# The Effects of Intellectual Capital on Performance in Australian Small and Medium Enterprises (SMEs)

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**ABSTRACT**

*There are limited studies in the literature that investigate the relationship between intellectual capital and SME Performance, and test the mediating effects of organizational innovation. This study examined 2,154 SMEs of various industries from 2009-2011 by using Business Longitudinal Database (BLD) from the Australian Bureau of Statistics (ABS).Our research findings show that human, structural, and relational capital has a positive and significant effect on SME performance when mediated by organizational innovation. The implication of our findings is that managers should simultaneously develop their human capital through training, improve their networking and collaboration, and increase their investment in information technology in order to improve SME performance through innovation.*

**Keywords:** SMEs, Intellectual Capital, Organizational Innovation, Firm Performance, Australia.

## INTRODUCTION

The literature generally acknowledges that intellectual capital (IC) contributes to economic growth, improves firm performance, which in turn leads to sustained competitive advantage (Huang and Liu 2005; Dean and Kretschmer 2007; Hsu and Fang 2009). However, IC in SMEs works differently compared to large firms. This is largely due to the limited resources available to SMEs, which are critical throughout the innovation process (Cohen and Kaimenakis 2007; Hewitt-Dundas 2006). Mention (2012), found gaps in the literature on the relationship between IC, innovation, and SME performance. There are also competitive barriers which SMEs are confronted with, primarily due to low cost goods from other countries such as India and China (Bessant & Tidd, 2007). Therefore, improving SME performance through the innovation of products and services has become a critical issue for Australian SMEs(Anderson and Sohal 1999). However, SMEs are faced with the question of how to achieve competitive advantage through innovation. Considering the above discussion, this article addresses the questions:

1) *Is there a significant relationship between Intellectual Capital and SME performance?*
2) *Does organisational innovation moderate the relationship between Intellectual Capital and SME performance?*

We used subjective measures to test the relationship between IC and SME performance, while testing the mediating effect of organizational innovation. Industry type and firm size are used to determine possible mediating effects on the relationship between IC and SME performance. Several hypotheses are tested using the Confidentialised Unit Record File (CURF) database from the Australian Bureau of Statistics (ABS), Business Longitudinal Database (BLD) (2011). The study makes a contribution to the literature and SME managers by identifying IC practices that are best predictors of SME performance, with possible implications for SMEs to consider when developing their strategy for their organisation.

## LITERATURE REVIEW

We review the literature with the aim of identifying key constructs and variables to include in our theoretical model, within which we formulate and test hypotheses. Our paper is guided by an article by Wang and Chang (2005) in the high-tech industry, however we use a different methodology, and the ABS the Confidentialised Unit Record File (CURF) database. Our theoretical foundation is based on the Resource Based View of (RBV) and the Knowledge-based views of the firm.

### Resource Based View (RBV)

Penrose (1959) developed the theoretical foundation of the resources based-view (RBV) of the firm, which was further enhanced by Wernerfelt (1984), and later was strengthened by Barney (1991). The theory developed by Penrose (1959) is based on the development of resources such as skills and capabilities that would contribute to competitive advantage (Wernerfelt, 1984). Later, Barney (1991) stressed the core principles of the RBV that relate to value, rareness, inimitable and not substitutable (VRIN) resources. Resources can be defined as any tangible or intangible asset (Wernerfelt, 1984). Hence, it is reasonable to argue that knowledge is the most important package of intangible resources (Hitt, Ireland and Hoskisson 2010; McEvily and Chakravarthy 2002). However, the major problem that SMEs are faced with, as discussed earlier, is lack of resources for innovation. According to Kim, Knotts and Jones (2008) SMEs' survival depends on how they manage their limited assets.

SMEs need to create opportunities to obtain these resources through collaboration with other firms (Hadjimanolis 2000). In addition to the RBV of the firm, we draw on knowledge and its management theories in relation to firm performance. (Eisenhardt and Schoonhoven 1996). We also draw on literature that integrates on the RBV and knowledge management in the context of intellectual capital (Herremans et al. 2011; Kristandl and Bontis 2007; Kamukama et al. 2011; Kianto et al. 2013; Leitner 2011). Lerro et al. (2014) Argue that the RBV is one of the main theories that is often used to explain the link between resources and innovation. Therefore, this study applies the RBV as the dominant theory that assumes intangible assets are more likely to lead to SME performance improvement.

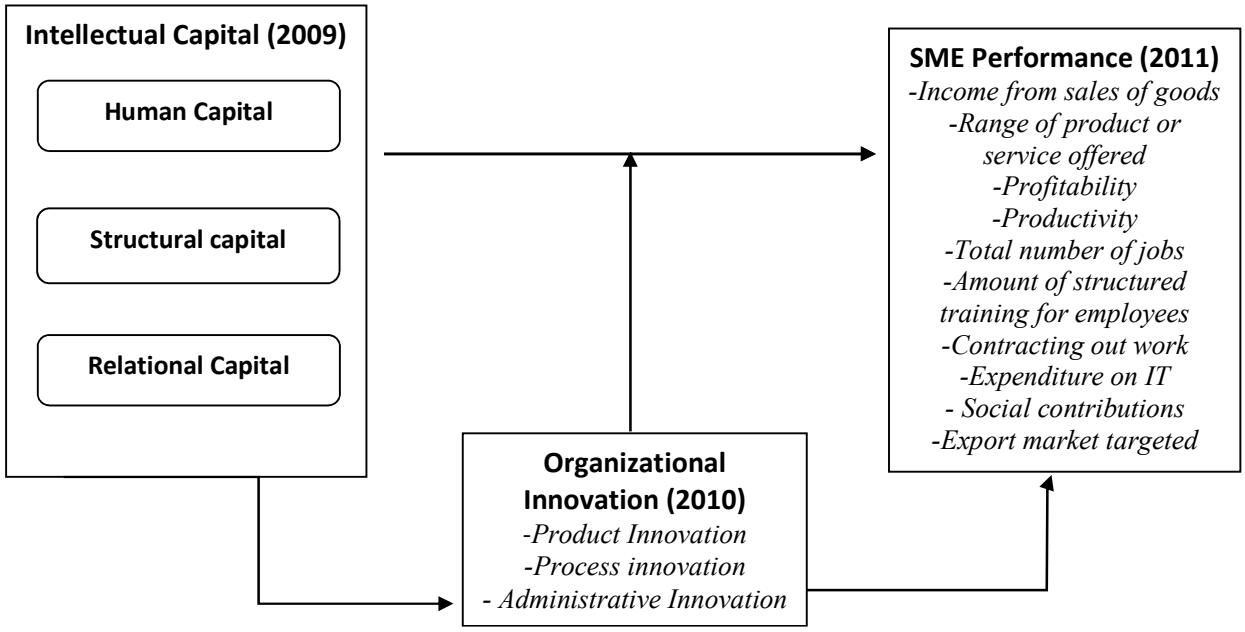
**Intellectual Capital (IC) Definition and Classification**

There are many definition of IC in the literature. For example, IC is defined in terms of soft assets such as knowledge and expertise (Klein Crawford and Alchian 1978). Stewart (1991) clarifies the definitions by defining IC as an intangible asset that can create wealth to the firm. Another definition of intellectual capital is based on the assumption that firms operate through a combination of intangible assets (Brooking 1996). There is a general agreement in the literature that the IC construct consists of human capital (HC), structural capital (SC) and relational capital (RC) (e.g. Bontis 1999; Edvinsson and Sullivan 1996; Kim and Kumar 2009; Mouritsen, Larsen and Bukh 2001; Zerenler, Hasiloglu and Sezgin 2008). Consequently, this study adopts HC, SC and RC dimensions as part of the IC construct. In the following section, we define HC, SC and RC.

**Research Model and Hypotheses**

In this section, we develop a theoretical model based on the integrated IC construct discussed earlier and its relationship with SME performance, and the mediating effects of OI. The RBV of the firm is used in the following section to explain the relationship between IC and SME Performance (Mortise 1998).

**Figure 1: Conceptual Framework**




**Development of Hypotheses**

In this section, we discuss each construct of the theoretical model with the aim of formulating hypotheses. There are several studies in the literature, which focus on the link between IC and firm performance. However, contradictions have emerged. For example, Bollen, Vergauwen and Schnieders (2005) found that HC, SC and RC do not have a significant relationship with firm performance in the German pharmaceutical industry. On the other hand, Sharabati, Jawad and Bontis (2010), based on their study in the pharmaceutical industry in Jordan; found that HC, SC and RC have a positive and significant relationship with firm performance.

Similar contradictions were found on the relationship between IC and innovation. For example, Chen Lin and Chang (2006) found that HC, SC and RC have a significant relationship with product innovation in high-tech SMEs in Taiwan. However, a study by Hsu and Fang, (2009) in Taiwan found that only HC and RC have a significant relationship with product innovation. Given the above contradictions, further research is warranted to analyse the relationship between IC and SME Performance while controlling for organisational innovation, industry type and firm size.

*Human capital, organizational innovation and SME performance*

Previous research suggests that human capital traits (education, experience, and skills) affect firm outcomes (Finkelstein, Hambrick and Cannella 2009; Huselid 1995; Wright, Smart and McMahan 1995). For example, a Canadian study in the manufacturing industry found a significant relationship between knowledge asset (possessed by employees) and firm performance (Thornhill 2006). Hitt et al. (2001) based on a study of professional service firms, concluded that human capital contributes to better firm performance. However, a review by Newbert (2007) reported that the human capital–performance relationship is still unclear when only 33 percent of the respondents supported the notion that human capital is significantly related to firm performance (Newbert 2007). There are several studies in the literature that did not find a significant relationship between HC and firm performance (Wang and Chang 2005; Bollen et al. 2005). Based on the above literature synthesis, research appears to be inconsistent in supporting the relationship between HC and SME performance. This leads to the formulation of hypothesis H1.

***Hypothesis 1 (H1):*** *Human Capital has a positive and significant relationship with SME Performance.*

Several scholars have suggested that studies should include mediating variables between resources and performance link in order to detect explanatory power from another source other than the independent variable. In other words, the independent variable may have an effect on the mediating variable which in turn would have an effect on the dependent variable. There are many mediating factors that might influence the HC-performance relationship. However, organisational innovation is often claimed to be a strong characteristic of SME culture. Therefore, we expect OI to have a positive effect on the HC-SME Performance relationship (Crook et al. 2011; Ray et al. 2004).

***Hypothesis 2 (H2):*** *Organizational Innovation mediates the relationship between Human Capital and SME Performance.*

*Structural capital, organizational innovation and SME performance*

According to Persaud (2001), information technology is an enabler of external knowledge. For example, Bontis, Keow and Richardson (2000) in their empirical study found that structural capital (SC) influenced organizational performance in all sectors. However, a study by Huang and Liu (2005) in large Taiwanese firms found that IT capital did not have a significant impact on firm performance. This finding is similar to research findings by Johannessen, Olaisen and Olsen (1999) who found that investment in IT does not necessarily influence firm performance. On the other hand, a study by Dibrell, Davis and Craig, (2008) found that IT mediated the relationship between innovation and firm performance. The study concluded that SMEs with strong innovation practice are likely to facilitate utilisation of IT in their firm. Assuming that structural capital will allow firms to capture new ideas, our third and fourth hypotheses state:

***Hypothesis 3 (H3):*** *Structural Capital has a positive and significant relationship with SME Performance.*

***Hypothesis 4 (H4):*** *Organizational Innovation mediates the relationship between Structural Capital and Firm Performance.*

*Relational capital, organizational innovation and SME performance*

Research on learning in alliances (Hamel, Doz and Prahalad 1989), strategic supplier networks (Dyer and Singh 1998; Jarillo 1988) and network resources (Gulati 1999), have examined the importance of inter firm relationships from a theoretical viewpoint. Bougrain and Haudeville (2002) studied the relationship between collaboration activities and SMEs internal research capacities and found that over time, SMEs need to depend on external collaboration. Asakawa, Nakamura and Sawada, (2010) found that the effects of collaboration on performance in large high tech firms depended on the R&D activities. A well-established collaborative arrangement between supply chain parties would improve firm performance (Cao and Zhang 2011). However, Rosenbusch, Brinckmann and Bausch (2011) challenge the finding that collaboration with external partners tends to have a positive effect on SME performance. On the other hand, there are several studies in the literature that acknowledge the

relationship between collaboration and innovation. For example, Cooke and Wills (1999), Nieto and Santamaría (2010) and Zeng, Xie and Tam (2010) found that collaboration in SMEs plays an important role in generating innovation. Therefore, our fifth and sixth hypotheses state:

> ***Hypothesis 5 (H5):*** *Relational Capital has a positive and significant relationship with SME Performance.*
>
> ***Hypothesis 6 (H6):*** *Organizational Innovation mediates the relationship between Relational Capital and SME Performance.*

## RESEARCH METHOD

### Data Collection – Business Longitudinal Database

The recently released Confidentialised Unit Record File (CURF) database from the Australian Bureau of Statistics (ABS), Business Longitudinal Database (BLD) (2011) was used to test the hypotheses. The database comprises three independent Panels (samples) of small and medium size businesses that are designated as Panel 1, 2 and 3. The database contains a longitudinal data that covers 5 years for each panel. Each panel is directly surveyed once a year. For the purposes of this research, Panel 3 is used, which has the most recent data (2007 until 2011). The data set consists of 3,075 businesses stratified by business type and company size in accordance with ASIC[1] (refer to Appendix 1). The data set has a one-year lag on the impact of the IC elements (HC, SC and RC) (2009) on organizational innovation (2010), and a two-year lag on SME performance (2011) (Gronum, Verreynne and Kastelle 2012; Subramaniam and Youndt 2005). Data collection in the BLD was done through self-administrated, structured questionnaires, mostly using closed questions. The major strength of this dataset is the full coverage of Australian SMEs and high response rate (>90%) (Sawang and Matthews 2010).

[1] Australian and New Zealand Standard Industrial Classification

**Sample Selection**

Firms with less than 200 employees were chosen for the research. Businesses matching the following criteria were removed from the database: (i) Non-employing companies were removed and (ii) Variables with missing data. Based on these criteria, 2,154 SMEs were selected for this study from the total of 3,075 firms in BLD Panel 3. From a sample of 2,154 SMEs selected, 35 percent were from the service industry, 27 percent from primary industry, 19 percent from manufacturing, 14 percent from logistics, and 14 percent from the retail industry. The sample was made up of 24 percent micro firms (1-4 employees), 32 percent are small firms (5-19 employees), and 31 percent of the sample is from medium size firms (20-199 employees).

**Measures of the Variables**

The relationship between IC and SME performance has been analysed in the literature using two methods: Value Added Intellectual Coefficient (VAIC) and subjective measures. VAIC is based on the accurate information of IC. However, Maditinos, Chatzoudes, Tsairidis and Theriou (2011) suggest that the VAIC methodology produces inconsistent results and raises questions on its effectiveness.

Subjective measures depend on manager's perceptions of IC and SME performance (e.g. Venkatraman and Ramanujam 1986). The measurement of human, structural and relational capital will use subjective measures. Most variables in the BLD data base were categorical. Therefore, all the items in each construct had to be calculated (Refer to Appendix 1 for the items in the questionnaire and the items in each construct).

## ANALYSIS AND RESULTS

Statistical analysis of the data was undertaken using SPSS (Statistical Package for Social Sciences). We also conducted multiple regression analysis (MRA) to test the six hypotheses articulated in this paper (Hair, Money, Samouel and Page 2007). Hierarchical multiple regressions analysis (HMRA) is used to test the mediating effects of organisational innovation Sequences of three regression analyses

were conducted (Imai et al. 2010). In order to confirm the mediation exist in the model, Sobel test was used. (Chen and Huang 2009; James and Brett 1984; Tang and Murphy 2012).

**Results of the Study**

Correlation coefficients as well as means and standard deviations of the variables are displayed in Table 1. SME performance and organizational innovation are positively associated with all independent variables; HC, SC and RC. Human capital is positively correlated with SC and RC, but SC is not correlated with RC. HMRA was used to test the hypothesized relationships between IC, OI, and SME performance. There was no evidence of multicollinearity in the data, with all univariate correlations below 0.8 and all VIF value below 10. With reference to Table 2, 22 percent of the variance can be attributed to IC and organizational innovation. While the adjusted $R^2$ for IC alone is 16 percent, many factors influence SME performance, therefore, low adjusted $R^2$ are almost inevitable in a study such as this and should be addressed in subsequent research. Hypothesis 1, which proposed that human capital ($\beta = 0.13$, $p < 0.05$) is positive and significantly associated with SME performance was supported. The relationship between human capital ($\beta = 0.06$, $p > 0.05$) and SME performance became insignificant when the relationship was mediated for OI, which leads to the support of Hypothesis 2.

The relationship between structural capital ($\beta = 0.20$, $p < 0.001$), and SME performance was positive and significant. The relationship between structural capital ($\beta = 0.15$, $p < 0.01$) and SME performance remained significant when the relationship was mediated for OI. This supports the hypothesized mediating effects of organizational innovation in Hypothesis 4. Relational capital ($\beta = 0.12$, $p < 0.05$), was found to have a positive and significant relationship with SME performance, leading to the support of Hypothesis 5. The relationship became insignificant when it was mediated with OI mediation effects for organizational innovation. This led to the support of Hypothesis 6. The results of the Sobel test for human capital ($Z = 3.22$, $p = 0.001$), structural capital ($Z = 2.60$, $p < 0.01$) and relational capital ($Z = 3.32$, $p < 0.001$) indicate significant mediating effects of organizational innovation. The results of the three steps of regression analysis are presented in Appendix 2.

Wilcoxon Signed Rank test was applied further to analyse possible differences between the relationships of the three types of intellectual capital-HC, SC and RC and SME performance. Table 3 shows the results for human capital (*Mdn* =1.00), $Z$ = -4.46, $p < 0.001$, $n$ =326; structural capital (*Mdn* =1.00), Z = -7.69, $p < 0.001$, $n$ =320; and relational capital (*Mdn* = 0.00), $Z$ = -22.51, $p < 0.001$, $n$ =1466. These findings provide support that HC is the most important element of IC among the three intellectual capital constructs in Australian SMEs, followed by SC, with RC was found to have a weaker relationship with SME performance.

## DISCUSSION

The purpose of this section is to discuss the major findings and to summarise the results. The direct outcome of human capital on SMEs performance is positive and significant although the outcome shows a low significance. Our results show that IC led to 22 percent of the variance in SME performance. While the adjusted $R^2$ for IC alone is 16 percent, many factors influence SME performance, therefore, low adjusted $R^2$ are almost inevitable in a study such as this and should be addressed in subsequent research. This is consistent with Clarke, Seng and Whiting (2011). Hsu and Wang (2012), Carmeli (2004) and Bontis (1998) also found a positive and significant relationship between HC and firm performance. The results support the notion that SME managers should invest in human capital to achieve better SME performance.

The results indicate that RC has a significant but weak relationship with SMEs performance. This finding is similar with findings by Chen et al. (2006) and Hsu and Fang (2009). Impediments such as lack of knowledge on networking and collaboration may prevent SMEs from taking advantage of relational capital. These obstacles exist because SMEs normally are unconscious of the help that they could receive from various sources externally, such as industry associations and government departments (Lambrecht and Pirnay 2005). Therefore, developing external knowledge and engaging in more networking would help SMEs to develop intellectual capital (Smallbone, North and Leigh, 1993). The results show that OI mediates the HC and RC-SME performance relationship. The results show that HC and RC support innovation, which in turn supports SMEs performance. However,

firms need to retain knowledge and skilled employees in the organization in order to develop an innovation culture. Employees with higher skills and knowledge are likely to be more creative in generating new ideas, leading to improved performance. This finding is supported by organizational learning theory (Nonaka and Takeuchi 1995), which postulates that the creation of knowledge sharing and/or knowledge transfer within an organization establishes the basis for sustained competitive advantage.

Our findings are consistent with Zeng et al. (2010), Nieto and Santamaría (2010) and Chen et al. (2006), who found that collaboration has the most significant and positive impact on the creation of an innovation culture. This is an important finding due to its strategic implications. That is, relational capital must be involved in research and development activities, which is likely to lead to improved performance. Our research findings also show that, SC has the strongest significant relationship with SME performance. This finding is consistent with Tovstiga and Tulugurova (2007), Jardón and Martos (2009) and Chen et al. (2006), who found that the SC- SME performance relationship is positive and significant. Therefore, SC has a greater effect on SMEs performance than HC and RC ($\beta = 0.195 > \beta = 0.125 > \beta = 0.115$). This result indicates that SME's effort to codify organisational knowledge through SC is likely to lead to sustainable competitive advantage (Orlikowski, 2000). On the other hand, we also found that OI mediates the relationship between SC and SME performance. The result supports the mediating role of OI on the relationship between IC and SME performance (Aramburu and Sáenz, 2011; Chen et al. 2006).

Table 2 shows RC has a significant and positive relationship with SME performance; and Table 3 shows that, the least significant relationship among the three components of the IC construct is RC. The results indicate that SME managers have difficulties in trusting their relationships with external parties when it comes to collaboration. Previous studies confirm that managers rely on partners from personal networks, with whom trust is established (Shrader 2001). Trust in a network will not only resolve conflicts, but also improve communication and synchronization between network members (Schulz 2001). Results in Table 3 show that managers need to organize and integrate their firm's activities internally and externally.

The key question is how efficient and effective synchronization of the three IC dimensions (Teece, Pisano and Shuen1997). The results from this research are well connected with the RBV of the firm that proposed the presence of assets and capabilities that are unique would contribute towards value creation (Barney, 1991). Therefore, it is vital for Australian SMEs to simultaneously exploit all three components of IC in order to improve SME performance. Finally, our results show that firm size and industry type do not add to the explanatory power of IC on SME performance.

## CONCLUSIONS AND IMPLICATIONS

With respect to the research questions, we conclude that HC, SC and RC have a positive and significant relationship with SME performance when mediated by organizational innovation. Our results show that human capital is a significant contributor towards SME's performance through organisational innovation. According to organizational learning theory, what is learned and practiced is kept and leads to firm performance improvement.

Therefore, a well-designed employee training and development system is likely to enhance employee's skills and knowledge. Based on our results we conclude that having knowledgeable, experienced and skilled workers, which engage in job sharing and flexible working hours, can contribute to SME performance improvement. SME managers are confronted with significant competitive barriers from low cost producing countries. Our results show that structural capital coupled with a focus on the creation of an innovation culture seems to make a significant contribution to SME performance.

The implication for managers is that IT software, hardware, and equipment should be replaced or a regular basis in order to overcome cost barriers of doing business. We further conclude that relational capital is important for overcoming performance barriers through innovation. Collaboration provides SMEs with better access to knowledge which would improve their relationship with customers, suppliers, universities and competitors.

This study has shed some new light called for by the literature (e.g. Hsu and Wang 2012; Tseng and Goo 2005; Hsu and Fang 2009; Chen et al. 2006; Mention and Bontis 2013) which recommended that

IC should be conducted using time lag since the impact of intangible asset needs more time to develop in order to observe the impact on SME performance.

**Table 1 Descriptive Statistics and Spearman's rho Correlation Coefficients**

| | Variables | Mean | Std. Deviation | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Industry : Manufacturing | 0.19 | 0.39 | 1 | | | | | | | | | |
| 2 | Industry : Logistic | 0.14 | 0.34 | -0.19** | 1 | | | | | | | | |
| 3 | Industry: Retail | 0.05 | 0.22 | -0.11** | -0.09** | 1 | | | | | | | |
| 4 | Industry : Services | 0.36 | 0.48 | -0.36** | -0.30** | -0.17** | 1 | | | | | | |
| 5 | Size: Medium Firm | 0.31 | 0.46 | 0.00 | 0.01 | -0.02 | 0.01 | 1 | | | | | |
| 6 | Size : Small Firm | 0.32 | 0.47 | -0.01 | -0.00 | 0.01 | -0.01 | -0.46** | 1 | | | | |
| 7 | Human Capital (2009) | 1.31 | 1.41 | 0.01 | 0.02 | 0.01 | 0.04 | 0.06* | 0.06* | 1 | | | |
| 8 | Structural Capital-IT Investment (2009) | 1.13 | 1.34 | 0.15** | 0.03 | -0.06 | -0.05 | 0.03 | -0.04 | 0.22** | 1 | | |
| 9 | Relational Capital-Collaboration(2009) | 0.30 | 0.74 | -0.04 | 0.04 | -0.02 | 0.02 | 0.08** | 0.03 | 0.20** | 0.03 | 1 | |
| 10 | Organizational Innovation(2010) | 0.83 | 1.49 | 0.06* | 0.05 | 0.03 | 0.03 | 0.12** | -0.02 | 0.27** | 0.18** | 0.23** | 1 |
| 11 | Firm Performance(2011) | 13.93 | 5.81 | 0.03 | 0.07** | 0.01 | 0.04 | 0.20** | -0.01 | 0.29** | 0.22** | 0.21** | 0.36** |

Industry: Primary is the baseline industry variable
Firm size: Micro firm (0-4 employees) is the baseline size variable
N = 2,154
*$p$< 0.05, **$p$< 0.01, ***$p$< 0.001, two-tailed.

**Table 2 Hierarchical Regression Analysis: Intellectual Capital (2009) and Organizational Innovation (2010) on Firm Performance (2011)**

| | SME Performance (2011) | | Sobel Test |
|---|---|---|---|
| | Non-mediated | Mediated | z score |
| **Control Variables** | | | |
| Industry : Manufacturing | 0.10 | 0.06 | |
| Industry : Logistic | 0.18** | 0.14* | |
| Industry : Retail | 0.02 | 0.02 | |
| Industry : Services | 0.12* | 0.10 | |
| Medium Firm | 0.23** | 0.20** | |
| Small Firm | 0.13* | 0.12 | |
| **Intellectual Capital** | | | |
| Human Capital (2007) | 0.13* | 0.06 | 3.22*** |
| Structural Capital- IT and Hardware (2007) | 0.20*** | 0.15** | 2.60** |
| Relational Capital- Collaboration (2007) | 0.12* | 0.05 | 3.32*** |
| Organizational Innovation (2010) | - | 0.29*** | |
| **R square** | 0.18 | 0.24 | |
| **R² Adjusted** | 0.16 | 0.22 | |
| **R² Δ** | 0.08 | 0.03 | |
| **F-value** | 7.51*** | 9.87*** | |
| **Max VIF** | 1.62 | 1.63 | |

Industry: Primary is the baseline industry variable
Firm size: Micro firm (0-4 employees) is the baseline size variable
N = 2,154
*$p$< 0.05, **$p$< 0.01, ***$p$< 0.001, two-tailed.

**Table 3 Wilcoxon Signed Rank test Human Capital, Structural Capital and Relational Capital.**

| | N | Median | A-B | B-C | C-A |
|---|---|---|---|---|---|
| **Variables** | | | ***Z*** | ***Z*** | ***Z*** |
| Human Capital (2009) (A) | 326 | 1.000 | -4.46*** | | |
| Structural Capital- Invest IT (2009)(B) | 320 | 1.000 | | -7.69*** | |
| Relational Capital- Collaboration(2009) (C) | 1466 | 0.000 | | | -22.51*** |

Missing value excluded cases test-by-test

*$p$< 0.05, **$p$< 0.01, ***$p$< 0.001, two-tail

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## Appendix 1: Items in BLD Questionnaires

**Firm Profile**

| | |
|---|---|
| Industry division 2006 (ANZSIC06) | 1 - Agriculture, Forestry and Fishing |
| | 2 - Mining |
| | 3 - Manufacturing |
| | 5 - Construction |
| | 6 - Wholesale Trade |
| | 7 - Retail Trade |
| | 8 - Accommodation and Food Services |
| | 9 - Transport, Postal and Warehousing |
| | 10 - Information Media and Telecommunications |
| | 12 - Rental, Hiring and Real Estate Services |
| | 13 - Professional, Scientific and Technical Services |
| | 14 - Administrative and Support Services |
| | 18 - Arts and Recreation Services |
| | 19 - Other Services |
| Size (based on Derived Size Benchmark employment) | 1 = DSB 0 to less than 5 |
| | 2 = DSB 5 to less than 20 |
| | 3 = DSB 20 to less than 200 |

**Item in HUMAN CAPITAL (7 items)**

*Flexible work arrangements (tick all that apply)*

| | |
|---|---|
| 1. Flexible work hours | 0 = No |
| | 1 = Yes |
| 2. Job sharing | 0 = No |
| | 1 = Yes |

*Factors significantly hampering innovation (Tick all that apply)*

| | |
|---|---|
| 3. Lack of skilled persons within the business | 0 = No |
| | 1 = Yes |
| 4. Lack of skilled persons within the labour market | 0 = No |
| | 1 = Yes |
| 5. Lack of access to knowledge or technology | 0 = No |
| | 1 = Yes |

*Factors significantly hampering other business activities or performance (Tick all that apply)*

| | |
|---|---|
| 6. Lack of skilled persons within the business | 0 = No |
| | 1 = Yes |
| 7. Lack of skilled persons within the labour market | 0 = No |
| | 1 = Yes |

**Item in STRUCTRAL CAPITAL (7 items)**

*Reason for seeking finance (Tick all that apply)*

| | |
|---|---|
| 1. Replacement of IT hardware | 0 = No |
| | 1 = Yes |
| 2. Replacement of other equipment or machinery | 0 = No |
| | 1 = Yes |
| 3. Upgrade of IT hardware | 0 = No |

| | |
|---|---|
| | 1 = Yes |
| 4. Upgrade of other equipment or machinery | 0 = No |
| | 1 = Yes |
| 5. Purchase of additional IT hardware or software | 0 = No |
| | 1 = Yes |
| 6. Purchase of additional other equipment or machinery | 0 = No |
| | 1 = Yes |
| 7. Purchase of additional assets not related to expansion | 0 = No |
| | 1 = Yes |

**Item in RELATIONAL CAPITAL (6 items)**

*Cooperative ("collaborative" from 2007-08 onwards) arrangements (Tick all that apply)*

| | |
|---|---|
| 1. Joint research and development | 0 = No |
| | 1 = Yes |
| 2. Joint buying | 0 = No |
| | 1 = Yes |
| 3. Joint manufacturing ("Production of goods or services") | 0 = No |
| | 1 = Yes |
| 4. Integrated supply chain | 0 = No |
| | 1 = Yes |
| 5. Joint marketing or distribution | 0 = No |
| | 1 = Yes |
| 6. Other cooperative arrangements | 0 = No |
| | 1 = Yes |

**Item in ORGANIZATIONAL INNOVATION (11 items)**

*Business introduced any new or significantly improved (Tick all that apply)*

| | |
|---|---|
| 1. Goods | 0 = No |
| | 1 = Yes |
| 2. Services | 0 = No |
| | 1 = Yes |

*Operational processes (Tick all that apply)*

| | |
|---|---|
| 3. Methods of manufacturing or producing goods or services | 0 = No |
| | 1 = Yes |
| 4. Logistics, delivery or distribution methods for goods and services | 0 = No |
| | 1 = Yes |
| 5. Supporting activities for business operations | 0 = No |
| | 1 = Yes |
| 6. Other operational processes | 0 = No |
| | 1 = Yes |

*Organisational/managerial processes (Tick all that apply)*

| | |
|---|---|
| 7. Knowledge management processes | 0 = No |
| | 1 = Yes |
| 8. New business practices for organising procedures | 0 = No |
| | 1 = Yes |
| 9. New methods of organising work responsibilities and decision making | 0 = No |
| | 1 = Yes |
| 10. Significant changes in relations with others | 0 = No |

| | |
|---|---|
| | 1 = Yes |
| 11. Other organisational/ managerial processes (2008-09 onwards) | 0 = No<br>1 = Yes |

**Item in FIRM PERFORMANCE (10 items)**

*Compared to the previous year, (Tick one box per row)*

| | |
|---|---|
| 1. Income from the sales of goods or services | 0 = Not applicable<br>1 = Decreased<br>2 = Stayed the same<br>3 = Increased |
| 2. Range of products or services offered | 0 = Not applicable<br>1 = Decreased<br>2 = Stayed the same<br>3 = Increased |
| 3. Profitability | 0 = Not applicable<br>1 = Decreased<br>2 = Stayed the same<br>3 = Increased |
| 4. Productivity | 0 = Not applicable<br>1 = Decreased<br>2 = Stayed the same<br>3 = Increased |
| 5. Total number of jobs or positions | 0 = Not applicable<br>1 = Decreased<br>2 = Stayed the same<br>3 = Increased |
| 6. Export markets targeted | 0 = Not applicable<br>1 = Decreased<br>2 = Stayed the same<br>3 = Increased |
| 7. Contracting out work/activities or outsourcing | 0 = Not applicable<br>1 = Decreased<br>2 = Stayed the same<br>3 = Increased |
| 8. Amount of structured/formal training for employees | 0 = Not applicable<br>1 = Decreased<br>2 = Stayed the same<br>3 = Increased |
| 9. Expenditure on IT | 0 = Not applicable<br>1 = Decreased<br>2 = Stayed the same<br>3 = Increased |
| 10. Social contributions | 0 = Not applicable<br>1 = Decreased<br>2 = Stayed the same<br>3 = Increased |

**Items in each Construct**

a. **Human Capital** - The items that measure human capital are: (1) flexible work hours; (2) job sharing; lack of skilled person within the business (3) for innovation and (4) performance; lack of skilled person within the market (5) for innovation and (6) performance; (7) lack of access to knowledge. Cumulative total of seven items representing both range and intensity.

b. **Structural Capital** - Seven items pertaining to structural capital were adapted in terms of investment in Information and Communication Technology (ICT). There are : (1) replacement of IT hardware; (2) replacement of other equipment or machinery; (3) upgrade of IT hardware; (4) upgrade of other equipment or machinery; (5) purchase of additional IT hardware or software; (6) purchase of additional other equipment or machinery and (7) purchase of additional assets not related to expansion.

c. **Relational Capital** - Six items were adapted to measure relational capital (heterogeneity): (1) joint R&D; (2) joint buying; (3) joint manufacturing; (4) integrated supply chain; (5) joint marketing/distribution and (6) other cooperative agreement.

d. **SME Performance** - Sveiby (1997) proposed that stronger IC is more likely to contribute to non-financial performance. Considering the view, further research is required to address how IC and OI simultaneously affect SME performance. SME performance is represented by ten items: (1) sales growth; (2) range of product; (3) range of product service growth; (4) profitability; (5) productivity;

(6) growth in total number of jobs; (7) amount of structured training for employees; (8) social contributions; (9) export market targeted and (10) contracting out work and expenditure on IT.

e. **Organizational Innovation (OI)** - OI in this research has three dimensions namely product, process and administrative innovations (Yamin et al. 1997). Eleven items taken from BLD are used to measure organizational innovation. The items are (1) new products; (2) new services; (3) new methods of manufacturing; (4) new distribution methods; (5) supporting activities for business operations; (6) other operational processes; (7) new knowledge management processes; (8) new business practices for organizing procedures; (9) new methods of organizing work responsibilities and decision making; (10) significant changes in relational with others and (11) other managerial processes.

f. **Firm Size** - is measured in terms of the number of employees in the firm. Two dummy variables represent the effects of three different firm sizes: small and medium size firms. Micro firm (0-4 employees) is the baseline for firm size. Firm size is most widely discussed concerning its impact on innovation (Balasubramanian and Lee 2008).

g. **Industry Type** - According to Kujansivu and Lönnqvist (2007), intellectual capital efficiency varies between the types of industry. Four dummy variables symbolize the five different industries, which act as the baseline. The observation variable is coded '1' while other variables will be coded '0'.

**Appendix 2: Hierarchical Regression Analysis: Intellectual Capital (2009) and Organizational Innovation (2010) on Firm Performance (2011)**

| | FIRM PERFORMANCE | | | |
|---|---|---|---|---|
| | **Control** | | | |
| **Control Variables** | | | | |
| Industry : Manufacturing | 0.15* | 0.10 | 0.06* | 0.06 |
| Industry : Logistic | 0.20** | 0.18** | 0.09** | 0.14* |
| Industry : Retail | -0.01 | 0.02 | 0.03 | 0.02 |
| Industry : Services | 0.13* | 0.12* | 0.08** | 0.10 |
| Medium Firm | 0.26*** | 0.23** | 0.20*** | 0.20** |
| Small Firm | 0.16* | 0.13* | 0.09** | 0.12 |
| **Intellectual Capital** | | | | |
| Human Capital | | 0.13* | | 0.06 |
| Structural Capital- IT and Hardware | | 0.20*** | | 0.15** |
| Relational Capital- Collaboration | | 0.12* | | 0.05 |
| Organizational Innovation | | - | 0.32*** | 0.29*** |
| **R square** | 0.10 | 0.18 | 0.17 | 0.24 |
| **R² Adjusted** | 0.08 | 0.16 | 0.16 | 0.22 |
| **R² Δ** | | 0.08 | 0.10 | 0.03 |
| **F-value** | 5.70*** | 7.51*** | 42.02*** | 9.87*** |
| **Max VIF** | | 1.62 | 1.48 | 1.63 |

Industry : Primary is the baseline industry variable
Firm size: Micro firm (0-4 employees) is the baseline size variable
N = 2,154
*$p$< 0.05, **$p$< 0.01, ***$p$< 0.001, two-tailed.