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The impact of open innovation practice on innovative performance through intellectual capital: Empirical study on SMEs

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Open innovation (OI) practices and intellectual capital (IC), though from developed countries and large firms' perspective, are related to higher innovative performance. But the influence of OI paradigm on IC and consequently on firms' innovative performance in the context of developing countries is not yet sufficiently explored. This study examined the link between OI practice and IC and their influence on the firms' innovative performance using a survey data of 243 manufacturing small and medium-sized enterprises (SMEs) operating in Ethiopia. Partial Least Squares (PLS) approach was applied to explore the relationships and test the mediating role of intellectual capital. The research findings indicated that OI practice has a positive and significant impact on intellectual capital and innovative performance in SMEs. It also revealed that human and organizational capitals have a significant positive effect on the innovative performance of SMEs. Moreover, the finding showed that only human capital mediates the positive influence of OI practice on the innovative performance. Managers/owners should work to improve the OI practice and intellectual capital simultaneously to augment the innovative performance of SMEs.

Key words: Innovative performance, intellectual capital, open innovation practice, small and medium-sized enterprises (SMEs).

INTRODUCTION

In the globalized and dynamic business settings, open innovation (OI) is anticipated to be one of the emerging future paradigms for managing innovation activities. In this paradigm, the internal and external ideas and paths are considered equally vital for the commercialization of innovation activities (Chesbrough, 2003; Lee et al., 2010). Recently, the subject has received an increasing attention from researchers, practitioners and governmental bodies. Nonetheless, prior studies on open innovation focused primarily on high-tech and large enterprises. Currently, few studies have analyzed OI practice in the context of SMEs focusing on the differences of OI practices in small and large firms (Lee et al., 2010; Spithoven et al., 2013; Popa, Soto-Acosta

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and Martinez-Conesa, 2017). Little attention is given to the connection between OI practice and performance of SMEs (Hailekiros et al., 2016; Popa et al., 2017). In addition, most of the studies on OI are descriptive by nature and based on case studies, and in-depth interviews of large and high- tech enterprises operating in developed countries (Chesbrough, 2003; Lee et al., 2010; Popa et al., 2017).

Furthermore, the relationship between OI and related management paradigms such as knowledge management which could bring synergy to firms' management solutions is not well explored (Užienė, 2015). Intellectual capital is one of the key knowledge management theories determined in transforming tangible resource into intangible assets. It deals with strategic management and has a close link with innovation activities (Kohl et al., 2015). The association among intellectual capital, OI practice, and innovation capabilities is witnessed in various contexts (Fan and Lee, 2009; Laine and Laine, 2012; Kohl et al., 2015). However, comprehensive researches on the effect of OI practice on intellectual capital and subsequently innovative performance in SMEs are meager (Užienė, 2015). Additionally, there are yet research gaps in the literature about the effect of intellectual capital (Shih et al., 2010; Mention, 2012) and OI practice (Popa et al., 2017) on the innovative performance of SMEs. The gap is even huge when it is assessed from the developing countries' perspectives (Spithoven et al., 2013; Khalique and Bontis, 2015; Hailekiros et al., 2016).

Therefore, empirical study on the impact of OI practices on intellectual capital and consequently innovative performance of SMEs in general and specifically in developing countries is imperative (Užienė, 2015; Hailekiros et al., 2016). A research model was developed based on literature from open innovation, intellectual capital, and innovative performance to study the relationship between OI practice and intellectual capital and their influence on the innovative performance of SMEs operating in Ethiopia- a developing country. The paper has important contributions. First, previous studies on OI practices and intellectual capital were focused primarily on high-tech and large enterprises in advanced economies (Lee et al., 2010; Hung and Chiang, 2010; Spithoven et al., 2013; Popa et al., 2017). Hence this paper provides evidence from SMEs operating in a developing country. Besides, the extant literature on OI practice yet relies, predominantly on case studies and conceptual frameworks (Lee et al., 2010; Popa et al., 2017). The paper further delivers empirical based research findings from the context of SMEs. Finally, the paper throws light on the mediation role of intellectual capital on the relationship between open innovation practices and innovative performance of SMEs. The remaining sections of the study are organized into literature review and hypotheses development, research methodology, and analysis, and finally discussion and conclusion.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

The impact of open innovation practice on innovative performance in SMEs

Firms had been using the research and development (R&D) as a key facility to discover, develop and finally commercialize innovations in the closed model (Chesbrough, 2003). But globalization and fast advancing information technology have changed the innovation milieu (Wang and Zhou, 2012). The availability and mobility of knowledgeable workers have increased largely, venture capital becomes abundant and knowledge is widely dispersed across multiple organizations. Enterprises are forced to move to the OI models to efficiently and effectively utilize the internal and external resources, acquire knowledge and exploit the technologies (Chesbrough, 2003). OI practice is similarly a common inclination to SMEs (Lichtenthaler, 2008; Van et al., 2009). They try to survive the severe competition and achieve their sustainable and competitive advantages through innovation. Nonetheless, high level inherent risk, uncertainty, and complexity of innovation process (Koufteros et al., 2005), limited resources (Dahlandera and Gann, 2010; Lee et al., 2010), lack of multidisciplinary competence base (Bianchi et al., 2010), low absorbing capacity (Wang and Zhou, 2012) and other relevant challenges may restrict their innovative competitiveness. Likewise, the mobility of skilled workers, the availability of abundant venture capital, widely distributed knowledge and very short product life cycles make the isolated innovation infeasible (Chesbrough, 2003). Hence, many and broad companies both large and small are practicing and increasingly adopting OI to complement their inadequacies (Van de Vrande et al., 2009; Parida et al., 2012; Hailekiros et al., 2016).

Indeed, SMEs are faced with limited resources, skills and capabilities in manufacturing, distribution, marketing, R&D funding, and structural innovation processes which are indispensable for transforming inventions into innovations (Lichtenthaler, 2008; Leiponen and Helfat, 2010). However, they are usually flexible and specific (Lee et al., 2010), high-risk takers, with more specialized knowledge and proactive for market changes (Parida et al., 2012). These factors favor SMEs to better benefit from OI practices compared with their larger counterparts. In this regard, the inbound, outbound and coupled OI processes (Gassmann et al., 2010; Spithoven et al., 2013; Hailekiros et al., 2016) are possible paths towards opening for SMEs. While the inbound open innovation process deals with searching for external ideas and data for complementing, strengthening the in-house R&D activities, outbound focuses on uncovering

the process of commercializing the unexploited internal innovation activities. The coupled OI combines both processes centered on strategic alliances (Spithoven et al., 2013). These processes are vital for SMEs to fill their technological, resource and competency gaps (Lichtenthaler, 2008), increase the speed and quality of innovations (Van de Vrande et al., 2009) and respond to market changes and thereby create new channels (Van de Vrande et al., 2009; Lee et al., 2010).

The inbound, outbound and coupled OI practices and their combination are possible choices firms adopt to overcome their deficiency and build up competitive and sustainable advantages from the internal and external resources. Nonetheless, the inherent high cost of patent management (Spithoven et al., 2013) and the inadequate capabilities to establish balanced relationships with established firms (Narula, 2004; Minshall et al., 2010) limit the regular adoptions of outbound and coupled OI in SMEs. Hence, the OI practice in SMEs opts more towards the inbound mode (Van de Vrande et al., 2009; Lee et al., 2010). Considering the trend and the actual practices of the SMEs at hand, the focus of this paper is on the inbound open innovation practices.

SMEs have restricted resources, they have to search for possible ways that compensate their constraint and minimize production cost, effectively market their products and provide satisfactory support services (Lee et al., 2010). They have to formally or informally tie with other organizations and institutions (Bigliardi et al., 2012). These connections are critical for them to access new ideas, knowledge, complementarity resources from the external environment and opportunity to commercialize on the shelf innovations (Dahlandera and Gann, 2010). Moreover, it aids them to get an additional resource on existing or new markets through the competencies and resources of external partners (Mortara and Minshall, 2011) and new opportunities and market channels (Buganza and Verganti, 2009). Thus, the following hypothesis is established.

Hypothesis 1: OI practice has a positive and significant effect on the innovative performance of SMEs.

Intellectual capital and innovative performance of SMEs

Intellectual capital is all the knowledge of an organization that is used to leverage conducting business to achieve competitive advantages (Youndt et al., 2004; Subramaniam and Youndt, 2005). In this knowledge-based and competitive era, the intellectual capital is accepted as the dominant factor for the realization of organizations and countries' economic growth (Subramaniam and Youndt, 2005; Alpkan et al., 2010; Khalique and Bontis, 2015). It is also becoming the unique competence factor for firms 'innovativeness

(Zerenler et al., 2008). Consistent with this Tovstiga and Tulugurova (2007) pointed out that the intellectual capital is the most powerful resource to increase the performance of organizations.

Previous researchers classified IC as human, organizational and social capitals based on how knowledge is developed, accumulated and distributed (Subramaniam and Youndt, 2005). Human capital is the tacit and explicit individual knowledge possessed by employees and shared with their organizations to create values. It includes the employees' experiences, abilities, learning or creation abilities (Youndt et al., 2004) and can be enriched by training and formal education (Dakhli and De Clercq, 2004). It is useful to conduct firms' activities to change their action and enhance growth (Delgado-Verde et al., 2016). The social capital is the knowledge rooted in and among networks of interrelationships. It is available and utilized through the network (Freel, 2000). It is the relational knowledge from stakeholders' ties including customers, suppliers, competitors, universities and the firm's internal environment. It represents a valuable knowledge source to accomplish activities efficiently (Subramaniam and Youndt, 2005). Finally, the organizational capital represents the codified and institutionalized knowledge and experience residing in and utilized through the organization's repository like databases, manuals, patents processes and the like (Subramaniam and Youndt, 2005; Carmona-Lavado, Cuevas-Rodríguez, and Cabello-Medin, 2010).

Basically, the IC components are closely intertwined and mutually dependent (Subramaniam and Youndt, 2005). Highly skilled and experienced employees use their knowledge base to analyze and solve customer problems (Subramaniam and Youndt, 2005). This process facilitates attempts to exchange and share information to learn customer preferences in a sustained manner (Hsu and Fang, 2009), which in turn promotes the exchange and utilization of valuable information between internal professionals and external consumers. This again enhances the generation of innovative ideas that respond to customer preferences (Chen et al., 2014). Accordingly, the knowledge and skills from human capital embedded in new service or product development are expected to contribute positively to social capital. Contrasting the human capital, organizational capital is embedded in organizations infrastructure rather than in employees' minds (Chen et al., 2014; Subramaniam and Youndt, 2005). This gives firms competitive advantages in advancing their collection of knowledge from customers and understanding customers' needs and preferences (Chen et al., 2014). When firms sustain a good relationship with customers and business partners, it creates a conducive environment for their employees to discuss business ideas, processes and innovations with customers and business partners thereby updating the structural capital of the companies (Hsu and Fang, 2009). Similarly, when employees involve in knowledge-based

discussions, they would exchange their knowledge with colleagues. This knowledge flow would upsurge the importance of the existing knowledge as expanded knowledge becomes valuable and meaningful. The organizational capital is a mechanism to take advantage of the information and knowledge. Similarly, it is a mechanism to capture, store, retrieve and communicate the knowledge and information (Chen et al., 2014).

Hence, the employees' skills and knowledge, experiences, attitudes, and commitments supported by the required infrastructure and harmonized and loyal relationship with strategic partners and customers create encouraging environments to develop distinctive competency. This distinctive competence can enhance a firm's effectiveness, efficiency, and innovation (Zerenler et al., 2008). It, consequently, allows firms to provide better values and benefits for customers than the competitors (Hill and Jones, 2001). When a firm has a unique competency, it can achieve a higher innovative performance (Garcia and Calantone, 2002). Consequently, the following hypotheses are formulated.

Hypothesis 2a: Human capital has a positive and significant effect on innovative performance in SMEs.

Hypothesis 2b: Social capital has a positive and significant effect on innovative performance in SMEs.

Hypothesis 2c: Organizational capital has a positive and significant effect on innovative performance in SMEs.

Open innovation practice and intellectual capital

The knowledge inflows and outflows from the diverse knowledge sources like universities, customers, competitors and the like positively influence the knowledge stock of the firm through organizational learning (Laine and Laine, 2012). Similarly, the inter-organizational knowledge exchange is crucial for creating organizational new knowledge (Fan and Lee, 2009). Thus, considering intellectual capital as a bundle of organizational knowledge, increasing knowledge flows across organizational boundaries triggered by OI paradigm changes the content and level of knowledge stock in organizations. However, the level and means of the effect of OI practice on the intellectual capital components are anticipated to be different based on their type and nature. The OI practice establishes new partnerships and the social capital tends to expand and becomes more diverse. The increased inter-organizational knowledge exchanges caused by the opening also changes substantially the landscape of human capital by diversifying the knowledge borrowing and lending dimensions (Užienė, 2015). Furthermore, as the organizational value creation schemes go beyond organizational boundaries the relational capital acquires a

matrix form under this paradigm. Hence, organizations could access the systems shared by partners and could get the advantage from these in joint value creation processes and increase the organizational capital. Accordingly:

Hypothesis 3a: Open innovation practice has a positive and significant effect on social capital in SMEs.

Hypothesis 3b: Open innovation practice has a positive and significant effect on human capital in SMEs.

Hypothesis 3c: Open innovation practice has a positive and significant effect on organizational capital in SMEs.

The mediating role of intellectual capital

The open innovation practice promotes opening up firms boundaries to let the flow of knowledge in and out and advances firms' innovativeness (Chesbrough, 2003). This knowledge flow is also a critical factor for organizational knowledge creation which in turn increases a company's innovation abilities and competitive advantage (Fan and Lee, 2009). Consequently, the positive impact of OI practice on innovation performance and competitiveness can be enhanced by increasing the knowledge stock (Intellectual capital). Hence, the following hypotheses are claimed.

Hypothesis 4a: Human capital mediates the positive effect of open innovation on innovative performance in SMEs.

Hypothesis 4b: Organizational capital mediates the positive effect of open i nnovation on innovative performance in SMEs.

Hypothesis 4c: Social capital mediates the positive effect of open innovation on innovative performance in SMEs.

Synthesizing these discussion and hypotheses claimed, a research framework that describes the connections among open innovation, intellectual capital, and innovative performance in SMEs is formulated (Figure 1).

RESEARCH METHODOLOGY

Sample and data collection

A survey was conducted from 08/2017 to 02/2018 to collect the data used to explore the effect of open innovation on intellectual capital and consequently innovative performance in SMEs. The survey questions were designed to assess the OI practice, intellectual capital, and innovative performances of SMEs. The initial survey draft was discussed with the firms' owners, managers, and relevant governmental agency representatives. It was pre-tested using 20 pilot interviews to check if the wording,
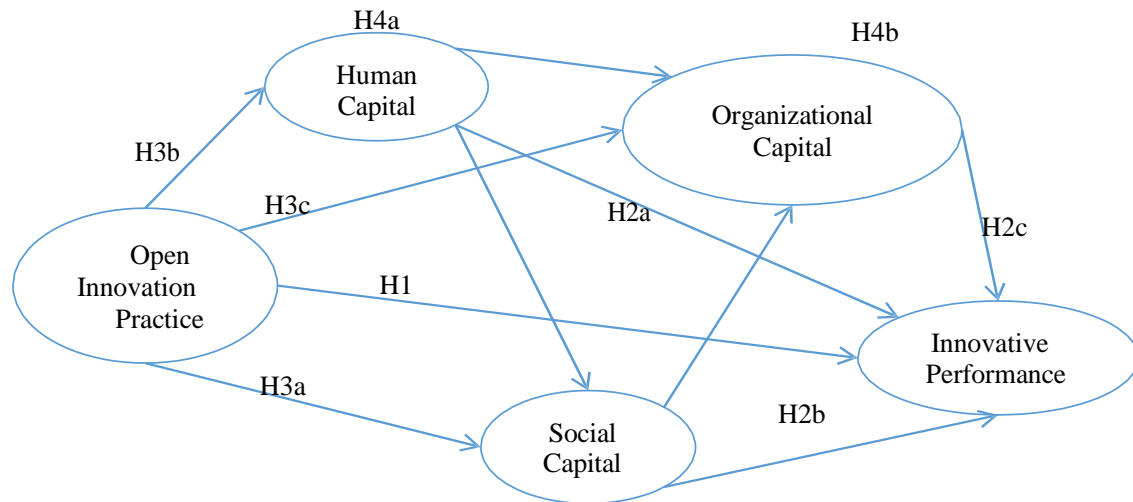
Figure 1. Research Framework.

comprehensibility, and sequencing of questions were acceptable.

SMEs relevant to the study were first screened from the master database in consultation with the representatives from the SMEs agents. The firms for the survey were then randomly selected from manufacturing firms comprising the metalwork, woodwork, textile and garment, leather, metal, and woodwork enterprises operating in the Northern part of Ethiopia. Considering the representativeness of the sector and zones covered in the study, four hundred firms were selected. The questionnaire was first given to each interviewee and the questions were asked face-to-face in the same order. 243 interviews were correctly and successfully performed, leading to a response rate of 60.75%.

The respondents who completed the questionnaire were mostly the owners as well as managers of the firms (92.6%), and managers but not owners (7.4%). The respondents were selected from the sectors (metalwork = 26.5%; woodwork = 23%; textile and garment = 26.5%; leather = 2%; metal and woodwork = 23.5%). Furthermore, the firm's operational age ranges from 4 to 23 years. The data were first screened and SmartPLS was applied for evaluating the model and testing the hypotheses.

Measurement of constructs

The measurement scales for the constructs were established based on existing academic literature and operational definitions. Accordingly, the OI practice measurement scale was developed based on concepts from (Laursen and Salter, 2006; Spithoven et al., 2013; Ahn et al., 2015). Eight items measurement scale was used to assess how the linkages with partners benefit SMEs. A 5-point Likert- scale (ranging from 1= less important to 5= very important) was adopted to measure the parameters. The measures for human capital assessed the overall expertise, skill, and knowledge of an organization's employees. Likewise, measuring items for social capital assessed the organization's ability to exchange and leverage within and among networks of employees, customers, suppliers, and alliance partners. The organizational capital measures the ability of the organizations to appropriately store knowledge in physical organization- level repositories. A five, five, and four items measurement scales were adopted from (Subramaniam and Youndt, 2005) to assess the human, social and organizational capitals, respectively. A 5-point Likert- scale

from 1(strongly disagree) to 5(strongly agree) was applied to measure the parameters. Finally, the innovative performance was measured with seven items scales used by (Gunday et al., 2011). Similarly, a 5-point Likert scale from 1 (much worse performance than competitors) to 5 (much better performance than competitors) was applied to evaluate the innovative performance.

RESULTS AND DISCUSSION

SmartPLS- SEM version 3.0 was used as a data analysis tool. It is a second generation tool which applies a component-based approach to SEM (Hair et al., 2016). It uses a two-step process to separately assess the measurement and the structural models. The first step, the measurement model, evaluates the validity and reliability of the scales. The second step, structural model, evaluates the research model and the paths among the research constructs.

Measurement model evaluation

As the measures are all reflective the individual itemand construct reliability, the convergent and discriminant validity of all items should be studied to examine the measurement model. The factor loadings, composite reliability (CR) and average variance extracted (AVE) were used to assess item reliability, construct reliability and convergence validity respectively as recommended by (Hair et al., 2016). The minimum cutoff values are set at 0.7, 0.7 and 0.5 for factor loadings, CR, and AVE respectively. To achieve the loading cutoff point, three items from OI practice construct and one item from innovative performance construct which did not reach this value was dropped to maintain parsimony (Hair et al., 2016) Finally, as it is shown in Table 1 the factor loading,

Table 1. Measurement of model evaluation.

Construct	Measures	Loading	CR	AVE
Human capital	HC1	0.848	0.932	0.734
	HC2	0.877		
	HC3	0.889		
	HC4	0.817		
	HC5	0.851		
Innovative performance	IP2	0.708	0.895	0.587
	IP3	0.777		
	IP4	0.715		
	IP5	0.797		
	IP6	0.779		
	IP7	0.814		
Organizational capital	OC1	0.869	0.882	0.600
	OC2	0.805		
	OC3	0.862		
	OC4	0.893		
Open Innovation practice	OI4	0.807	0.917	0.736
	OI5	0.782		
	OI6	0.74		
	OI7	0.769		
	OI8	0.774		
Social capital	SC1	0.805	0.923	0.705
	SC2	0.833		
	SC3	0.857		
	SC4	0.862		
	SC5	0.839		

CR: composite reliability; AVE: average variance extracted.

Table 2. Discriminant validity.

S/N Variable	1	2	3	4	5
1 Human capital	**0.857**				
2 Innovative performance	0.661	**0.766**			
3 Organizational capital	0.762	0.648	**0.858**		
4 Open innovation	0.661	0.652	0.651	**0.775**	
5 Social capital	0.827	0.640	0.774	0.691	**0.839**

CR, and AVE values are all above the suggested thresholds. Hence the items measurement reliability, internal consistency reliability, and convergent validity are satisfactory and sufficient.

Lastly, discriminant validity was assessed through the Fornell and Larcker (1981), which states that each latent construct's AVE should be greater than the construct's highest squared correlation of another latent construct. Table 2 shows that the correlation matrix of the constructs and the square roots of AVE (diagonal and bold). The diagonal values are all larger than the off-diagonal values in the respective rows and columns,

signifying adequate discriminant validity.

Structural model evaluation

Once the measurement evaluation criteria were fulfilled, the goodness of the theoretical model should be determined. Structural model can be evaluated using the coefficient of determination (R^2) and the strength of path coefficients (β) derived from bootstrapping techniques (Chin, 2010). Besides, as the hypotheses formulated in this research involved mediation relationships, the
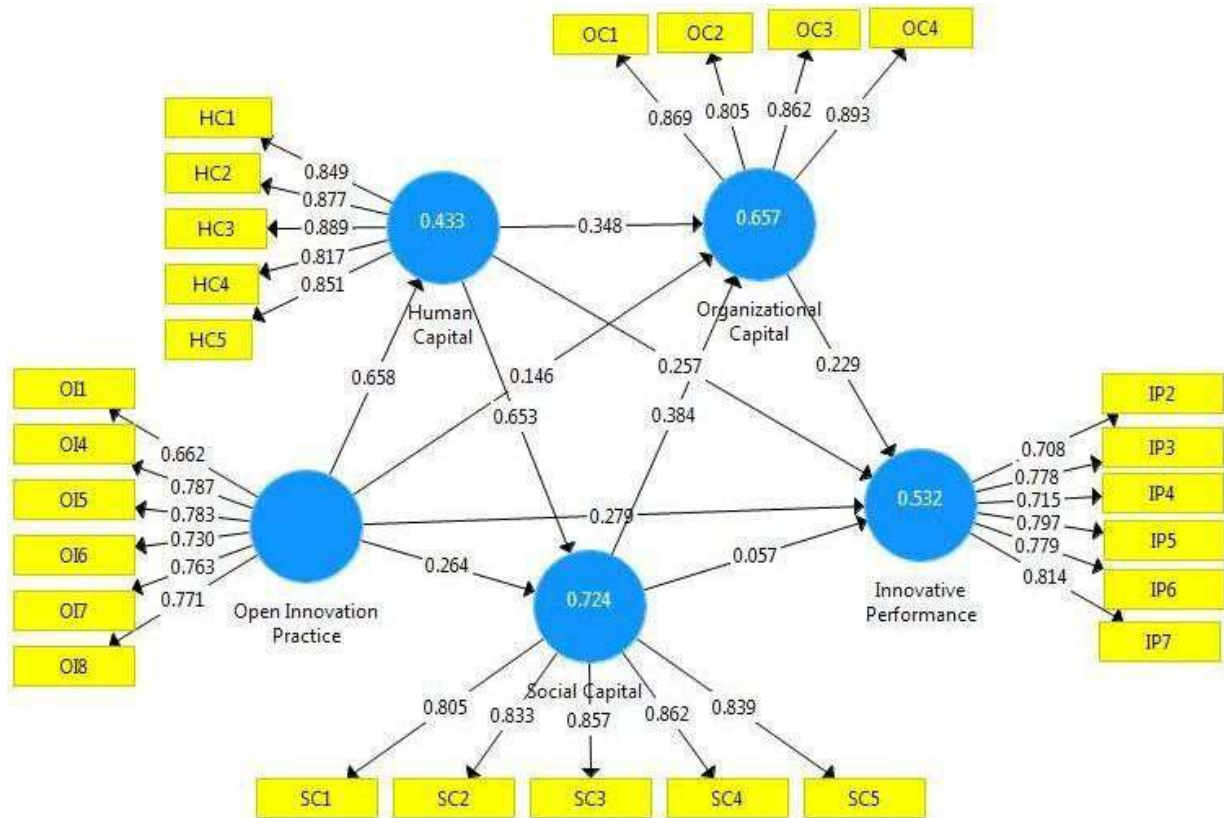
Figure 2. Structural model evaluation results.

Table 3. Hypothesis testing-direct relationships.

Hypothesis	Path	β	S.E	T-Statistics	Result
H1	OI -> IP	0.311***	0.067	4.6	Supported
H2a	HC -> IP	0.249**	0.082	3.034	Supported
H2b	SC -> IP	0.054n.s	0.085	0.64	Rejected
H2c	OC -> IP	0.214**	0.076	2.82	Supported
H3a	OI -> SC	0.256***	0.06	4.31	Supported
H3b	OI -> HC	0.661***	0.043	15.4	Supported
H3c	OI -> OC	0.164**	0.064	2.55	Supported

Note: ** $p < 0.01$; *** $p < 0.001$; n.s=not significant
OI=Open Innovation Practice; HC= Human Capital, IP= Innovative Performance; OC=Organizational   Capital;
SC= Social   Capital, β =Path coefficient; S.E=standard Error.

significances of the indirect effects were verified by the variance accounted for (VAF) analysis (Hair et al., 2016). Figure 2 and Table 3 summarize the results of the final model. Table 3 summarizes the results of the proposed hypotheses. Accordingly, the OI practice has positive and significant direct influence on both the intellectual capital and the innovative performance, supporting H3a, H3b, H3c, and H1. Moreover, the organizational and human capitals have a positive and significant direct influence on the innovative performance, confirming H2a and H2c. But

the impact of social capital on the innovative performance is not significant, rejecting H2. The explanatory power of the model was examined using the coefficient of determination (R^2) value (Hair et al., 2016). R^2 denotes the extent of variance in the endogenous constructs explained by the exogenous variable/s (Chin, 2010). As depicted in Figure 2, the R^2 results indicate a robust model with 72% of the variance in the social capital, 66% of the variance in the organizational capital, 54% of the variance in the innovative performance and 44% of the
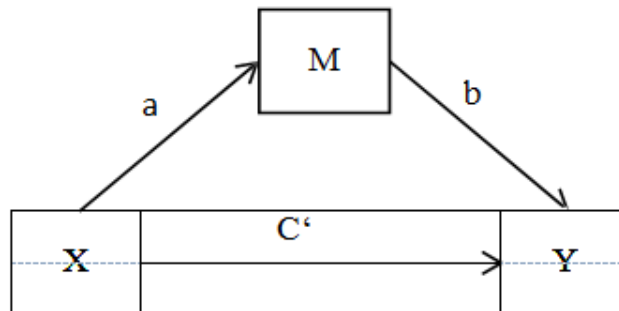
Figure 3. Mediation model.

variance in the human capital explained by the independent variable/s.

The analysis of mediation effects

Mediation occurs when causal predecessor X influences the outcome variable Y through intervening variable M (Figure 3). The whole effect of X on Y is divided into direct and indirect components. The route from X to Y without passing from M is called direct effect and represented by-c' ‖. The path from X to Y through M is called the indirect effect. The indirect effect coefficient (a x b) is the product of -a‖ and -b‖. The full effect (C) is hence the accumulation of direct and indirect effects (C=c'+ a x b).

The bootstrapping approach was applied to check the mediation effect. The bootstrapping approach does not make any assumptions about the shape of the variables' distribution or sampling distribution of the statistics. It can be used to small sample sizes with high confidence. The approach is therefore flawlessly fit for the PLS method. Besides, this approach exhibits higher statistical power compared with the Sobel test. As suggested by Hair et al. (2016), the significance of the individual paths (X-M and M-Y) is a requirement for the mediation condition. Moreover, the indirect effect is assessed by the size of its effect relative to the total effect (Indirect effect/Total effect) described as variance accounted for (VAF). When the indirect effect is significant but does not absorb any of the exogenous latent variable's effect on the endogenous variable, the VAF would be less than 20% which implies almost no mediation. Conversely, when the VAF has relatively large outcomes (above 80%) a full mediation occurs. When the VAF value is between 20 and 80% the situation is characterized as partial mediation. Table 4 shows the bootstrapping results including direct, indirect, total effects and VAF for the paths with the potential mediating factors. Accordingly, as the impact of social capital on innovative capital is insignificant, the mediation role of social capital between open innovation practice and innovative performance (H4c) is not supported. The

other mediating factors were evaluated with respect to the VAF, as the values of _a' and _b' are significant. Given the VAF values, the impact of OI practice on the innovative performance is partially mediated by human capital. But the organizational capital has an insignificant role in mediating this effect. Hence H4a is supported but H4b is dropped. Furthermore, the result from Table 4 confirms that the impacts of social and human capital on the innovative performance are partially mediated through the organizational capital.

Conclusion

This paper examined the link among OI practice, intellectual capital, and innovative performance using a sample of 243 manufacturing SMEs operating in Ethiopian. A conceptual model which delineates the relationships was developed and evaluated using the SmartPLS. Empirical results revealed that OI practice has a significant and positive effect on the innovative performance of SMEs, supporting H1 (β=0.311, t = 4.60, p<0.001). This implies that SMEs in developing countries may increase their innovative performance by implementing the open innovation practices. This result similar to Hung and Chiang (2010) findings validated the relationship between open innovation and firms' performance. The finding reveals that the open innovation practice is a common trend both for large and SMEs in developed and developing countries. It also shows that adopting an open approach is worthwhile for companies to improve their innovative performances. The effects of open innovation practice on social capital (H3a: β=0.256, t = 4.31, p<0.001), human capital (H3b: β=0.661, t = 15.40, p<0.001) and the organizational capital (H3b: β=0.164, t = 2.55, p<0.001) were also positive and significant. This result suggests that SMEs in developing countries may enhance their intellectual capital using open innovation practices. These findings illustrated that open innovation practice is critical for SMEs to get technological resource (Lichtenthaler, 2008) and new channels (Lee et al., 2010, Van de Vrande et al., 2009)

Table 4. Hypothesis testing-mediating effect.

Hypothesis	Path	C'	a	b	(a*b)	(c'+a*b)	VAF (%)	Mediation
H4a	OI -> HC -> IP	0.31 ***	0.661***	0.249**	0.1646	0.476	**34.61**	**Partial**
H4b	OI -> OC-> IP	0.311***	0.164**	0.214**	0.0351	0.346	**10.14**	No
H4c	OI -> SC -> IP	0.311***	0.256***	**0.054n.s**				No
	HC ->OC--> IP	0.249***	0.341***	0.214**	0.073	0.322	**22.66**	**Partial**
	HC ->SC--> IP	0.249***	0.658***	**0.054n.s**				No
	SC ->OC--> IP	0.054**n.s**	0.379***	0.214**	0.0811	0.135	**60.03**	**Partial**

Note: ** p < 0.01; *** p < 0.001; n.s=not significant
VAF: Variance accounted for; a*b: indirect effect; c'+a*b: total effect, VAF%: indirect/Total effect.

that enhance the quality and speed of their innovations (Van de Vrande et al., 2009). They also showed that OI practice is critical for them to access new ideas, knowledge, supplementary resources and opportunities from the external environment which could improve the stock of knowledge (human, organizational and social capital) in the company (Laine and Laine, 2012).

Moreover, the impacts of the intellectual capital components on the firm's innovative performance were also investigated independently. The results discovered that human capital is positively and significantly associated with innovative performance in SMEs, supporting H2a (β=0.249, t = 3.034, p<0.01). This finding supports the previous result from Zerenler et al. (2008) and Alpkan et al. (2010). In fact, when SMEs are equipped with highly skilled employees they are capable to perform and innovate better. The impact of organizational capital was similarly found to be positively and significantly connected to the innovative performance, supporting H2c (β=0.214, t = 2.82, p<0.01). This implies as the organizational capital of SMEs is enhanced, SMEs create capability to improve their products and processes, which further boost their innovative performance. This result is consistent with previous findings that approved the critical role of organizational capital for the innovative performance (Zerenler et al., 2008; Leitner, 2011). But the association between social capital and innovative performance was attested to be insignificant and H2b (β=0.054, t = 0.64, n.s) was rejected. This result contradicts the discoveries of Zerenler et al. (2008) and Hsu and Fang (2009). The impact of social capital on the innovative performance was found to be indirectly through the organizational capital. Hence the impact of social capital can be improved through the development of organizational capital. Finally, as presented in Table 4 the relationship between OI practice and innovative performance is partially mediated by human capital (H4b). In contrast, the mediation role of social capital (H4c) and organizational capital (H4b) are not supported.

The paper has important theoretical and practical contributions. First, previous studies on OI practices and intellectual capital were focused primarily on high-tech and large enterprises in advanced economies (Lee et al., 2010; Spithoven et al., 2013; Popa et al., 2017). The findings of this paper could expand our understanding of the connection among open innovation practice, intellectual capital and the innovative performance from the context of SMEs operating in a developing country, which could also provide good implications to SMEs operating in similar situations. Secondly, the prevailing literature on OI practice yet relies, predominantly on case studies and conceptual frameworks with little empirical research in the context of SMEs (Lee et al., 2010; Popa et al., 2017). Therefore, the paper supplements the literature on the effects of open innovation practice on intellectual capital and subsequently on the innovative performance by assessing empirically. This provides additional evidence to elucidate the conclusive results.

Furthermore, the study adds to the body of knowledge on the impact of OI practice on the elements of intellectual capital and the interplay among the different intellectual capital components. Finally, the paper throws light on the mediation role of intellectual capital components on the positive impact of open innovation practice on the innovative performance of SMEs.

From practical perspectives, the findings hold crucial implications for managers. First, the result shows that OI practice is a key factor in enhancing the innovative performance in SMEs. The innovative performance in SMEs can be considerably improved by pursuing open innovation practice designed to stimulate new idea sharing, knowledge creation, and supply of complementary resources, new market opportunities, and channels. It was likewise found that innovative performance needs more intellectual capital, indicating that managers should highly emphasize on developing and wisely utilizing the intellectual capital. Specifically, firms should train employees to enrich their work experience and improve human capital, develop a close relationship with their stakeholders to enhance the social capital and design efficient systems to improve structural capital. Another key finding is that human capital reinforces the positive effect of open innovation practice on the innovative performance in SMEs. Hence, equipping employees with the required skill and knowledge is a

critical issue to increase the effect of open innovation practice on the innovative performance of SMEs.

Lastly, the findings of this paper are specific to manufacturing SMEs operating in Ethiopia. Generalizing the results to all industry and all sizes of enterprises need further investigations based on both cross-sectional and longitudinal data. In addition, with more openings, the spread of intangible knowledge across firms' boundaries could erode the unique assets of firms and could create challenges in managing the intellectual capital. Therefore, it needs further investigation.

CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

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REFERENCES

Ahn J, Minshall T, Mortara L (2015). Open innovation: A new classification and its impact on firm performance in innovative SMEs. Journal of Innovation Management 3(2):33-54.

Alpkan L, Bulut C, Gunday G, Ulusoy G, Kilic K (2010). Organizational support for entrepreneurship and its interaction with human capital to enhance innovative performance. Management Decision 48(5):732-755.

Bianchi M, Campodall'Orto S, Frattini F, Vercesi P (2010). Enabling open innovation in small and medium-sized enterprises: how to find alternative applications for your technologies. Research and Development Management 40(4):414-430.

Bigliardi B, Dormio A, Galati F (2012). The adoption of open innovation within the telecommunication industry. European Journal of Innovation Management 15(1):27-54.

Buganza T, Verganti R (2009). Open innovation process to inbound knowledge Collaboration with universities in four leading firms. European Journal of Innovation Management 12(3):306-325.

Carmona-Lavado A, Cuevas-Rodríguez G, Cabello-Medin C (2010). Social and organizational capital: Building the context for innovation. Industrial Marketing Management 39(1):681-690.

Chen CJ, Liu TC, Chu MA, Hsiao YC (2014). Intellectual capital and new product development. Journal of Engineering Technology and Management 33(1):154-173.

Chesbrough HW (2003). Open innovation: The new imperative for creating and profiting from technology. Boston: Harvard Business School Press.

Chin WW (2010). How to write up and report PLS analyses. In Handbook of partial least squares. Springer, Berlin, Heidelberg. pp. 655-690.

Dahlandera L, Gann D (2010). How open is innovation? Research Policy 39(6):699-709.

Dakhli M, De Clercq D (2004). Human capital, social capital, and innovation: A multi-country study. Entrepreneurship and Regional Development 16(2):107-128.

Delgado-Verde M, Castro GD, Amores-Salvadó J (2016). Intellectual capital and radical innovation: Exploring the quadratic effects in technology-based manufacturing firms. Technovation 54(1):35-47.

Fan I, Lee R (2009). A complexity framework on the study of knowledge flow, relational capital, and innovation capability. Proceedings of the International Conference on Intellectual Capital. pp. 115-123.

Fornell C, Larcker DF (1981). Evaluating structural equation models with unobservable variables and measurement error. Journal of Marketing Research 18(1):39-50.

Freel M (2000). External linkages and product innovation in small manufacturing firms. Entrepreneurship and Regional Development 12(1):245-266.

Garcia R, Calantone R (2002). A Critical Look at Technological Innovation Typology and Innovativeness Terminology: a Literature Review. Journal of Product Innovation Management 9(2):110-132.

Gassmann O, Enkel E, Chesbrough H (2010). The future of open innovation. Research and Development Management 40(3):213-221.

Gunday G, Ulusoy G, Kilic K, Alpkan L (2011). Effects of innovation types on firm performance. International Journal of Production Economics 133(2):662-676.

Hailekiros GS, Renyong H, Qian S (2016). Adopting Open Innovation Strategy to Empower SMEs in Developing Countries. International Conference on Engineering and Technology Innovations (ICETI 2016) Atlantis Press pp. 82-87.

Hair Jr JF, Hult GT, Ringle C, Sarstedt M (2016). A primer on partial least squares structural equation modeling (PLS-SEM). Sage Publications.

Hill CW, Jones G (2001). Strategic Management Theory — An Integrated Approach. Boston, New York: Houghton Mifflin Company.

Hsu YH, Fang W (2009). Intellectual capital and new product development performance: The mediating role of organizational learning capability. Technological Forecasting and Social Change 76(1):664-677.

Hung KP, Chiang YH (2010). Open innovation proclivity, entrepreneurial orientation, and perceived firm performance. International Journal of Technology Management 52(3/4):257-274.

Khalique M, Bontis N (2015). Intellectual capital in small and medium enterprises in Pakistan. Journal of Intellectual Capital 16(1):224-238.

Kohl H, Galeitzke M, Steinhöfel E, Orth R (2015). Strategic intellectual capital management as a driver of organisational innovation. International Journal of Knowledge and Learning 10(2):164-181.

Koufteros X, Vonderembse M, Jayaram J (2005). Internal and External Integration for Product Development the Contingency Effects of Uncertainty, Equivocality and Platform Strategy. Decision Science 36(1):97-133.

Laine MO, Laine A (2012). Open innovation, intellectual capital, and different knowledge sources. Finland pp. 239-245.

Laursen K, Salter A (2006). Open for innovation: The role of openness in explaining innovation performance among UK manufacturing firms. Strategic Management Journal 27(2):131-150.

Lee S, Park G, Yoon B, Park J (2010). Open innovation in SMEs-An intermediated network model. Research Policy 39(1):290-300.

Leiponen A, Helfat C (2010). Innovation objectives, knowledge sources, and the benefits of breadth. Strategic Management Journal 31(2):224-236.

Leitner KH (2011). The effect of intellectual capital on product innovativeness in SMEs. International Journal of Technology Management 53(1):1-18.

Lichtenthaler U (2008). Open innovation in practice: an analysis of strategic approaches to technology transactions. IEEE Transactions on Engineering Management 55 (1):148-157.

Mention AL (2012). Intellectual capital, innovation, and performance: A systematic review of the literature. Business and Economic Research 2(1):1-37.

Minshall T, Letizia M, Robert V, David P (2010). Making "Asymmetric" Partnerships Work. Research-Technology Management 53(3):53-63.

Mortara L, Minshall T (2011). How do large multinational companies implement open innovation? Technovation 31(10-11):586-597.

Narula R (2004). R & D collaboration by SMEs: new opportunities and limitations in the face of globalization. Technovation 25(2):153-161.

Parida V, Westerberg M, Frishammar J (2012). Inbound Open Innovation Activities in High-Tech SMEs: The Impact on Innovation Performance. Journal of Small Business Management 50(2):283-309.

Popa S, Soto-Acosta P, Martinez-Conesa I (2017). Antecedents, moderators, and outcomes of innovation climate and open innovation: An empirical study in SMEs. Technological Forecasting and Social Change 118(1):134-142.

Shih KH, Chang CJ, Lin B (2010). Assessing knowledge creation and

intellectual capital in banking Industry. Journal of Intellectual Capital 11(1):74-89.

Spithoven A, Vanhaverbeke W, Roijakkers N (2013). Open innovation practices in SMEs and large enterprises. Small Business Econnmics 41:537-562.

Subramaniam M, Youndt M (2005). The influence of intellectual capital on the types of innovative capabilities. Academy of Management Journal 48(1):450-463.

Tovstiga G, Tulugurova E (2007). Intellectual capital practices and performance in Russian enterprises. Journal of Intellectual Capital 8(4):695-707.

Užienė L (2015). Open innovation, knowledge flows, and intellectual capital. Procedia-Social and Behavioral Sciences 213(1):1057-1062.

Van de Vrande V, De Jong JP, Vanhaverbeke W, De Rochemont M (2009). Open innovationin SMEs:Trends, motives and management challenges. Technovation 29(1):423-437.

Wang Y, Zhou Z (2012). Can open innovation approach be applied by latecomer firms in emerging countries? Journal of Knowledge-based Innovation in China 4(3):163-173.

Youndt MA, Subramaniam M, Snell S (2004). Intellectual Capital Profiles: An Examination of Investments and Returns. Journal of Management Studies 41(2):336-361.

Zerenler M, Hasiloglu S, Sezgin M (2008). Intellectual capital and innovation performance: Empirical evidence in the Turkish automotive supplier. Journal of Technology Management and Innovation 3(4):32-40.