Pakistan, thereby availing industrial cluster resources. Which type of processes or which perspectives are

necessary for instrumentation of organizational ambidexterity will be dealt with in the next section.

Thus, objectives of this study are thereby to

1. Combine three theoretical viewpoints (mentioned above) as a mediating variable, namely, knowledge and learning processes.
2. To examine the role of industry cluster resources on organizational ambidexterity.
3. To examine whether knowledge and learning processes, mediate the relationship between industry cluster resources and organizational ambidexterity.

LITERATURE REVIEW & RESEARCH HYPOTHESES

This study proposes four main hypotheses and four sub-hypotheses exploring relationships between industrial cluster resources, knowledge and learning processes, and organizational ambidexterity. A discussion for development of hypotheses appears below.

The Three Perspectives for Mediating Processes leading to Organizational Ambidexterity

This section deals with identification of three relevant perspectives for the processes that could possibly orchestrate dual innovations.

Nonaka & Peltokorpi (2006) strongly recommended to integrate objective and subjective perspectives with respect to knowledge and learning processes for studying innovation. According to them, Knowledge management a resource based perspective (Alavi, & Leidner, 2001; Bollinger & Smith, 2001; Filius, Jong, & Roelofs, 2000; Gold, & Arvind Malhotra, A. H. S, 2001) has more of an objective stance whereas SECI processes (Nonaka, 1994; Nonaka, & Takeuchi, 1995) has more of subjective dimensions. Another subjective perspective from learning organization is 4I framework (Crossan, Lane & White, 1999) entailing intuition, for several learning organizational theorists agreed that a generic model for learning organization could not be specified for every organization is unique in its own peculiar way. This thereby requires flexible and subjective models based on broad guidelines (Örtenblad, 2004; 2018). Jiminez-Jiminez & Sanz-Vallez (2011) suggested that knowledge management dimensions like knowledge management and application should be integrated with knowledge creation and intuitive processes. Krogh et al (2012) suggested to incorporate knowledge creation processes with knowledge management processes.

As cited by Krogh, Takeuchi, Kase & Canton (2013) many researchers suggested that SECI processes like socialization and externalization should be combined with knowledge management processes like knowledge application and transfer and even frameworks comprising 'intuition' should also be incorporated. Bolisani & Handzic (2015) proposed to incorporate a research stance wherein resource based knowledge management perspective should be complemented with organizational learning and SECI perspectives. Henderson, Gulati and Tushman (2015) beckoned that organizational learning processes should be complemented with knowledge processes.

McInerney and Koenig (2011) observed that near emphasis on knowledge management dimensions without incorporating human elements based on learning organization perspective often leads to failure. Donate and DePablo (2015) stressed that exploratory innovative activities need knowledge creation processes whereas exploitative innovative activities need knowledge management processes. Contrasts and similarities between three aforementioned perspectives i.e. knowledge management, knowledge creation/SECI processes, and 4 I framework have been highlighted and it has been proposed and verified that three perspectives influence exploratory and exploitative innovation (Mahmood, 2015 & 2017; Mahmood, Qureshi, & Hadi, 2019).

Thus it is proposed that socialization and externalization from SECI/knowledge creation perspective; knowledge application and transfer from knowledge management perspective and intuition from 4I framework and learning organization perspective is hence being integrated in Hypothesis 1.

H1: In a firm, Knowledge and learning processes (Knowledge Management Processes, Knowledge Creation Processes, and Intuition/ Deep Thinking when combined as Knowledge & Learning Processes) exert a positive influence on Organizational ambidexterity= exploratory+ exploitative innovations. (For path 'b' of mediation model).

Industry Cluster Resources with Knowledge and Learning Processes

Cluster firms often store, transfer, create, learn and apply knowledge to strengthen their knowledge base (Lai et al, 2014). The impact of industry cluster resources with knowledge processes have been explored previously (Arkin, 2009; Belso-Martinez, Molina-Morales & Masverdu, 2011; Casanova et al, 2013; Lai et al., 2014; Tallman et al., 2004).

Not only this but cluster firms through their social networks are able to create, learn and manage knowledge (Lai et al, 2014; Casanova et al, 2014; Lorenzen & Maskell, 2004).

Literature studying the effect of industrial clusters resources on learning mechanisms especially intuition among the firms is rare. However industry cluster firms not only socialize, create, transfer and apply knowledge but learn and intuit (Jimmenez-Jiminez & Sans Vallez, 2011). Hence, H2 is being proposed.

H2: Industry cluster resources positively influence knowledge and learning processes in a firm. (Path a)

Industry Cluster Resources with Dual innovations

Since industry cluster resources enable the cluster firms to procure competent professionals, secure trustful contracts from a host of suppliers, lower the costs of operation and overhead charges due to being part of an industrial zone or cluster; firms thereby are able to attain various innovative goals for their organizations (Audretsch & Feldman, 1996; Feldman & Florida, 1994; Genyawali & Srivasta, 2013; Phelps, 2010; White & Burton, 2010; Tallman et al., 2004).

Thus in light of above H3 is being proposed.

H3: Industry cluster resources exerts a positive influence on Organizational ambidexterity= exploratory+ exploitative innovations. (Path c)

Industry cluster resources, knowledge learning processes and organizational ambidexterity

Thus the effect of industry cluster resources on innovation through knowledge and learning processes though very rare should be studied. Having discussed in the previous section that network firms help attain several innovative options, the effect of industrial cluster resources on innovation with knowledge processes as mediator with organizational ambidexterity is being proposed here. This mediating relationship has already been confirmed by Connell and Voola (2013) and Lai et al., (2014). More so the same set of authors suggested that industrial cluster resources with mechanisms and processes focusing on knowledge creation and learning activities should also be explored.

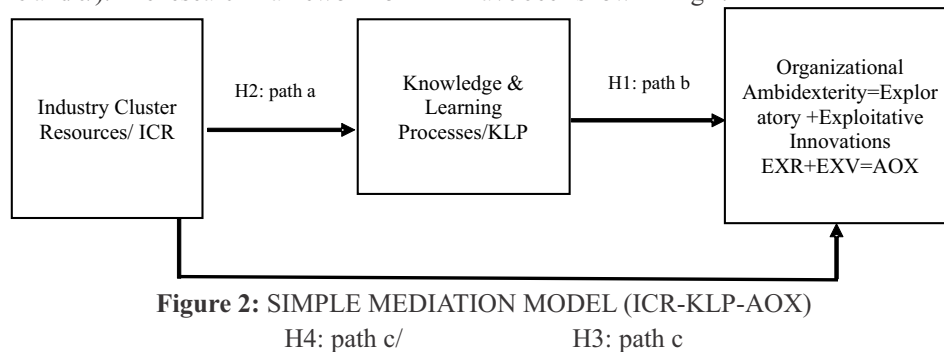
Yli-Renko, Autio and Sapinez (2001) supported that industry cluster firms often exchange knowledge and learning from one another which helps attain innovative goals for organizations. Several other researcher pointed the importance of mediating processes based on knowledge and learning between industry cluster resources and organizational ambidexterity (Arkin, 2009; Casanova et al., 2013;

Connell and Voola, 2013 & Tallman et al., 2004).

Porter (1998) suggested that the application of knowledge to create new products and improve existing ones is the key to innovation. Knowledge management activities lead to improvements in innovation (Arikin, 2009; Belso-Martinez, Mollina-Morales & Masvardu, 2011; Bollinger & Smith, 2001; Casanova et al, 2013). Knowledge creation and SECI activities are responsible to orchestrate innovation (Bollinger & Smith, 2001; Nonaka & Takeuchi, 1995). Intuitive activities often become source of innovation (Berson et al, 2006; Bollinger & Smith, 2001; Crossan et al, 1999; Nonaka & Jhonson, 1985; Swap, Leonard, Shields & Abrams, 2001). It has been verified in Pakistani scenario that knowledge and learning processes mediated the relationship between team processes and dual innovations and it was further proposed that the mediation of knowledge and learning processes should be assessed between industry cluster resources and dual innovations as well (Mahmood, Qureshi, & Hadi, 2019).

Thus, in light of above discussion, following is being proposed.

H4: Knowledge and learning processes mediate the significant and positive relationship between industry cluster resources and Organizational ambidexterity= exploratory+ exploitative innovations. (Path b and c/). The research framework for H1-4 have been shown in fig 2.4



Sub-Hypotheses

This section also proposes to study the individual specific indirect effects of three mediators which have been derived from three perspectives. They are, namely knowledge management perspective from which knowledge transfer and knowledge application; SECI perspective from which knowledge creation processes like socialization and externalization; and learning organization perspective from which intuitive processes of 4I Framework have been incorporated.

The simple mediator model doesn't facilitate to model more than one mediating mechanisms simultaneously in one model. However in this study independent effects is operating through three mediators and therefore in such cases according to Hayes (2018) the simple mediator model approach should be complemented with parallel multiple mediator model. Thereby, Parallel multiple mediator model was incorporated because it allows estimation of the total indirect effect comprising of all mediators as well as specific indirect effects associated with each mediator. Inclusion of three mediators in one model allow for formal contrasts between their specific indirect effects through pairwise contrasts. This aids to ascertain which indirect effect is stronger of the other two mediators and whether the relationships are significant or not.

Thus, relevant hypotheses for the same are:

H4a: Knowledge Management processes mediate the positive and significant relationship between industry cluster resources and Organizational Ambidexterity=exploratory innovation + exploitative innovation.

H4b: Knowledge creation processes mediate the significant and positive relationship between industry cluster resources and Organizational Ambidexterity=exploratory innovation + exploitative innovation.

H4c: Intuition mediate the significant and positive relationship between industry cluster resources and Organizational Ambidexterity=exploratory innovation + exploitative innovation.

Thus the aim of this study is to observe the effect of industrial clusters on exploratory and exploitative innovations in Pakistani sector through mediating effects of knowledge and learning processes that firms often resort to. How such innovative efforts are orchestrated through knowledge management elements like knowledge transfer and application; knowledge creation/SECI like socialization and externalization and organizational learning elements like intuition is therefore the mainstay of this study.

METHODOLOGY

This section discusses the statistical method, techniques, measuring instruments, and sampling method. Firstly, factor structure of both first-order and second-order constructs, construct reliabilities, validities were determined using exploratory factor analysis/EFA and confirmatory factor analysis/CFA through SPSS 23 and AMOS 23. Next main hypotheses H1-H4 were tested through PROCESS macro (Hayes, 2018) model-4 while sub-hypotheses were tested incorporating parallel multiple mediator model, also an extension of model 4. Bias corrected bootstrapping with 5000 resamples was incorporated to generate confidence intervals because it is the most preferred, reliable and recently updated method evaluating indirect effects, and mediation analyses in both simple and multiple mediation models (Preacher & Hayes, 2008; Mackinnon, Lockwood, & Williams, 2007; Hayes, 2018). Bootstrapping method minimizes the number of tests and commands and estimates the indirect paths directly. Since there is no moderator, and there is a need to test the hypothesized relationships simultaneously, process macro is used; more so it is a valid technique for testing mediation analysis (Hayes, 2018).

Average means of exploratory and exploitative innovations as organizational ambidexterity (Junni et al, 2013); socialization, externalization, knowledge application, knowledge transfer and intuition has been taken as knowledge and learning processes by following lead of several prior researches (Bandalos & Finney, 2001; Chang & Huhges, 2012; Enticott, Boyne & Walker, 2008; Lai et al, 2014) for simple and parallel multiple mediator models.

The details of the measures incorporated in this study are as follows:

Industry cluster resources measure with four items has been adapted from Lai et al (2014). The measures for knowledge management transfer with five items and knowledge application with eight items have been adopted from Donate and Pablo (2015). The measure for knowledge creation/SECI processes comprising of five items of socialization and five items of externalization have been adopted from Nonaka, Byosiere, Borucki and Konno (1994). The measure for intuition has been modified and developed from Crossan et al (1999) and Mahmood, Qureshi, and Hadi (2019). The

The measure for organizational ambidexterity comprising of six items of exploratory innovations and six items of exploitative innovations has been adapted from Jansen et al (2006).

Research design discusses the following details. The target population comprised of employees of all registered software firms in Pakistan. After consulting the firms, it has been estimated that approximately twenty five thousand professionals are working in 348 firms. This information was cross verified with P@SHA records. The unit of analysis for this study was IT professionals having 0-1 year, 1-5 years, 5-10 years, > 10 years, and internees' IT field experiences. The 348 registered IT firms in Pakistan are arranged in 14 software technology parks pursuing exploratory and exploitative innovations both. The former aims at creating new things whereas the latter aims at the refinement of existing services. According to research professionals at software firms they undertake projects with exploratory and exploitative innovative natures. E.g. exploratory nature of projects focusses on intelligent game agents, artificial intelligence, bioinformatics, and green computing. Exploitative nature of projects focusses on software development comprising of app and web development and desktop applications for hospitals, banks, schools, universities, accounting firms and restaurants.

Data was collected from primary sources through online and manual self-administered survey questionnaires. 348 questionnaires were received through online method while 952 questionnaires were administered through manual method. The manner of data collection was completely anonymous and based on convenience sampling techniques. The survey was closed on receiving of 855 questionnaires out of which 655 were complete and thus valid to be used for statistical study.

Results and Findings

Reliability, Exploratory Factor Analysis, & Correlation Analysis

This study has three dimensions. As table 4.1a shows, all Cronbach values of all dimensions or factors are above .85 which suggests good reliability of all dimensions or factors.

Factor analysis incorporating Principal components analysis with varimax rotation extracts mutually exclusive factors from varied items or variables when the factor structure is undetermined. Kaiser Meyer-Olken KMO value was .937 which exceeds the acceptable value of .5. Bartlett's test of sphericity was also significant. These values beckon that factor analysis is suitable to be carried out (Field, 2009; Hair, Black, Babin, Anderson, & Tatham, 2009). Items from knowledge management/KMP, SECI or knowledge creation/KCP, industry cluster resources/ICR, intuition/DT, exploratory and exploitative innovations/EXR&EXV were subjected to common factor analysis to predict and identify the factor structure. A 7-factor solution was extracted wherein factor 1, 2, 3, 4, 5, 6, and 7 showed 14.6%, 9.7%, 9.7%, 9.5%, 9.4%, 7.8%, and 7.3% variations after extraction. Overall the variance explained by 7 factors was 68.03% after extraction. Eigenvalues for all 7 factors were greater than 1. Table 4.1a shows rotated component matrix results with varimax rotation of 44 items of which 36 were retained and 8 were dropped because items having factor loadings less than .60 were deleted (Field, 2009; Hair et al, 2009). Deleted items included 3 items of knowledge transfer-KT, 2 items of knowledge application-KA, 2 items of EXV and 2 items of EXR. Secondly, both components of KMP i.e. KA and KT were loaded on one factor- KMP. While none of the other items of KCP- which are Externalization-EZ and socialization-SO, DT/Intuition were either dropped or had any cross-loading issue. Secondly, most of the factor loadings in table 4.1a are above .7 showing presence of well-defined factor structure (Field, 2009; Hair et al, 2009).

Table 1: 1a EFA & Reliability

Dimension/Factors & Items	Factor Loading	Eigenvalue	Accumulated Explained Variance	Cronbach Alpha
Knowledge Management		13.98	37.8%	.93
KT1	.761			
KT5	.753			
KA3	.743			
KT8	.743			
KT2	.731			
KT4	.731			
KA1	.720			
KA5	.667			
Externalization		2.38	44.2%	.88
EZ2	.782			
EZ1	.778			
EZ3	.777			
EZ5	.673			
EZ4	.670			
Exploitative Inv		2.3	50.4%	.89
EXV1	.863			
EXV2	.845			
EXV5	.772			
EXV3	.689			
EXV6	.683			
Socialization/SO		2.1	55.96%	.88
SO1	.793			
SO3	.737			
SO2	.695			
SO4	.684			
SO5	.672			
Intuition		1.6	60.22%	.87
DT3	.786			
DT5	.760			
DT4	.757			
DT1	.747			
DT2	.743			
Exploratory Inv		1.5	64.21%	.86
EXR3	.776			
EXR2	.764			
EXR1	.739			
EXR5	.724			
Industry cluster res		1.4	68.03%	.86
ICR2	.781			
ICR1	.761			
ICR3	.707			
ICR4	.644			

Pearson correlation analysis was conducted to assess correlation between variables. Table 4.1b shows that all independent/ICR and mediating (KMP, SO, EZ, DT) variables share a significant and positive relationship among one another and also with dependent variable/AOX supporting hypothesized relationships.

Table 2: 1b Correlations

Variables	Mean	S.D	1	2	3	4	5	6
Organizational Ambidexterity/OAX	3.0	.70	1					
Industry Cluster Resources/ICR	3.1	.92	.510**	1				
Knowledge Management/KMP	3.0	.84	.639**	.521**	1			
SECI/Socialization/SO	3.0	.83	.518**	.486**	.567**	1		
SECI/Externalization/EZ	3.0	.93	.456**	.444**	.504**	.536**	1	
Intuition/DT	3.0	.84	.443**	.451**	.451**	.436**	.357**	1

** Correlation is significant at the 0.01 level (2-tailed).

Confirmatory Factor Analysis-CFA for higher-order Factor/HOC- Mediator-KLP/Knowledge & Learning Processes

CFA was conducted to validate the EFA results such as that the underlining items of the sub constructs in the higher-order-construct-HOC-CFA model emerged as they had in EFA. Figure 4.3 of CFA model shows that all factor loadings are above range of .5 (Bryne, 2010; Hair et al, 2009). The HOC-CFA model in fig 4.3 shows that all model fit indicators reflect that the model fits the data well. Df= 225; $\chi^2=2.850$; RMR=.048; GFI=.922; CFI=.956; RMSEA=.053 and TLI=.952. The four latent sub-constructs F4, F5, F6 and F7as shown in figure 4.3 are moderately to highly correlated (F4*F5=.58, F*F4=.56; F5*F6=.59; F4*F7=.53; F6*F7=.52). Therefore, hypothesized HOC explain good correlations among sub-constructs (Cunningham, 2008; Hadi & Muhammad, 2017). HOC/F10/Knowledge learning processes/KLP has factor loadings of .74, .78, .76 and .68 for SO, EZ, KMP and DT respectively all of which are above the prescribed range of .5. The AVE for KLP is .55, and CR=.89 both of which are above prescribed ranges. None of items were deleted nor was the model re-specified. The factor loadings of all sub-constructs were well above the range of .5 as shown in Fig 4.3. Sub-Constructs SO, EZ, DT, KMP have AVE=.61, .6, .56 and .63 and have CR=.93, .93, .91 and .96 respectively (as calculated from factor loadings shown in fig 4.3). These values are above threshold level of .5 and .7 respectively. Thus, all mentioned first order and second order constructs exhibit more than acceptable levels of convergent and thereby construct validities (Byrne, 2010; Hair et al, 2009; Awang, 2017).

Secondly, comparison of CFA tests of higher order 4 factor model with one factor model was done which indicated that SO, EZ, KMP and DT were distinct from each other. The higher-order 4 factor model as indicated above (Df= 225; $\chi^2=2.850$; RMR=.048; GFI=.922; CFI=.956; RMSEA=.053 and TLI=.952) fit the data better than one factor model (Df= 230; $\chi^2=15.194$; RMR=.116; GFI=.582; CFI=.654; RMSEA=.147 and TLI=.619).

Thirdly, CFA was conducted to investigate the discriminant validity of higher order 4 factor model. The higher order 4 factor model (Df= 225; $\chi^2=2.850$; RMR=.048; GFI=.922; CFI=.956; RMSEA=.053 and TLI=.952) fit the data better than first order 4 factor model (Df= 224; $\chi^2=3.203$; RMR=.038; GFI=.914; CFI=.948; RMSEA=.058 and TLI=.941).

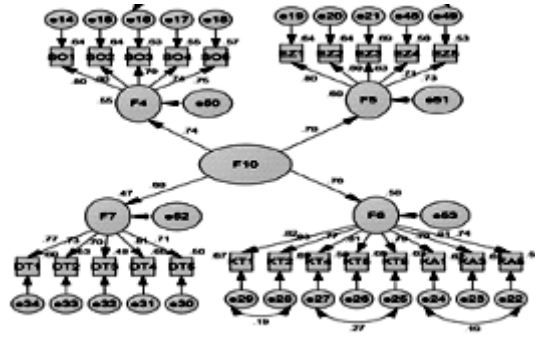


Figure 1: CFA-KLP-Knowledge & Learning Processes

For checking discriminant validity of all the constructs in higher-order construct Fornel and Larcker criterion is adopted wherein inter-construct correlations between main constructs in second-order were compared with square root of their AVES; if the latter are greater than the former, discriminant validity is established. In table 4.3 the diagonal represent the square root of AVES while the values underneath the diagonal represent inter-construct correlations. As evident, the diagonal values exceed the inter-construct values underneath, thereby attaining the discriminant validity among constructs (Byrne, 2010; Hair et al, .2009; Awang, 2017).

Table 3: Discriminant Validity

	OAX	ICR	KLP
OAX	.71		
ICR	.512	.79	
KLP	.660	.610	.76

Simple Mediation Model

Figure 4.4 -Mediation with bootstrapping displays the results and shows paths 'a', 'b', 'c' and 'c'-results in Process (Hayes, 2018). Table 4.4 summarizes the bootstrapping results with mediation.

First, it was found that industry cluster resources/ICR was positively associated with exploratory and exploitative innovations/ organizational ambidexterity/OAX (B=0.36, t (651)=22.94, p=.001). It was also found that industry cluster resources/ICR was positively related to knowledge learning processes/KLP (B=.4471, t (651) =19.98, p=.001). Lastly the results indicated that the mediator, Knowledge learning processes/KLP, was positively associated with exploratory and exploitative innovations/organizational ambidexterity/OAX (B=.6005, t (651) =16.46, p=.001). Because both a-path and b-path were significant, mediation analyses were tested using the bootstrapping method with bias-corrected confidence estimates (MacKinnon, Fritz, Williams, & Lockwood, 2007; Preacher & Hayes, 2004). In the present study, the 95% confidence interval of the indirect effects was obtained with 5000 bootstrap samples (Preacher & Hayes, 2008). Results of the mediation analysis confirmed the mediating role of the knowledge learning processes/KLP in the relation between exploratory and exploitative innovations/organizational ambidexterity/OAX and industry cluster resources/ICR (p=.2685, CI=.23 to .31). In addition, results, indicated that the direct effect of industry cluster resources/ICR on OAX reduced but remained significant (B=.11, t (651) =4.03, p=.001) when controlling for knowledge learning processes/KLP, thus suggesting partial mediation. While calculating for effect size 1 abcs, CI=.3134 to .4160, thus completely standardized indirect effect of x

on Y has no zero in its confidence interval. While calculating effect size 2, percentage of mediation is $P_m = 72\%$. This means that mediator accounts for 72% of total effect. Secondly little variance in KLP is explained by ICR ($R^2 = .38$) whereas the combined effect of both ICR and KLP has brought a much larger variation ($R^2 = .48$).

Table 4: Coefficients for Mediating effect/Bootstrapping with Mediation with ICR-KLP-AOX

Testing Paths	B	SE(B)	95% CI	Beta
Path c: DV=Organizational ambidexterity/OAX				
$R^2 = .26, F(1, 653) = 229.08, p = .000$				
IV=ICR	.3572	.0248	.3265 to .4239	.510
Path a: DV=KLP				
$R^2 = .38, F(1, 653) = 399.58, p = .000$				
IV=ICR	.4471	.0224	.4032 to .4910	.616
Path b & c' DV=OAX				
$R^2 = .48, F(2, 652) = 297.36, p = .000$				
IV=ICR (c)	.1067	.0265	.0547 to .1587	.145
IV=KLP (b)	.6005	.0365	.5289 to .6722	.592
Total=(a*b)				.2685

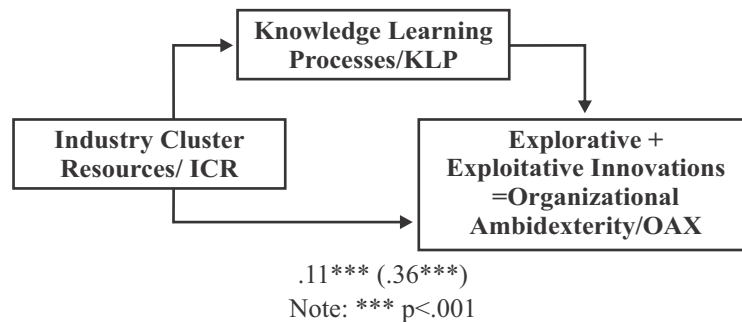


Figure 2: Simple Mediation Model ICR-KLP-AOX

Parallel Multiple Mediator Model

A single step parallel multiple mediator model was incorporated in which knowledge management Processes (knowledge transfer and application), knowledge creation or SECI processes (socialization and externalization), and learning organization process (intuition) were hypothesized to mediate the relation between industry cluster resources and organizational ambidexterity. Process macro (Hayes, 2018) using 5000 bootstrapping samples were used to derive the 95% bias-corrected confidence interval for the indirect effects, path coefficients, and the significance effects of indirect effects.

Referring to table 4.5 and figure 4.5, confidence interval (95%) not containing 0 indicate significant indirect effects and thus the effect of the antecedent variable on the outcome variable is partially mediated by mediators for path c/ decreased in size in all 3 parallel multiple mediator paths but remained significant. Figure 4.5 show the effects represented as unstandardized coefficients of the antecedent variable/ICR on the proposed mediator variables (a-path); the effects of the mediator variables on the outcome variable (AOX) taking the other mediators into account (b paths); the total effect (c path); the direct effect (c/ path) and the specific indirect effects (a*b paths).

The total indirect effect of ICR on AOX through KMP, KCP, and DT ranged from .2257 to .3074 (95% c.i) for ICR; which do not contain 0 signifying that all indirect effects for parallel multiple mediator

model with ICR-KLP-AOX do not contain 0 and thus are statistically significant at $p < .05$. The specific indirect effect of ICR on AOX through KMP estimated to lay between .1102 to .1833 (95% c.i); whereas specific indirect effect through KCP ranged between .0480 to .1224 (95% c.i); through DT ranged between .0119 to .0606 (95% c.i). Thus all specific indirect effects through KMP, KCP, and DT were significantly different from 0 at $p < .05$ and mediate the effect of ICR on AOX.

With regards to interpreting pairwise comparisons between each of the 3 specific indirect effects, the question here is whether or not specific indirect effect of one mediator like KMP differ from the specific indirect effect of other mediator like KCP or is a_1b_1 stronger in executing mediating influence than a_2b_2 ? The answer to this question lies in the fact that if the confidence interval of contrasts where $\text{contrast} = a_1b_1 - a_2b_2$ does not contain 0; then it provides the evidence that the 2 indirect effects are statistically different from each other; whereas if a confidence interval of contrasts contains 0, then it provides the evidence that the 2 indirect effects are not statistically different from each other. As for the estimation of strength of which specific indirect effect is greater in the former case, point estimates for the 2 specific indirect effects of same signs are compared, then the one greater in absolute value will claim to have greater effect than the other. For interpretation of all paths, table 4.5 is being referred to. All contrasts are being calculated. $\text{Contrast 1/C1} = a_1b_1 - a_2b_2$ is calculated. The point estimate of the difference between specific indirect effects is (.1470-.0835=.0635) and the confidence interval from point estimate of C1 does contain 0 (-.0011 to .1239); so they are not significantly different from each other.

While comparing specific indirect effects of KMP and DT, it is seen that $C_2 (a_1b_1 - a_3b_3) = (.1470 - .0349 = .1121)$ and the confidence interval of this point estimate does not contain 0 (.0687 to .1547). So the 2 specific indirect effects are statistically different from each other and since KMP (.1470) has greater point estimate than DT (.0349), therefore KMP's specific indirect effect has greater mediating influence than DT's specific indirect effect.

While comparing specific indirect effects of KCP and DT, it is seen that $C_3 (a_2b_2 - a_3b_3) = (.0835 - .0349 = .0486)$ and the confidence interval of this point estimate of C3 does contain 0 (-.0007 to .0995); so the 2 specific indirect effects are not statistically different from each other.

In multiple mediator model, total indirect effect is the sum of all specific indirect effects. The total indirect effect of KRL on AOX through 3 mediators is $\text{KMP} + \text{KCP} + \text{DT} = a_1b_1 + a_2b_2 + a_3b_3 = .1470 + .0835 + .0349 = .2654$. Secondly it can be claimed that we are 95% confident that the total indirect of ICR on AOX through 3 mediators is between .2257 to .3074. This confidence interval is way above 0, supporting that KMP, KCP and DT collectively mediate the effect of ICR on AOX.

Table 5: Results of Parallel Multiple Model for ICR—KLP—AOX: Point Estimates and Confidence intervals for in Indirect Effects & Pairwise Contrasts

Mediation Pathway	Point Estimate	SE	BC 95% c.i		Decision	Comparisons
			Lower	Upper		
TOTAL	.2654	.0211	.2257	.3074		
H4a: ICR → KMP → AOX	.1470	.0187	.1102	.1833	Accepted	
H4b: ICR → KCP → AOX	.0835	.0188	.0480	.1224	Accepted	
H4c: ICR → DT → AOX	.0349	.0122	.0119	.0606	Accepted	
Contrasts ICR KLP--AOX						
C1=KMP-KCP	.0635	.0316	-.0011	.1239		No Difference
C2=KMP-DT	.1120	.0219	.0687	.1547		KMP>DT
C3=KCP-DT	.0485	.0251	-.0007	.0995		No Difference

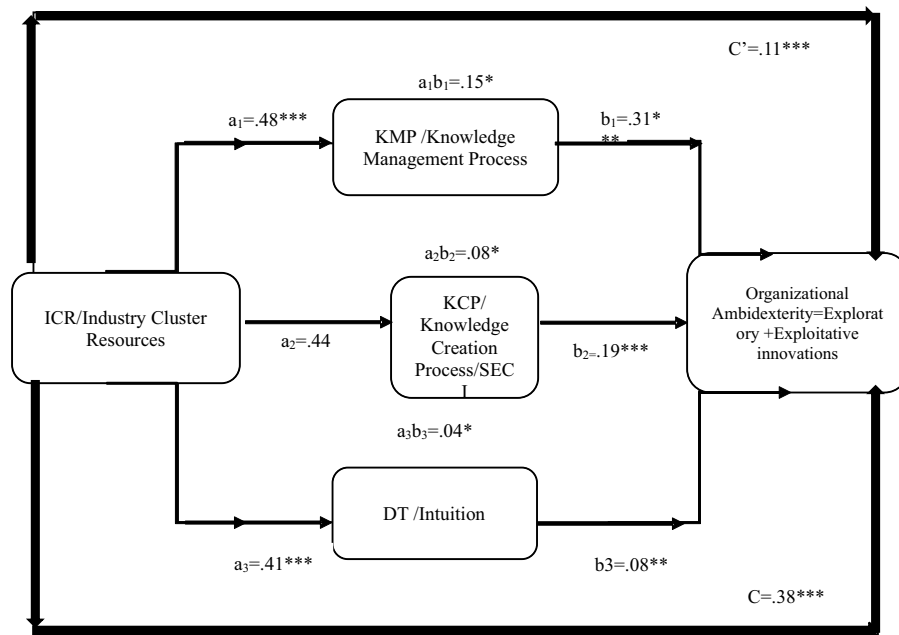


Figure 3: Parallel Multiple Mediator Model ICR-KMP, KCP, DT-AOX
Parallel Multiple Mediator Model. Note. * $p < .05$, ** $p < .01$, *** $p < .001$.

DISCUSSION

The results of all 4 hypotheses are summarized in table 5.1. It was proposed in H1 that Knowledge and learning processes/KLP positively influences organizational ambidexterity=exploratory +exploitative innovations/OAX and results confirmed H1. Standardized Beta value indicates that as KLP increased by 1 standard deviation, OAX increased by .592 standard deviations. In other words, a 100-point change in KLP brings about .592 change in OAX. Results of H1 are consistent with earlier studies which supported that both organizational knowledge and organizational learning are vital procedures leading to innovation (Nosella et al., 2012; Chang et al., 2011; Donate & Pablo, 2015; Bolisani & Handzic, 2015; Goh, 2002; Henderson, Gulati & Tushman, 2015; Jimenez-Jimenez & Sanz-Vallez, 2011; Krogh et al., 2013; Mc Inerney & Koenig, 2011; Nonaka & Peltokorpi, 2006; Nosella et al., 2012; O'Reilly & Tushman, 2013; Sok & O'Cass, 2015; Zimmerman et al., 2015). Processes like socialization, externalization, intuition, and knowledge transfer and application enhance the attainment of dual innovations.

It was proposed in H2 that Industry Cluster Resources/ICR positively influences knowledge and learning processes/KLP and results confirmed H2. Standardized Beta value indicates that as ICR increase by 1 standard deviation, KLP increases by .48 standard deviations. In other words, a 100-point change in ICR brings about .48 change in KLP. These findings are consistent with previous findings (Arikan, 2009; Belso-Martinez, Molina-Morales, & Mas-Verdu, 2011; Casanueva et al., 2013; Crossan et al, 1999; Lai et al., 2014; Lorenzen & Maskell, 2004; Raisch et al, 2009; Tallman et al., 2004). The presence of well competent, expert personnel in an organization enables it to organize and synchronize varied knowledge and learning processes like experience accumulation, knowledge

transfer and application, knowledge creation, socialization, externalization and articulation of tacit knowledge into explicit knowledge forms like standard operating processes or prototypes' procedures etc.

It was proposed in H3 that Industry Cluster Resources/ICR influences organizational ambidexterity=exploratory +exploitative innovations/OAX and results confirmed H3. Standardized Beta value indicates that as ICR increase by 1 standard deviation, OAX increases by .510 standard deviations. In other words, a 100-point change in ICR brings about .510 change in OAX. The finding that positive influence of industrial clusters resources on innovation performance as gauged and confirmed by H3 is in line with prior researches (Audretsch & Feldman, 1996; Feldman & Florida, 1994; Genyawali & Srivasta, 2013; Lai et al, 2014; Phelps, 2010; White & Burton, 2007; Raisch et al, 2009; Tallman et al., 2004). The access of firms to industry cluster resources enable them to invest in qualified, professional experts and experienced personnel so that innovative goals could be encountered. It was proposed in H4 that knowledge and learning processes/KLP mediate the positive relationship between industry cluster resources and organizational ambidexterity=exploratory +exploitative innovations/OAX. Mediation results showed that combined construct-KLP partially mediated between industry cluster resources and exploratory and exploitative innovations/organizational ambidexterity. This means that industry cluster resources/ qualified professional knowledge work force was associated with at least .2685 points higher OAX scores when mediated by KLP-knowledge and learning processes. As hypothesized in H4a, H4b, H4c, and H4d individual components of KLP i.e. knowledge management processes/KMP, knowledge creation processes/KCP/SECI, intuition/DT also mediated between industry cluster resources and exploratory and exploitative innovations/organizational ambidexterity respectively. Thus all specific indirect effects through KMP, KCP, and DT were significantly different from 0 at $p < .05$ and mediated the effect of ICR on AOX. While comparing contrasts of specific indirect effects of all three standpoints, knowledge management standpoint has greater intervening effect than other DT/intuitive processes in one instance, 'whereas there was no difference of greater or lesser mediating effects between knowledge creation processes/KCP/SECI processes and KMP/knowledge management processes; and between SECI/KCP and DT/Intuitive thinking processes' in two other instances. Pm/percentage of mediation by mediator KLP between ICR and AOX according to parallel multiple mediator model is 71% while in simple mediation model is 72%, thus strengthening the mediation assumption.

The positive effect of combined mediator/knowledge and learning processes in simple mediation model and specific indirect effects of knowledge management, knowledge creation processes/SECI processes and intuition as separate mediators in parallel multiple mediator model have been confirmed by various previous studies (Arkin, 2009; Belso-Martinez, et al., 2011; Casanova et al., 2013; Connell & Voola, 2013; Crossan et al, 1999; Lai et al., 2014; Lissoni, 2001; Nonaka & Takeuchi, 1995; Nonaka & Jhonson, 1985; Porter, 1990; Swap et al., 2001; Tallman et al., 2004; Yli-Renko, Autio & Sapinez, 2001).

Industry cluster resources alone, can bring a result in dual innovations but when knowledge and learning processes intervene between the two, this effect escalates by .2685 points. Partial mediation infers that there is not only a substantial relationship between the mediator and the dependent variable, but also some straight relationship between the independent and dependent variable. Hence, it was confirmed that the combined variable, knowledge and learning processes partially mediated the pathways between industry cluster resources and organizational ambidexterity by 72%.

Unless, industry cluster resources are complemented with processes which helps personnel to think deeply or intuitively, socialize with external factors in their environment like fellow personnel or

suppliers etc., externalize their views consequently, transfer knowledge among themselves, and apply what they have refined; they cannot constitute innovative results. To date little research examines the joint and separate intervening effects on the connection between industry cluster resources and organizational ambidexterity in Pakistani setup. The results of the present study conducted in Pakistan provide further confirmation to earlier literature stated above.

Table 6: Summarized Results

Hypotheses	Path	B	se	t-value	p	Decision
H1	KLP → AOX	.6005	.0365	16.46	.0000	Accepted
H2	ICR → KLP	.4471	.0224	19.99	.0000	Accepted
H3	ICR → AOX	.3572	.0248	15.14	.0000	Accepted
H4	ICR → KLP → AOX a*b=.2685 c.i (.2278-.3098) Boot se=.0206	.1067	.0265	4.031	.0001	Partial Mediation 72% /Accepted

CONCLUSION

One of the important sources for generation of true wealth of nations is innovation which may be either incremental/exploitative or radical/exploratory. World's most successful companies with regards to market capitalization are pre-dominantly innovative IT businesses like Apple, Google, IBM etc. (Bloomberg, 2016). This research has endeavored to explore the 'black box', 'the processes', and 'the how' for innovative businesses. It has also tried to come with an integrative approach by combining three perspectives on strong theoretical recommendations. In short, this research has tried to address the research gaps of exploring and combining three perspectives that could lead to the attainment of dual innovations. Hence, the complementary relation of combining knowledge with learning has been highlighted.

It also adds to the body of knowledge by confirming the important mediating influence of triple perspectives in orchestrating dual innovations in the presence of an important antecedent, industry cluster resources in Pakistani scenario.

RECOMMENDATIONS

Future research may be conducted incorporating different assortments of processes derived from three perspectives keeping in view situational contingencies. Different antecedents regarding teams, leadership styles may be opted for future research.

With regards to managers, it is suggested that they should facilitate a blend of processes from three perspectives instead of one. Firms should have access to industry cluster resources which are qualified, experienced professionals. Knowledge management activities like use of new technology, clear communication styles, and periodical meetings should be held to communicate new things; suggestions from employees, suppliers, customers and external experts should be utilized into refinement of existing services. Secondly, with regards to SECI processes, employment should be encouraged to socialize and gather knowledge from production area, sales points or even by wandering inside the firm. Then employees should be encouraged to develop ideas through dialogues, brainstorming or other sessions where ideas can be exchanged freely. With regards to intuitive activities employees of the firm should be strongly committed to develop research and development activities, they should be encouraged to build upon their professional experience; should be allowed

episodes of active engagement and passive relaxation; they should be encouraged to arrive at solving problems either gradually or instantaneously and lastly they should be allowed to engage to do their responsibilities before sharing with others.

Not only managers but academicians should also incorporate education and training modules that help inculcate intuitive thinking, socialization, externalization, and knowledge and learning practices in prospective IT employees.

LIMITATIONS

The sample of this research is relatively smaller and use of convenience sampling technique may not be fully representative of population. Since the data collected represented IT sector of Pakistan, generalizability of finding to other cultures or industries may be done with care.

Lastly, since the nature of data collected is cross-sectional whereas IT industry dynamics are ever changing, there may be need of longitudinal data collection method.

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