Intellectual capital and its impact on firm's performance

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Abstract

Intellectual Capital (IC) has been identified as one of the most important factors in driving economic growth. Rapid globalization characterized by advances in technology, research and development and increasing competition has been essentially driven by growth in IC. The purpose of this work is to study how components of intellectual capital affect business results. The study derived a measurement model from three streams of literature (absorptive capability, intellectual capital and dynamic capabilities). The analysis is conducted on the large Global Manufacturing Research Group database (GMRG) V taken place in 2012, comprising 1089 companies. The proposed model is proven robust. All four components of IC positively affect business results, they are highly correlated, but the highest influence shows the external social capital component. This result shows the importance of developing good relationships with external partners, but in order to do so the other three components of IC are also important.

Keywords: Intellectual capital, business performance, GMRG 2012 survey

JEL code: L2, L6, M11, O3

Introduction

Competitiveness through ability to learn by its employees is researched in several different streams of literature. Macher and Mowery (2009); Ellonen et al (2011) and Pavlou and El Sawy (2011) this ability call dynamic capability. Other streams of literature explaining innovation and business performance are the Absorptive capability stream that started with work of Cohen and Levinthal (1990) and Intellectual capital literature that started with work of Bontis (1998). However, our literature research showed great overlapping of measurement instruments in all three streams of literature. So, our first research goal is to provide a sound and tested measurement instrument that could measure this ability to learn, which we will call Intellectual capital, because in all three streams of literature the work of Subramaniam and Youndt (2005) is mentioned, and they termed that ability to stay competitive – intellectual capital.

IC is the sum of hidden resources of any organization not being fully reflected in the accounting statements (Harsh and Tandon, 2015). According to Teece (2000, 2011) competitive advantage of companies stems not from market position, but from difficult to replicate knowledge assets and the manner in which they are deployed. The essence of a firm resides than in its ability to create, transfer, assemble, integrate and exploit knowledge assets. Bueno et al. (2004) describe the evolution of the concept of intellectual capital and presents it as a four component model (Internal social capital, Structural capital, Human capital and External social capital).

Our research question is how each component of intellectual capital (human capital, structural capital and social capital) affects business performance.

The large database from Global Manufacturing Research Group (GMRG) V is used. The data was collected in 2012. The database consists of 1089 companies from 16 countries. Structural equation modelling for analysis is used in order to assess complex relationships among constructs. Even though we performed all the standard tests and obtained a good model fit, the majority of the paper is concentrated around explaining the variables that entered the model, that is, to contribute to calls of Pisano (2015), Knoppen et al. (2015), and Mariano and Walter (2015) and Aribi and Dupouët (2015) to empirically test a measurement instrument that is derived from components of these three different streams of literature, yet showing significant overlapping.

This work tries to reconcile divergent literature streams in a concise, testable measurement model and as such represents a contribution to the existing theory on the subject. That is possible because GMRG research instrument is extensive and covers data from demographic data, innovation, organizational culture, supply chain management and sustainability.

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Second contribution is in the fact that large GMRG database is used, comprised of developed and developing countries, in fast and slow industries that could contribute to more generalizable results. So far, the majority of research is conducted in hyper competitive environments, lacking insights from the majority of manufacturing that is not in such hyper space. The results present a very good model fit explaining the role of innovation investment, supply chain leveraging and intellectual capital and its effects on business results.

This work is organized as follows: first, Intellectual capital components are described and hypotheses are proposed. Then follows the methodology and results and the article ends with conclusion.

Literature research

Intellectual capital

Absorptive capital by Cohen and Levinthal (1990, p. 128) "is an ability to recognize the value of new information, to assimilate it, and apply it to commercial ends". This is in line with Teece's (2014) definition of dynamic capabilities. Teece (2014) divided dynamic capabilities into: (1) sensing opportunities from the market, (2) seizing, that is, mobilizing resources to address opportunities (asset orchestration) and (3) continued renewal – transforming (learning and reconfiguration). These dynamic capabilities Simon (2010) calls organizational culture, but many of the variables for measuring organizational culture are from Subramaniam and Youndt (2005). Subramaniam and Youndt (2005), however, call their constructs Intellectual capital and show that this intellectual capital presents a competitive advantage.

Until Aribi and Dupouët (2015) there was no work that compared innovation from absorptive capability (AC) and intellectual capital (IC) approaches. Both approaches (AC and IC) suffer from lack of unified measurement instrument. For example, Knoppen et al. (2015), and Mariano and Walter (2015) on grounds of thorough literature research, explicitly show that there is still no measurement model for absorptive capacity. Our literature research showed great inconsistency in intellectual capital research, both in terms of naming components as well as the number of components.

Aribi and Dupouët (2015), being the most recent authors investigating IC define IC as: "the sum of all knowledge firms utilize for competitive advantage" (Subramaniam and Youndt, 2005, p. 450) and includes three distinct dimensions:

1. the human capital, that is, the knowledge possessed at the individual level;
2. the organizational capital that lies in the structure and formal rules of firms, knowledge databases, patents..; and
3. social capital that represents informal networks of interrelationships and the knowledge that can be accessed through these (Subramaniam and Youndt, 2005; Youndt et al., 2004).

Since, new knowledge can be built only on already possessed knowledge by means of practice and communication, Aribi and Dupouët (2015), as in the AC field, define IC as a dynamic capability. They do not provide a measurement model rather they use three case studies to show overlapping of AC and IC.

Human capital

Human capital is rooted in a certain way in the talent of employees. Human capital consists of components such as knowledge, expertise, skills, experience and competence (Sydler et al., 2014). According to Snell and Dean (1992); Subramaniam and Youndt (2005) and Lee et al. (2011) human capital will be greater if: there are highly skilled employees, employees have great knowledge and are considered as best people in the organization, employees are experts in their particular jobs and functions, employees have useful experience.

Structural capital

From the organizational viewpoint it is the output of a creative process that is important to the company (e.g. in terms of new product revenues, competitiveness trough market share and business results) Goepel et al. (2012). Scientists agree that performance of a company is no more sole individual's job, rather, result of complex interactions among employees (Pérez-Luño et al., 2011; Filieri and Alguezaui, 2014). Creativity is one person's idea, usually very helpful in an early stage of innovation process, however, positive business results are more a coordinated effort of many individuals (from inside and outside of the company). Employees leave companies even if all resources are well invested. Therefore companies have to find ways to retain knowledge of employees that leave. That, on the other hand, necessities investment into knowledge management systems. But, these investments have also another positive effect, that is,

knowledge is readily available and easy to share. Therefore it can be safely said that existence of knowledge databases, manuals and the like will enhance knowledge sharing which is important for competitiveness (Subramaniam and Youndt, 2005). But, in order to systemize knowledge it is necessary to have detailed work procedures in place. Especially procedures on information and knowledge capturing should be known and detailed. Therefore, a company with competitive potentials larger than its competitors will have knowledge stored in databases as well as standard operating procedures. This will enable effortless data gathering process. Brown and Eisenhardt (1997) explain this benefit of structure, because organized knowledge and procedures make work easier and more effective. Employees are privileged by not having to "reinvent the wheel" each time. Therefore, according to Subramaniam and Youndt (2005), a company possesses high level of structural capital if: standard operating procedures are in place, much of this plant's knowledge is contained in manuals, archives, or databases, the employees usually follow the sequence of written procedures and rules and processes in the company are well defined.

Internal social capital
According to Çokpekin and Knudsen (2012) creativity, innovation and continual improvement in the company will be enhanced if members have freedom in executing their tasks, tasks are intellectually challenging, employees have idea time, the management is proactive, and there is culture of debate.

All these premises mean that in order to enhance creativity there has to be balance between freedom of employees and the level of easiness of debating ideas. Enhancing culture of debate is management's job. Also assigning intellectually challenging tasks, giving employees idea time and proactive style of management is all managers' tasks. That can be accomplished when management facilitates open debate, but in order to do so, management has to express confidence in employees behaviour and intervene when problems arise. Besides that, there should be a clear support of innovation through incentive schemes. It is highly unlikely that employees will gather and share ideas if this type of behaviour is not encouraged. If for example management is rigid and puts emphasis on productivity, employees will less likely gather around to share ideas because they are rewarded by the number of complete jobs on time, and therefore employees will concentrate on effective usage of time. In such circumstances, social talks will be first to go (Çokpekin and Knudsen (2012).

As a consequence of supportive management's attitude towards continual improvement, employees will gather in informal conversation, be it for discussing innovative ideas, discussing possible solutions to a problem or for a simple social talk. These talks should not be limited to only one department as it is known that successful product launch needs collaboration from different departments (e.g. engineering, marketing, R&D) (Rese et al., 2013). So, it is extremely beneficial if employees are able and comfortable with talking to members form other departments. It has also been shown that proximity and accessibility of interaction among employees is important for creativity. E-mail or telephone calls help, but there is nothing as efficient for idea generations as personal contact. No wonder workshops and brainstorm sessions are so effective (Boschma, 2005). Finally, one has to be realistic and know that not all ideas are chosen for further financing. So, even with such unpopular decisions, employees should be able to talk freely and openly. This ability to talk freely and openly across organization, backed by management support is called internal social capital in line with intellectual capital literature. Therefore, it is assumed that if: employees engage in informal conversation, there is high cross-functional cooperation, employees are accessible to each other and open discussion on hard topics is possible, then continual improvement that leads to sustainable competitive advantage will be facilitated through organization.

External social capital
Unlike internal connections between employees who don't usually choose their peers, external ties are usually on a voluntary base. An employee will engage in such a voluntary action only if there are mutual interest and high levels of trust and reciprocity. Although trust and reciprocity is also important for internal relations among employees, but employees being in the same company, will have similar goals so the trust and reciprocity is somewhat assumed. For external social ties trust and reciprocity is a precondition. The exchange of knowledge will start only after shared norms are established usually through a longer period of negotiation and probing the potential partner (Dhanaraj and Parkhe, 2006; Fichter, 2009). Hemphälä and Magnusson (2012) prove that social networks with outside partners enhance innovation, and by that means competitive advantage. They conclude that external relations will be more important for radical innovation while internal relations will be more important for incremental innovations. It should also be noted that in intellectual capital literature this external relations are called relational capital. Martínez-Torres (2006); Hsu and Fang (2009); Sydler et al. (2014) instead of using the term social capital they use the term relational capital and define it as relationships the firms have with outside partners. Taking into account this trust, norms, willingness to cooperate with outside partners

3

Subramaniam and Youndt (2005) believe that this external connection will result on better performance if there is: common understanding with outside partners, shared objectives and visions, shared common language, common understanding of concepts (e.g. quality, cost,…), similar behavioural rules and norms and common values and culture.

Influence of IC components on business performance and hypotheses
Business performance is based upon both accounting and market information (Jahankhani et al., 1995). The first empirical study for measuring intellectual capital was conducted in the mid-1980s by a Swedish association, followed by numerous studies on the topic (Tseng, 2006). Bontis (1998) studied the impact of intellectual capital on business performance. Their results suggested a valid, reliable, significant, and substantive causal link between dimensions of intellectual capital and business performance. Chang (2004) studied the relationship between intellectual capital and business performance in the technology industry in Taiwan and prove a positive link. Baum and Silverman (2004) also found a significant effect of the components of intellectual capital on the performance and financial risk of the firms. Therefore our first hypothesis is that IC will have a positive impact on firm performance. As such, this hypothesis is nothing new, but it is important because the assessment of IC differs in named studies. Therefore we start by proving first common knowledge. However, we hypothesize on grounds of definition of each component of IC that they will equally affect business performance. The five hypotheses can be summarised as follows:
H1: Intellectual capital positively affects business results
H2a: Human capital positively affects business results and this effect is comparable in magnitude with other three components
H2b: Structural capital positively affects business results and this effect is comparable in magnitude with other three components
H2c: Internal social capital positively affects business results and this effect is comparable in magnitude with other three components
H2d: External social capital positively affects business results and this effect is comparable in magnitude with other three components

Methodology

Data collection
A large database from Global Manufacturing Research Group (GMRG) V is ideal for complex issues such as dynamic capabilities. The data is a sub-sample of the round V GMRG data collection effort taken place in 2012. The Global Manufacturing Research Group (www.gmrg.org) is an international community of researchers studying the improvement of manufacturing supply chains worldwide. The GMRG consists of leading international academic researchers from over 20 countries. These researchers developed the GMRG survey instrument to understand manufacturing practices around the world. This survey instrument facilitates a global comparison of the effectiveness of manufacturing practices (Whybark, et al., 2009). Where possible, existing constructs and measures were used to ensure their validity. Since 1985, the GMRG has completed five rounds of the worldwide survey. When translating the questionnaire into the language of the respective country, particular attention is paid to translation equivalence of the questionnaire versions by rigorous translating and back-translating rounds by language and subject matter experts (Douglas and Craig, 1983). The unit of analysis for the survey is the manufacturing site or plant, and all data are collected from plant managers as key informants within that site. These managers are targeted since they are deemed to possess a comprehensive knowledge of the plant's operations, in addition to having insight into related functions. The managers are advised to solicit input from other functions, such as marketing and finance, when appropriate. Data is collected by individual members of the GMRG, who are requested to apply the most appropriate approach and the most suitable population frame depending on the country-specific circumstances (Whybark, 1997). This flexibility is afforded to the researchers owing to the complexity and length of the questionnaire, often requiring the key respondent to consult with other individuals within the firm, or the compilation of historical data and the calculation of indices. As such, most questionnaires are completed during an on-site visit (43%) by the researcher, followed by Internet (29%) and mail surveys (23%) (Schoenherr and Narasimhan, 2012). GMRG survey is tested for common method bias in accordance with Conway and Lance (2010); Ota, et al. (2013).
A $\chi 2$ analysis is conducted against early and late respondents to validate for non-response bias in each country (Armstrong and Overton, 1977). As no significant differences are revealed, non-response bias is

not evident. The survey instrument uses observable and perceptual measures. Past studies have demonstrated that perceptual measures are useful for empirical research that is related to managerial evaluations (Vickery et al., 1993; Klassen and Whybark, 1999).

Results

In Table 1 we present results from confirmatory factor analysis showing that indeed our model is reliable. The analysis is conducted using SPSS and AMOS. SPSS was used for descriptive analysis and assessing the Cronbach Alpha reliability measures, and post hoc Harman one-factor analysis. AMOS is used for confirmatory factor analysis and evaluating the structural equation model. Table 1 presents Constructs, Measurements and factor loadings for the model.

The questionnaire has five modules, of which the Core module is obligatory and contains demographic data of the company. Other modules are elective, and the researcher that collects the data is obtaining only the data from other gatherers on modules he/she collects. The core module in round V answered 1089 companies.

Table 1: Variables and results from confirmatory factor analysis

		Factor loading*	S.E.	Critical ratio (t-value)
	Internal social capital Moenaert and Souder (1996), Subramaniam and Youndt (2005), Lee et al. (2011)			
Intellectual capital (CR=0,924, AVE=0,510, Cronbach's Alpha=0,934)	There is ample opportunity for informal conversations among employees in the plant.	0,75		
	Employees from different departments feel comfortable calling each other when need arises.	0,75	0,044	29,353
	People are quite accessible to each other in the plant.	0,724	0,047	29,692
	We are able to discuss problems and tough issues openly.	0,737		
	Structural capital Subramaniam and Youndt (2005)			
	Standard operating procedures are in place.	0,746	0,035	27,886
	Much of this plant's knowledge is contained in manuals, archives, or databases.	0,566	0,043	24,23
	We usually follow the sequence of written procedures and rules.	0,662	0,042	23,252
	Processes in our plant are well defined.	0,616	0,04	23,432
	Human capital (Snell and Dean (1992), Subramaniam and Youndt (2005),Lee et al. (2011))			
	Employees in this plant are highly skilled in their respective jobs.	0,604	0,043	17,202
	Employees in this plant are considered among the best people in the organization.	0,655	0,042	20,244
	Employees in this plant are experts in their particular jobs and functions.	0,575	0,044	19,019
	Every employee in this plant has useful experience.	0,551	0,042	18,14
	External social capital Subramaniam and Youndt (2005)			
	This plant and its major external partners have common understanding about what activities are best for our relationship.	0,613	0,047	20,076
	This plant and its major external partners have shared objectives and visions.	0,631	0,049	17,498
	This plant and major external partners share common language and codes (e.g. special vocabulary, abbreviation, and technical terms).	0,58	0,052	16,757
	This plant and its major external partners have common understanding about the same concepts (e.g. good, fast, cost, quality).	0,538	0,047	17,969
	This plant and its major external partners have similar behavioural rules and norms.	0,367	0,048	19,056
	This plant and its major external partners have common values and culture.	0,728	0,044	17,403
	Business performance (Measured on 7-point Likert scale as a change in the last fiscal year, 1 –decreased by 25%, 7 increased more than 25%), Knoppen et al. (2015)			
Business performance (CR=0,885, AVE=0,719, Cronbach's Alpha=0,880)	Total sales of goods and services	0,801		
	Profitability	0,86	0,044	29,353
	Market share	0,881	0,047	29,692
X²/df=3,308, GFI=0,903, NFI=0,927, IFI=0,948, CFI=0,947, REMSA=0,048, PCLOSE=0,942				

As it can be seen in Table 1, all threshold values are all in acceptable range ($\chi 2/df<5$), IFI and CFI>0,8, REMSA<0,1 (Hu and Bentler, 1999). Composite reliability (CR) statistics indicates strong construct reliability in each case; all values are well above 0.7 (Fornell and Larcker 1981). The results established

convergent validity and unidimensionality for each construct, as all item loadings (lambdas) are highly significant (all t-values are >2.0). The results also indicated acceptable discriminant validity for the measures at both the construct and item levels. The average variance extracted (AVE) for each construct variable is greater than the squared correlation of the construct with any other construct, indicating acceptable construct discrimination (Fornell and Larcker 1981). All AVE (convergent validity) are greater >0,5 in line with Hair et al. (2010).

All item loadings are above 0.5 and significant at the 1-per cent significance level which indicate convergent validity (Bagozzi et al., 1991). Even though some values of factor loadings are less than 0,7 we did not need to exclude any single variable from our proposed model. The main difference of our model and Subramaniam and Youndt (2005) is in the fact that they had one component for both internal and external social relationship.

Common method variance is a crucial question when both the dependent and focal explanatory variables are perceptual measures derived from the same respondent. Four approaches are recommended in the literature as methods that researchers should use to avoid or correct CMV (Chang et al., 2010; Podsakoff et al., 2003). In this work all four preconditions are fulfilled.
1. Using different sources for independent and dependent variables (in this research increase in revenues, market share and profits are an objective value generated by the bookkeeping unit of the company, whereas other perceptual measures are self-rated on seven point Likert scales).
2. In the design phase of the questionnaire the questions are in different sections, and different scales are used, so this prescription is also fulfilled. The core part of the questionnaire gathers financial data, whereas innovation module gathers perceptual measures on intellectual capital.
3. Complicated specifications of regression models reduce the likelihood of CMV. Specifically, respondents are unlikely to be guided by a cognitive map that includes difficult-to-visualize interaction and non-linear effects. This is less likely the more complicated the model. Intellectual capital and dynamic capabilities and the performance outcomes of a company are not a linear effect (Eisenhardt and Schoonhoven, 1996) and it is hard to visualize, so this prescription is also fulfilled.
4. A post hoc Harman one-factor analysis is often used to check whether variance in the data can be largely attributed to a single factor. The post hoc Harman one-factor analysis is performed and the results indicated presence of loading to more factors.

Table 2. Correlations among constructs

	Extern SOC	HUMAN	STRUCT	Inter SOC	BUSRES
Extern SOC	1				
HUMAN	0,665	1			
STRUCT	0,583	0,595	1		
Inter SOC	0,557	0,6	0,546	1	
BUSRES	0,223	0,117	0,158	0,181	1

Figure 1. Tested model
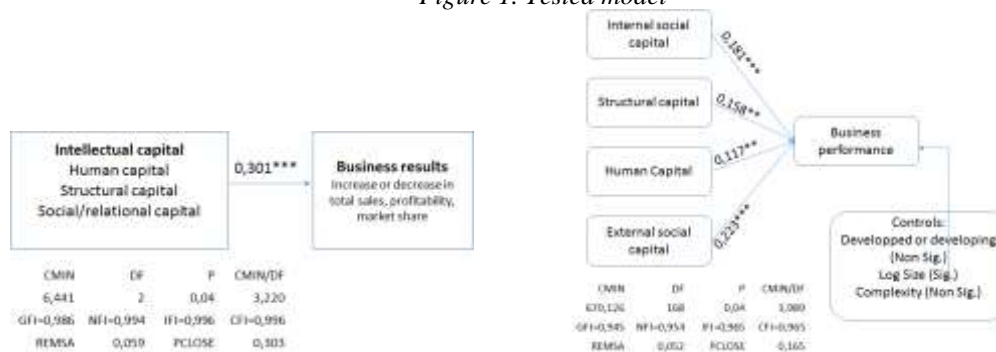
There is a strong correlation between internal social capital and business performance (0,181***), but a smaller correlation between structural capital (0,158**) and human capital (0,117**) on business performance. Highest impact is from external social capital (0,223***) to business performance. We find a very significant and strong relationship between intellectual capital and business performance (0,301***). All five of our hypotheses are confirmed, except that external social capital has more impact on business performance than the three other components. However, if we look at Table 2. than we see very high correlations of Human and Structural capital on both internal and external social capital. This

6

means that maybe structural and human capital indirectly affect business performance through communication of employees both inside of the company and external partners.

Conclusion:

There is not enough research connecting companies' capabilities and business performance (Braunscheidel and Suresh (2009) and Tavani et al. (2014)). In this regard, this study contributes to the literature showing intellectual capital enhances business results. Intellectual capital is not a static variable and could be easily considered as dynamic capabilities. Such studies are rare (Pisano, 2015). We show that intellectual capital has strong positive impact on business performance. This finding is not new, however, the contribution of this work is a proposed measurement instrument that enabled to evaluate exact influences of each component of IC on business results. Our results show that external social capital is the most influential component on business performance. We suggest to other researches to use this instrument and possibly verify results.

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