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Review

Entrepreneurship complexity: Salient features of entrepreneurship

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The topic of entrepreneurship has attracted a lot of attention in academia and industry circles. This paper seeks to explore theories of entrepreneurship as well as its definitions. To this end a model that includes the salient entrepreneurial features, such as non-resource ownership and non-monetary gain, in defining entrepreneurship has been developed. It is now a known fact that no country can do without entrepreneurial activity to boost its economic development as well as the social welfare of its citizenry. Economic constraints, such as resource availability, need urgent addressing for micro enterprise. In spite of their contribution to economic development and job creation, micro entrepreneurs face a challenge of recognition as all the attention is at times given to macro and industry entrepreneurship in most economies and government policy. Micro and social entrepreneurs' ability to thrive in adverse conditions is captured in the salient features that this article describes. Emphasis of these salient features may enhance stronger policy support as well as inspire a risk-averse atmosphere for aspiring and established entrepreneurs.

Key words: Entrepreneurship, policy, theory, salient features, resource ownership, non-monetary gain.

INTRODUCTION

As a field of research, entrepreneurship research has addressed the phenomenon of entrepreneurship from different viewpoints. The phenomenon is more complex and heterogeneous than was thought in the 1980s (Bruyat and Julien, 2000).

Entrepreneurs perceive challenges and act differently in order to bring about an impact, in spite of resource and monetary constraints. Berglund (2005) asserts that if it was not for them seeing and acting differently, entrepreneurs would not make an economic or social impact. It is from the variety of perceptions and activities that the complexity arises making it difficult to define

what entrepreneurship exactly is. Acting is mainly dependent on perceptions and there can be no doubt that policies are affected by prevalent perceptions. It can be well understood that besides every perception, there is a background knowledge or principle leading to such a perception. It is this knowledge that this study explores in the context of applicable theories and the attendant definitions that indicate the astonishing complexity of the field of entrepreneurship. Economics is said to have had a unique influence on entrepreneurship, and that though there have been many empirical investigations from the perspective of psychology and sociology in the discourse.

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It is further argued that even the very attempts to delineate entrepreneurship as a field of study with both theoretical and academic legitimacy, base input solely on economic theories (Davidsson and Honig, 2003; Ventakaraman, 1997).

Whereas the above authors have considered that economics has given entrepreneurship its theoretical vitality, it is worth looking into other areas where entrepreneurship is believed to have gained its vitality and strength. These areas are addressed in this paper.

Theory has a significance that affects the reality of issues upon which people act. Theory is based on knowledge that has been verified from a scientific point of view. In view of this statement it is worth quoting from Schumpeter (1934:85) who attests to the fact that it is from the bias of previous knowledge that people act.

What has been done already has the sharp-edged reality of all things which we have seen and experienced; the new is only the figment of our imagination. Carrying out a new plan and acting according to a customary one are things as different as making a road and walking along it. How different a thing is becomes clearer if one bears in mind the impossibility of surveying exhaustively all the effects and counter effects of the projected enterprise. Even as many of them as could in theory be ascertained if one had unlimited time and means must practically remain in the dark.

The assertion of Schumpeter above lends itself to the knowledge that people act according to seen experience. If this position is agreed without further deviation, then it should also be agreed that experiences differ according to situations and circumstances. Situations or circumstances, however, may exist without choices as seen in the various developmental eras the world has undergone: the agricultural, industrial and Information technology eras. The development from the agricultural era to industrial era was accompanied by different changes that were dictated by the different challenges that became opportunities for entrepreneurial activities in each stage. This is applicable to the information technology era. The resources needed for agricultural era success, were not the same as those needed for the industrial era and information technology era, notwithstanding some exceptions where need be. However, the knowledge resource to a certain degree from each era is often carried forward, thus helping in developing the concepts or ideas for the next level of development. Schumpeter's statement above, denotes the fact that even if someone had the 'means'(resources) there is a possibility of not achieving all that is needed. In a way therefore, the previous concepts, some of which proven to be true and factual continue to be in use, in other words, nothing is totally new in the next dispensation.

Constraints on entrepreneurial understanding as well as practice may be varied, educational objectives being one

of them. The educational objectives, as far as entrepreneurship is concerned, reached their embryonic stages by the 1980s (Hill, 1998). The confusion and the varied approaches to teaching entrepreneurship are based on differing definitions of entrepreneurship as a single definition has not been agreed on by the academics, as pointed out by Garavan and O'Connell (1994:4). There is also diversity among academics as to what constitutes an entrepreneurship programme (Vesper and Gartner, 1997:407). In this regard the actual content of dealing with this subject is still in dispute. There is also a divide in understanding as to whether entrepreneurship should be linked to organisation creation, growing of firms, innovation, value creation and ownership (Vesper and Gartner, 1997). In spite of the varied understanding of entrepreneurship, it is noted that it has benefited even developed economies. The driver for the United States (US) economy is said to be entrepreneurship. Three quarters of US businesses are run by self-employed individuals. Moreover, the 28.8million small businesses in the US generate more than half of the gross domestic product (GDP) and employ more than 50 per cent of the private workforce (Department of Labour, 2007). Many a time, welfare of a nation is reflected in the development or lack of development of the GDP as well as levels of unemployment. Entrepreneurs have the task of organising factors of production when revisiting business plans. It is at this juncture that resource ownership or asset ownership requires entrepreneurial judgment (Foss et al., 2007). The discourse of entrepreneurial benefit is embedded in the resource and monetary aspects among others. Although resource-based entrepreneurial theories mention these aspects, they are not much featured in policy platforms. Moreover, against the odds and in the absence of these factors, do some entrepreneurs thrive and what would their recognition be but a reinforcement of support from both social and policy platforms. This paper has been constituted by the use of primary data, scrutinizing theories and definitions, and finally proposing a model in response to the often overlooked aspects of economic constraints faced by entrepreneurs.

IMPORTANCE OF THEORIES

Theories should not be considered to be simply academic. They help in the comprehension of concepts, which may guide decisions and actions in a much better way than if no clear understanding (theory) were in place. Theories have a fundamental influence in shaping judgment and action at every conceivable level. The challenges that are faced as a result of differences in definitions may be related to the theories that need review. Such review is necessary for the opening up of a robust debate in contextualising the understanding of

entrepreneurship from a scholarly perspective, as well as for policy platforms. So far, many definitions have seemingly mirrored economic and sociological aspects with less emphasis on resource theorems. It should be hastily added that it is not the intention of this paper to create further definitions to satisfy anticipated representation/s of fields yet to be constructed. Entrepreneurship itself had been left out of the earlier economic theorems due to constricted theoretical understanding. Incorporation of all elements involved in the interplay of economic, sociological, anthropological, technological and political spheres may be necessary during the current globalised climate for the realisation of a generally accepted entrepreneurial understanding.

THEORIES ON ENTREPRENEURSHIP

This section handles the various theories associated with entrepreneurship as noted below.

Economic entrepreneurship theories

The role of directing resources in a competitive marketplace, and in particular the distribution and production of resources, lies with the entrepreneur. The virtues of free trade, competition and specialisation have been emphasised by the classical theorists who were responding to the British Industrial Revolution that lasted from the 1700s to the 1830s (Ricardo, 1817; Smith, 1776 cited in Simpeh, 2011). Nonetheless, these theorists are accused of not explaining the dynamism entrepreneurs generated in the industrial age (Murphy et al., 2006).

The neoclassical theory was adopted in response to questioning the closed economy approach of the classical theorists. The need to respond to the impact of diminishing marginal utility was the concern of the neoclassical theorists and the need for entrepreneurial response was required for the change of the status quo. Neoclassical theorists in turn were criticized for conjectures on aggregate demand, which ignored entrepreneurship at the level of the individual. Besides, rational resource allocation does not capture the complexity involved in market systems. The value of innovation and its outcomes may not be captured by efficiency-based systems postulated in economic theories. Perfect competition does not allow for innovation and entrepreneurial activity (Simpeh, 2011). It is important to underscore the importance of an entrepreneurship based at the level of the individual that could spur positive development in an organisation, institution or even personal business operation.

Although achievements in organisations are credited to the organisation, they still find their basis in individual initiatives and motivations. The theory therefore limited the understanding of the role played by individuals in entrepreneurship.

Austrian market process (AMP)

This theory was in response to unanswered questions posed by the neoclassical theorists. It addressed human action in the context of a knowledge economy. The motion of the market economy required the creation of an impulse and this impulse was found in the creation of something new in the enterprise, which was the function of entrepreneurship (Schumpeter, 1934).

In the view of Murphy et al. (2006), in support of entrepreneurial efficacy, the AMP movement provided a logic for a dynamic reality. It affirms that knowledge is communicated through a market system, for example, via price information. Benefits are often incurred when there is knowledge of how to create new goods or services, or better ways of providing goods or services. Murphy et al. (2006) attest that entrepreneurs effectuate knowledge when they believe that it will have individually-defined benefits. The AMP is credited with three conceptualizations. The first involves the arbitraging of the market as opportunities emerge, others overlook certain opportunities and some offer to undertake a suboptimal activity. The second conceptualization is alertness to profit-making opportunities, which is an entrepreneurial advantage. The third conceptualization is the understanding that entrepreneurship and ownership of resources are not necessarily connected. Say (1803) and Schumpeter (1934) affirm the principle that ownership is distinct from entrepreneurship and entrepreneurship does not require ownership of resources. This in itself adds context to risk and uncertainty (Knight, 1921 cited in Murphy et al., 2006).

Owing to the nature of the market, the AMP has received its criticisms, among which is the fact that market systems are not purely competitive but at times can involve antagonistic cooperation. It should also be noted that resource monopolies can hinder competition and entrepreneurship. Further criticisms are that market activity can be influenced by fraud, deception, taxes and administrative controls, and that both government and private firms can be entrepreneurial and entrepreneurship can occur in non-market competitive situations (Simpeh, 2011).

Psychological entrepreneurship theories

Landstrom (1998) stipulates that the level of analysis in psychological theory is the individual. Issues regarding personality traits, the need to achieve and locus of control are the aspects that tend to produce the entrepreneurial inclination according to reviewed empirical evidence.

Personality traits theory

In considering this theory, it is necessary to reflect on the definition by Coon (2004), who considers personality

traits as stable qualities that a person displays in most situations. The trait theorists consider that certain qualities are characteristic of an entrepreneur. These qualities, however, can be understood by making an inference from behaviour, argues Simpeh (2011).

The characteristics associated with entrepreneurial tendencies include being opportunity driven: the 'nose around' mentality. Entrepreneurs also have optimism and, as such, often see the glass as half full rather than the glass as half empty. Their mental energy and emotional resilience prompts their hard work coupled with intense commitment and perseverance. They are dissatisfied with the status quo and hold out with a competitive desire to win and excel, while exercising integrity and having visionary minds. This theory of personality traits is not fully supported by research evidence argues Simpeh (2011), besides the fact that one has to conclude that such traits are inborn based on observation.

The locus of control

In the 1950s the theory of how events in one's life shape their actions was developed by Rotter (1966). The locus of control is said to be an important aspect of personality. The outcomes of our actions are contingent on what we do (internal control orientation) or external orientation- referring to events outside our personal control. One's own abilities as well as outside support determine entrepreneurs' success. Literature has denoted that internal locus of control is a characteristic of entrepreneurial behaviour (Cromie, 2000; Ho and Koh, 1992; Robinson et al., 1991). In support of this view, Bonnet and Furnham (1991) found in a student sample that internal locus of control was positively associated with a desire to become an entrepreneur. In addition, in a study conducted by Rauch and Frese (2000), business owners reported a higher locus of internal control than other populations. The degree of innovativeness, competitive aggressiveness and autonomy reported was also found to be higher in business owners (Utsch et al., 1999). Begley and Boyd (1987) noted the same: a higher level of risk taking among business owners than other populations.

Need for achievement theory

The Need for Achievement Theory was proposed by McClelland (1961) to explain the human desire to achieve, succeed, excel and accomplish. There is no evidence to support this personality trait with regard to entrepreneurship by Johnson (1990); however, he found that there was a relationship between achievement, motivation and entrepreneurship. Shaver and Scott (1991) found out that achievement motivation was the only convincing personalogical factor associated with new

venture creation. Mohar et al. (2007) also found that need for achievement besides risk taking; ambiguity tolerance had a positive significance to entrepreneurial inclination did exist.

The degree by which risk aversion would be reduced as a result of a successful entrepreneurial effort was found to be high in the studies done by Eisenhauer (1995), cited in Simpeh (2011). Brockhaus (1980) found that some entrepreneurs exhibit mild risk-loving behaviour. In envisioning a secure income, it seems to follow that entrepreneurs get encouraged by successful effort to risk-taking for the next possible venture. This then helps support the view of risk taking by entrepreneurs.

Sociological entrepreneurship theory

The sociological entrepreneurship theory is said to be the third largest major theory (Simpeh, 2011). The role of society is the bedrock of this theory. Four social contexts have been identified in relation to entrepreneurial opportunity. The society values their trust towards the entrepreneur in terms of what he/she is to offer, as compared to simply filling the gap of production and making profit out of it. Success of an entrepreneur should not come as a result of taking advantage of people but as a consequence of faith in people. This then leads to the first of the social contexts: *social networks*.

The second social context is derived from experiences that people have gone through, and as such actions may be directed to doing something meaningful in their lives. The decision to become an entrepreneur therefore is after analyzing life situations. Hence, this second social context is termed: *life course stage context*.

The sociological background can operate as a 'push' factor in becoming an entrepreneur. It is understood that marginalized groups can rise against all odds to make life better. In this context the ethnic background will determine how far a person can go. Therefore, the third context is referred to as the *ethnic context*.

The fourth category is derived from the understanding of environmental factors in shaping the survival of a business. Competition, employees, government legislation, political systems and customers can impact on the survival of a new business venture. Hence, the fourth social context is *population ecology* (Reynolds, 1991).

Anthropological entrepreneurship theory

According to the anthropological entrepreneurship theory, for someone to successfully initiate a new venture, there has to be consideration of the social and cultural aspects. Influence of one's culture plays a pivotal role,

according to this theory, in influencing innovation and venture creation. Anthropology studies origins, culture, beliefs and customs of a community. Baskerville (2003) discovered that ethnicity affects attitude and behaviour. Attitudes and entrepreneurial behavioural differences can be produced through cultural environments (North, 1990; Shane, 1994). The social, economic, ethnic and political complexities in an individual are often reflected in culture (Mitchell et al., 2002). The anthropological entrepreneurship theory interestingly leaves out the economic as well as other aspects in pursuit of considering the entrepreneurial behaviour of an individual.

Resource-based entrepreneurship theories

Resource-based entrepreneurship theory encompasses a number of theories attesting to the fact that resource availability to the founders is an all important factor in opportunity-based entrepreneurship and new venture creation (Alvarez and Busenitz, 2001). An individual's ability to detect or even act upon opportunities is enhanced by the availability of resources (Davidsson and Honig, 2003). Resource-based entrepreneurship theory has three classes that help elucidate the connection between entrepreneurship and resources as hereunder:

The liquidity theory/ financial capital theory

The liquidity theory is based on the understanding that the founding of new business is more common when people have access to capital as evidenced by empirical research (Evans and Jovanovich, 1989; Holtz-Eakin et al., 1994; Blanchflower et al., 2001). The theory, however, is under dispute following studies that have reported that financial capital is not significantly related to the probability of starting a new venture by nascent entrepreneurs (Aldrich 1999; Davidsson and Honig, 2003; Hurst and Lusardi, 2004).

The theory articulates that some individuals have individual specific resources that facilitate acquisition and recognition of new opportunities for an emerging new venture (Alvarez and Busenitz, 2001). Nonetheless, it is also observed that some persons have been able to exploit resources and opportunities due to the better knowledge and information available to them, other than finances or liquidity (Aldrich, 1999; Shane and Venkataraman, 2000 in Simpeh, 2011; Shane, 2003; Anderson and Miller, 2003).

The social capital or the social network theory

Reynolds (1991) stipulates social networks as being one of the four sociological theories. This theory supports the understanding that stronger social ties to resource providers can enhance the probability of opportunity

exploitation as well as facilitate resource acquisition processes (Aldrich and Zimmers. 1986). In connecting the understanding between opportunity recognition and business startup, Shane and Eckhardt (2003:333) state that: 'an individual may have the ability to recognize that a given entrepreneurial opportunity exists, but might lack the connections to transform the opportunity into a business startup. It is thought that access to larger social network might help overcome this problem'. Research has also supported this claim that nascent entrepreneurs would do well to have access to entrepreneurs in their social network so that the competencies of their cultural capital can be drawn on in detecting opportunities (Aldrich and Cliff, 2003; Kim et al., 2003; Gartner et al., 2004)

Human capital entrepreneurship theory

Two factors have been considered as underlying the entrepreneurship capital theory: education and experience (Becker, 1975). For opportunity identification to be effectively done it is necessary to centre on the knowledge gained from education and experience. This type of resource is said to be heterogeneously distributed to individuals (Chandler and Hanks, 1998; Shane and Venkataraman, 2000; Anderson and Miller, 2003). The relationship between human capital and nascent entrepreneurship has been empirically verified (as noted by Kim et al., 2003; Davidsson and Honig, 2003; Korunka et al., 2003).

Opportunity-based entrepreneurship theory

According to Drucker (1985), entrepreneurs do not cause change but they respond to changes created by opportunity. Such changes may occur in technology, consumer preferences, etc. An opportunity-based theory is said to provide a wider framework for entrepreneurship research. Both the Schumpeterian and Austrian schools of theory claimed that an entrepreneur creates change. Stevenson and Jarillo (1990:2) are said to have extended the postulation by Drucker to include resourcefulness, and contend that entrepreneurial management is, 'the pursuit of opportunity without regard to resources currently controlled'. This research helped differentiate entrepreneurial management and administrative management. Yet at the same time, it begs to be understood that the concept is referring to the scarcity of resources, which is basically an economic assumption. This discourse can only be continued in a definitive understanding of entrepreneurship.

DEFINITIONS OF ENTREPRENEURSHIP

"Good science has to begin with good definitions",

asserts Bygrave and Hoffer (1991:15). It is necessary that the research field be differentiated clearly from other fields to help a discipline gain its legitimacy relative to neighbouring fields. Boundaries can then be established for its long-term existence however, fuzzy they are, states Kuhn (1970). Bruyat and Julien (2000) point out that the differentiation of a particular field has often led the scientific community into the art of creating devices such as journals and reviews, chairs, conferences, doctoral programs, etc., but its significance is emphasized at the same time. Greenfield and Strickon (1986) state that when there is no consensus on the paradigm, researchers then tend to *speak after one another* rather than *to one another*. It should be noted that differentiation is symptomatic of a need for creating a space upon which a consensus is built on the subject of interest. This paper does not look into every definition given for entrepreneurship, but looks into those that are refined and tries to understand the relationship to theory. It also looks at possible policy implications and puts forward some recommendations, leaving room for debate. Bob Reiss, successful entrepreneur and author, considers entrepreneurship as a recognition and pursuit of opportunity without regard to the resources you currently control, with confidence that you can succeed, with the flexibility to change course as necessary, and with the will to rebound from setbacks (Reiss et al., 2000).

Marriotti and Glacklin (2012) regard an entrepreneur as a person who organizes and manages business, assuming the risk for the sake of potential return. The return can be immense and multifaceted, but the issue of risk though undesirable is an essential element of an entrepreneurial venture. In both definitions so far, an entrepreneur is seen as pivotal in bringing change to the product or service, however, the resource issue distinguishes the first definition from the second.

Definitions of entrepreneurship do vary a great deal and there has been a concern regarding the lack of a generally acceptable definition of entrepreneurship, as pointed out by Sharma and Chrisma (1999), cited in Lumpkin (1989); Baden-Fuller (1994); Wortman (1987); Zahra (1991) and (Aldrich 2011 cited in Simpeh 2011), who categorized the various definitions into four groupings:

1. The setting up of high-growth and high-capitalisation firms (as opposed to low-growth and low-capitalisation 'lifestyle' businesses);
2. Innovation and innovativeness leading to new products and new markets (the Schumpeterian tradition);
3. Opportunity recognition (the Kirznerian tradition);
4. The creation of new organisations.

There are problems that Aldrich (2011) notes in these definitions of entrepreneurship. Firstly, he notes a strong bias in selection in the first two. As to whether a firm had high growth and did have an innovation can only

be established retrospectively and yet, at the same time, high capitalisation is no guarantee for innovativeness. There is also an effect on policy if the state takes, for example, the definition which emphasises a particular aspect such as the setting up of high-growth and high-capitalisation firms, as opposed to low-growth and low-capitalisation firms or organisations. A policy can be developed that supports high-growth firms as being entrepreneurial, although high-capitalisation is no guarantee that the firm will be innovative, a key characteristic of entrepreneurship.

While still considering the issue of the limitations of these definitions, Aldrich (2011) notes that the second and third definitions are too general in their applicability where entrepreneurship is simply inclusive. Corporate venturing and intrapreneurship, along with research and development became synonymous with this Schumpeterian tradition concept than the new venture creation concept in the fourth definition. The innovation and innovativeness leading to new markets and new products is certainly a component necessary in entrepreneurship as well as opportunity recognition, but would these lead to new venture creation, a key characteristic of entrepreneurship? Aldrich also notes that entrepreneurship studies have forgotten Schumpeter.

Furthermore, the issue of recognition of opportunity as encapsulated in Kirzner's notion is particularly based on a disciplinary effect, '*recognition of opportunity*', which Aldrich (2011) referred to as a mind alertness. This would then confine entrepreneurship to the cognitive psychology of an entrepreneur.

In the fourth definition, it is difficult to delineate when old organisations emerge to become new social entities. Agreement on a definition seems to have eluded the scholars in this area of understanding. Perhaps more interesting as well, is the fact that there is much literature and many studies based on the already existing firms as pointed out by Davidsson and Wiklund (2001). In another observation Davidsson and Honig (2003) stipulate that there are very few studies that focus on the early phases of the entrepreneurial process. The basis for the fundamentals of entrepreneurship may be essential for determining further concepts. While the categorisation of these definitions carries one to the level of a dilemma, the crucial aspects of resource limitation remain unattended to. In any event, resources in all forms become the cross-cutting baseline for entrepreneurial support and success.

CHALLENGES AND SIGNIFICANCE OF MICRO ENTERPRISES AND SOCIAL ENTREPRENEURS

The role of small micro business was not understood in developed economies and had often been confined to developing countries; nonetheless, it has provided financial independence in countries such as America (Guste, 2006). Micro enterprises have a sizeable

existence in developed countries like United States where more than a half of all businesses are considered micro. The importance of small businesses has been understood by the Small Business Administration (SBA). It has been recognised that more than a half of the employees are employed by the private sector. This is no small number considering that the figure in question here is 99.7% of the employer firms (Shah, 2010). In some places like Maryland State, micro enterprises are considered as a focus of public investment with admirable returns falling in the range of #2.06 to #2.72 per dollar invested. This is in addition to providing 17.8% of employment, which essentially refers to the provision of over half a million jobs to individuals.

In spite of the above stated benefits derived from micro enterprise, it has a share of challenges to contend with. Research has identified financial challenge as a common denominator to micro enterprise. In a study conducted by Panel Study on Entrepreneurial Dynamics (PSED) though uncertainty was noted as higher among micro entrepreneurs in dealing with the regulatory compliance in the local and federal laws, financial challenge was as well noted. The categorisations in this study underscored the following uncertainties in micro enterprise: Financial uncertainty; Competitive uncertainty and Operational uncertainty. This in essence indicates that the financial uncertainty is a challenge in as far as the bottleneck of micro enterprise is concerned. Likewise, in a study conducted by Rogoff et al. (2004) it was noted that among the factors that impeded success of micro entrepreneurs were regulation, finances, competition, technological and environmental factors.

Social enterprises have been credited with the role of undertaking to fulfil pressing social concerns with innovative solutions (Sivathanu, 2013). Nonetheless, there is a common element that these enterprises face that is connected to the micro enterprises. Underwood et al. (2012) have noted that among the challenges that face social enterprise are the issues on resource depletion and the financial system disruption. The remedy to these challenges they argue cannot be found either in the government sphere, business or the civil society actors in isolation. SBA (2004) has noted in its findings that nascent firms did struggle in obtaining credit among other challenges such as market entry. Cohen et al. (2008) in their submission towards factors that contribute to a social enterprise success point out the need for sufficiency in start-up capital and sustained resource support. It is further noted that social enterprises need no less than 3-4 years to help cover their own costs (SVA, 2010).

THEORY, DEFINITIONS AND POLICY

Entrepreneurial theory has been varied according to different perspectives, as seen above. A number of

theories have thus far defined the role and intent of an entrepreneur. Definitions have captured the individual aspect of entrepreneurial endeavours, though economic theories have mainly been concerned with the macro aspects of entrepreneurship. Besides, there are some important issues that require underscoring, for example, Simpeh (2011) has noted how ownership and entrepreneurship are distinct and yet this has not been noted in the definitions. To be an entrepreneur does not necessarily mean possessing ownership of resources, as may be noted in an entrepreneurial individual in a government facility as opposed to a venture-creating individual. The understanding that an entrepreneur is a resource owner is assumed in definitions directly or indirectly. It is important to acknowledge that definitions have often emphasised issues related to risk-taking in connection to resource possession rather than venturing without necessarily owning resources.

The summary of definitions observed in the categorisation by Aldrich (2011) also does not help clarify the issue with regard to resource possession as opposed to resource allocation by entrepreneurs. Policy makers have thus often made policies based on the assumption that all business owners are entrepreneurs. In addition to this situation, individuals that are entrepreneurial in organisational setting may then become unrecognised. The recognition of such individuals therefore is based on the discretion of the organisations or companies they work for and simply passes as an additional effort. Although such recognition cannot be regulated the cultivation of entrepreneurial culture would lead to an automatic recognition of such individuals.

Another aspect of importance is that of monetary gain. The aspect of gain in entrepreneurship is an important incentive that cannot be categorized in monetary terms only, and so far this understanding is prevalent at the very mention of small, micro and medium enterprises (SMMES) policies. Although it is notable that social entrepreneurship does not necessarily consider an entrepreneur in terms of gain, as in an economic input for motivation, yet by and large the entrepreneur is seemingly seen in that context by policy makers. This in effect biases the support that should be given to develop social entrepreneurs.

In the field of commerce there is a need for leveling the playing field. In as far as the domains of tax laws, labour and product market regulations are concerned, entrepreneurship is contextualised by such an atmosphere unavoidably. It is common knowledge that public policy is mainly intended to correct market failures, where entrepreneurship happens to find its perpetual habitation and it is in this need that entrepreneurial policy is made to exist. Various countries have goals justifying public intervention, such as the creation of comparative advantage, advancement of technological frontiers and poverty alleviation. The interdisciplinary nature of entrepreneurship includes management, finance, psychology,

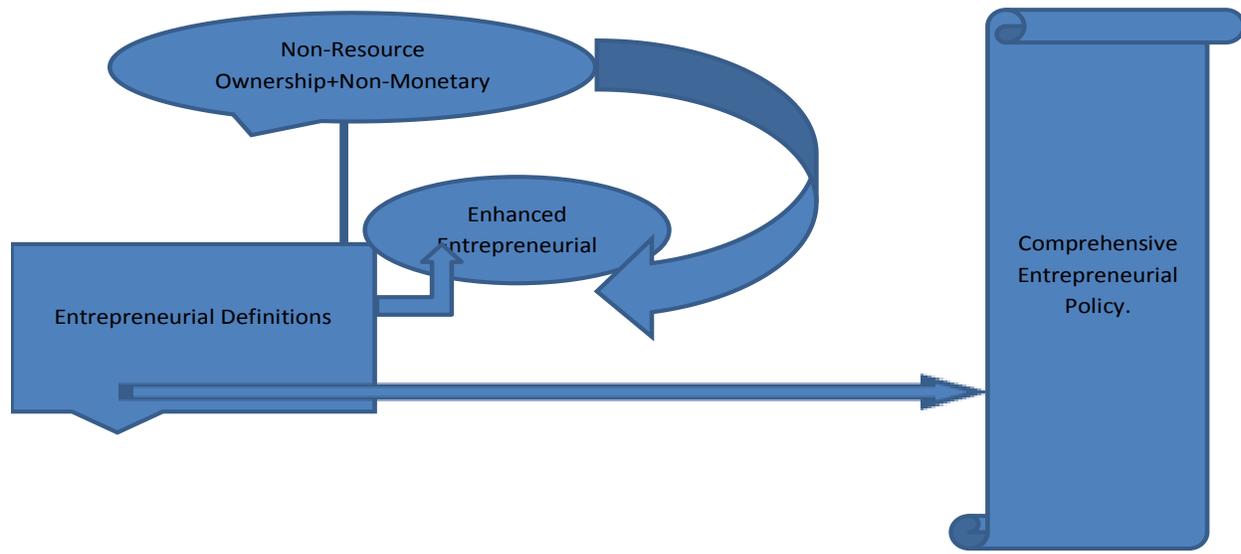


Figure 1. Research model.

political science, economics, geography and sociology (Audretsch and Thurik, 2001). All these areas have inadvertently been areas of public policy, without a shadow of doubt, in most economies, be they developing or developed.

In dealing with entrepreneurial policy, it has to be understood to be distinct from the policy measures necessarily taken to improve the performance of small and medium enterprises or business start-ups as done in developed and developing countries in a number of instances. From an economic point of view, one of the economic aspects has been noted in the area of financial access through credit systems. In the US for example, there are liquidity constraints binding on firm size decreases according to empirical evidence (Fazzari et al., 1998). Policies have always reflected on the existing political, social and economic environments. Ireland, for example, developed protectionist policies in 1932, in order to eliminate British control (Garvin, 2004) in pursuit of patriotism. This, however, distorted the Irish economy and caused a restraint on international trade (Garvin, 2004; Ruan and Görg, 1996). Although there were economic ramifications, the policy was politically motivated. Policies tend to be expressed at the expense of theories underpinning the success of entrepreneurial efforts, which can be derived from an understanding of economic theory, which may capture the element of resource scarcity. Resource ownership is on many occasions unarguably linked to resource scarcity, an economic factor, which may restrain or foster the acquisition or possession of assets. In their paper, Turker and Selcuk (2009) contend that although personality factors, such as the need to achieve, locus of

control, the ability to risk take and self-confidence, are linked to entrepreneurial intention, an individual is surrounded by a range of external factors, which include technological, cultural, political, demographical, social and economic factors. They further argue that in the social sciences a more accurate explanation takes into account the interaction of other factors rather than the impact of a single factor.

Resource ownership and monetary gain are dominant aspects by which entrepreneurs are being identified, which can bias the policy towards those who may be entrepreneurial and yet may not own resources. Such policy may well be motivated by social concerns such as poverty alleviation and other economic, social and psychological aspects. If resource ownership is not included in the definitions, policy guidelines are unlikely to benchmark it. Though there can be interventions that may support entrepreneurs who do not have resource ownership and do not have financial motivation, they may not be sustainable due to the discretionary nature upon which they are considered. It is worth noting that the entrepreneur's cognitive motivation model considers that there are monetary and non-monetary gains that matter to an entrepreneur. Before an entrepreneur acts, incentives put forward by policy makers can inspire them to take up some venture creation initiatives (Gabr and Hoffman, 2006).

Conclusion (proposed model)

This model includes the salient entrepreneurial features such as non-resource ownership and non-monetary gain

in the definition of entrepreneurship. Presently, the definitions leave out these important aspects. This also follows on the fact that the three levels of understanding entrepreneurship being Micro, industry and macro (Audretsch et al., 2007) be factored in. Non-resource ownership is an aspect that is to be understood from all angles regardless of the theoretical differences. This may be a discouraging factor for venture creation, but once policies fully recognise the intervention targeting this need will remedy this economic handicap. The non-monetary gain in some entrepreneurial endeavours as generally applicable to those organisations dealing with social entrepreneurship can be remedied by a supportive and appropriate policy intervention. Interventions from the policy level platforms can incentivise operations of such organisations and individuals alike.

The proposed model below explains how non-resource ownership and non-monetary gain concept, if inbuilt in the definitions of entrepreneurship can influence an enhanced entrepreneurial image and a comprehensive entrepreneurial policy. There is need to underscore the importance of the salient features such as non-resource ownership and non-monetary gain which can be made to feed into the concepts of defining a holistic entrepreneurial activity leading to a comprehensive entrepreneurial policy. The diagram therefore entails the non-resource and non-monetary gain from the top, pointing to both the entrepreneurial image as well as definition which together lead to a new policy outlook, that is more accommodative to the salient features mentioned above (Figure 1).

Conflict of Interests

The authors have not declared any conflict of interests.

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Full Length Research Paper

Measuring organizational innovative climates in technical institutes and university teachers

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Teachers' perceptions of organizational innovation climates are vital to understand the success or failure of innovational implementations of technical institutes and universities. This study aims to develop a "Measure of Organizational Innovation Climates for Technical Institutes and University Teachers (MOIC-TT) in order to recognize the influence of schools on teachers' creative behaviors. First, this study analyzes literature and scales related to organizational innovation climates, and reorganize the factors of technical institutes and university teachers' innovation climates into a draft of scale. Secondly, a pretest is designed according to expert examination, teacher interviews, and expert panel. This study examines items, reliability, and validity by 125 subjects in pretesting, and 627 subjects in formal testing. Results of confirmatory factor analysis reveal that three latent factors (i.e., resource support, innovation leadership, and team cohesion) are related, and the factor model has good fit. Full scale coefficient is .96 and reliabilities of sub-scales are .87~.93. The research results indicate that teachers have positive attitudes toward the organizational innovation climates of schools. They tend to agree with "team cohesion" and "working independence". Lastly, suggestions regarding content, characteristics, and future studies are proposed as reference for organizational innovation climates in technical institutes and universities.

Key words: Organizational innovation climates, technical institute and university technical Institute, working independence, innovation leadership, team cohesion.

INTRODUCTION

Organizational climates are an organizational members' attitudes, beliefs, motivations, and values upon subjective perceptions of the formal system of the organization,

managements leadership, and other critical environmental factors, and can influence overall organizational innovation ability (Chou et al., 2010; Dunn and Mott,

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2009; Grewa and Slotegraaf, 2007; Polat, 2010; Sekiguchi et al., 2008; Vinarski-Peretz et al., 2011). When encountering the competitive educational environments of higher education and low birth rates in Taiwan, technical institutes and universities must create valuable operational performance through limited resources and organizational knowledge for sustainable operations.

They should emphasize cooperation with industries in order to enhance the cultivation of technical talents, creativity, and team work, as well as enhance organizational creativity and construct a “core ability” of software and hardware innovation (Chou et al., 2010; Damanpour and Wischnevsky, 2006; Imran et al., 2010; Liu et al., 2010; Meyer et al., 2010; Wen and Chiu, 2009).

For technical institutes and universities, upon organizational innovation climate, outcomes of innovative operations are revealed through excellent leadership, team work, and knowledge management, and can influence teachers’ creative instructions (Cassar and Briner, 2011; Chen and Hu, 2008; Jing and Zhou, 2010; O’Connor, 2008; Shieh, 2010). Organizational innovation indicators of technical institutes and universities refer to from-the-outside-in performance oriented organizational innovation evaluation. The evaluation function is explicit and quantitative.

The evaluation of organizational innovation climate scale can probe into organizational members’ perceptions of psychological climates, and both diagnose innovation criterion of evaluations and environmental factors of teachers’ creative performances (Chen and Kuang, 2010; Yavuz, 2010).

Chiu and Chen (2008) indicated that “characteristics of works and tasks”, “educational policy and social trends”, “organizational structure and operational mechanisms” and “interpersonal interactions” would influence the innovative climates of schools. It does not emphasize the working independence for organization member. Organizational innovation climate development is creative, and involves innovative climates and psychological security in order to maintain creative behaviors (Amabile et al., 1996; Baranik et al., 2010; Chen and Hu, 2008; Imran et al., 2010). Innovation climate is based on innovative behaviors or results; in other words, the members’ perceptions of organizational innovation would be displayed through workers’ sense of freedom, sense of adventure, and support, and it demonstrates their identification with and trust in the organization’s innovation (Iyer et al., 2006; Gumusluoglu and Ilsev, 2009; Jing and Zhou, 2010; Konings et al., 2007; Neiningner et al., 2010; Panaccio and Vandenberghe, 2009). This study completed team cohesion and working independence which lack previous studies of Neiningner et al. (2010) and Mathisen et al. (2006).

This study will develop instrument of organizational innovation climate and measure the perception of vocational and technological school in Taiwan.

LITERATURE REVIEW

Organizational innovation climate

Organizational innovation climate means that the atmosphere in which the organization encourages innovative behavior through the construction of formal measures and tools, as well as the provision of resources. Generally, organizational innovation climates are measured according to organizational operations, team work, learning and growth, leadership efficacy, working approach, environment, organizational values, resources, etc. (Chen and Huang, 2007; Chiu et al., 2009; Gumusluoglu and Ilsev, 2009; King et al., 2007; Patterson et al., 2005; Shieh, 2010).

Amabile and Grysiewicz (1989) measured organizational innovation climates by overall organization, characteristics of organizational management, control, and team work. The members’ perceptions of organizational innovation climates include: 1) emphasis on members’ innovative ability and working independence; 2) emphasis on interpersonal interactions and innovative equipments, 3) supervisors’ support and members’ innovative behaviors are the main concerns; 4) emphasis on bureaucratic structure in comparison to an open and empowered structure, attitude, and approach of creativity (Chuang et al., 2010; Crespell and Hansen, 2008; Fang et al., 2010; Grewal and Slotegraaf, 2007; Imran et al., 2010; Liu et al., 2010; Vinarski-Peretz et al., 2011; Polat, 2010; Yavuz, 2010).

Innovation leadership

For schools, innovation leadership is a key factor of sustainable operations. Dunn and Mott (2009), Gumusluoglu and Ilsev (2009) and Harryson (2008) suggested the importance of innovation leadership in a progress from a close system to an open strategy network system (Khaliq et al., 2011; Wang et al., 2010). O’Connor (2008) argued that appropriate culture, leadership context, and interface mechanisms within the mainstream organization are key factors of an innovation system. O’Connor (2008) also indicated the sense of being rewarded for identifying and implementing innovative ideas, and the sense of an organizational environment that is supportive of the development and implementation of innovative ideas. Employees’ idea generation the sense they are expected and encouraged to take the initiative and try new ways of doing things are critical characteristics of leadership in organizational innovation climates (Cassar and Briner, 2011; Dunn and Mott, 2009; Wang et al., 2010).

Bouckenoghe et al. (2009) suggested that participation, support of supervisors, quality of change communication, and the attitude of top management toward

change are the processes of organizational change; however, the members' cognitive, intentional, and emotional readiness result from change.

Team cohesion

For teams, team cohesion relies on supervisors that support the teams as models; from high ranking to the basic level, members agree to creative jobs, develop vision of new ideas, and share values, and construct an open environment, which facilitates good interactions with employees and is reliable (Baranik et al., 2010; O'Connor, 2008; Meyer et al., 2010; Lee and Yu, 2010; Neiningner et al., 2010).

Bouckennooghe et al. (2009) deduced 10 dimensions of organizational changes from literature, and suggested that trust in leadership, politicking, and cohesion are important variables for members' perceived changes of organizational climates.

Working independence

For teachers, working independence means that their works should be accepted and independently determined by teachers to further develop teachers' creative talents and behaviors (Gumusluoglu and Ilsev, 2009; Reuvers et al., 2008; Rooney and Gottieg, 2007; Tsai et al., 2010). Teachers' working independence aims to result in members' self-growth, and emphasizes the necessity of organizational openness, trust, communication, and participation (Bernacki, 2002; Panaccio and Vandenberghe, 2009; Yang and Hsu, 2010). Bouckennooghe et al. (2009) suggested that in the processes of organizational changes, members would actively interpret related incidents and phenomenon by participating in shared jobs, using resources provided by supervisors, and the challenge of job. Thus, working independence emphasizes teachers' freedom of thought and debate, and leaders should provide them with resource support and rewards.

Based on the above, organizational innovation climate includes three major constructs: 1) innovation leadership: supervisors have unique creative opinions and support creativity on the job; 2) team cohesion: there is positive communication between diverse members, and open and respectful attitudes toward new ideas; 3) working independence: members are motivated to control job content accomplished and future progress by their thoughts and cognition. This study aims to develop an organizational innovation climate scale for technical institutes and universities. It targets technical universities and vocational schools to probe into their teachers' perceptions of organizational innovation climates. Through exploratory and confirmatory factor analysis (EFA), this study extracts the dimensions of organizational

innovation climates of technical institutes and universities, and examines the reliability of the organizational innovation climate scale by confirmatory factor analysis (CFA) in order to accomplish scale development through reliability and validity testing.

RESEARCH METHODS

Study 1: Scale writing

This study first designs pretesting for an organizational innovation climate scale; the items in the draft are based on the scale proposed by Chiu et al. (2009), Organizational Change Questionnaire—Climates of Change, Processes, and Readiness (OCQ—C, P, R) of Bouckennooghe et al. (2009), and climates for innovation scales of King et al. (2007). According to literature, there are five main factors, with each factor involving 8-10 items, and the elimination of improper items. There are 65 items in the scale for pretesting.

Study 2: Scale examination

Upon expert examination, teachers' modifications, and an expert panel, the propriety of content and items of scale for the pretest are validated as follows:

1. Expert examination: five participants with instructional and administrative experience in vocational schools and technical universities had three discussions in order to examine the questionnaire contents, and upon the addition or elimination of some items, a total of 52 items remain.
2. Teachers' modifications: this researcher invited five teachers with more than 15 years of experience teaching at different levels in order to modify the descriptions in the draft to meet teachers' thoughts and cognition.
3. Expert panel: 21 principals and directors of vocational schools and technical universities were invited to discuss the overall questionnaire direction. In groups, they discussed the items with the aim of enhancing their meanings. They also examined descriptions, meanings, theories, concepts, perceived innovative educational values, and propriety of items in order to validate the content of the scale. After examination and upon organizational innovation characteristics of technical institutes and universities, this researcher generalized factors of the pretest scale, for a total of 40 items.

Study 3: Pretest of scale

Pretesting, item analysis and exploratory factor analysis are shown as follows:

1. Pretesting was based on convenience sampling; this study treated 185 technical institute and university teachers as pretest participants, consisting of 70% males, 30% females, 50% full-time teachers, and 50% teachers and administrators.
2. Item analysis: this study conducted missing value tests, descriptive tests, and extreme value comparisons on pretest samples, and item-total correlation analysis and overall consideration, and eliminated inappropriate items with significant skewness, extreme means, and large coefficient of skewness. Among the 185 pretest samples, the first and last 27% (about 52 people) of the total score of the full scale were treated as a high-score group and a low-score group. Criterion analysis of internal

consistency (t test of mean difference between high and low score groups) was conducted. According to analysis, the t value of the five items did not reach statistical significance, and thus, 10 items were eliminated, and 30 items were retained for factor analysis.

3. Exploratory factor analysis: factor analysis was conducted on extracted items in order to construct validity for the sub-scales and scales, and this study continued to eliminate improper items. Exploratory factor analysis was based on SPSS 16.0. Factors with eigenvalues over 1, and principal components analysis were adopted. Since correlation among factors was over 3, the factors were extracted by oblique rotation (Hair et al., 2006). After data analysis, KMO reached .938, Bartlett Sphericity Test was significant, Degrees of Freedom were 105, and commonality was over .6, which indicates that the scale was proper for factor analysis testing (Hair et al., 2006). According to the results of the first exploratory factor analysis, 30 items were categorized into four major factors, which explain 70.3% of the variance. Based on factor analysis, most items met the expected factors in pretesting; however, some items were allocated as independent factors. In order to extract definite and simple factors, they were categorized into three, and items with high load and stable fall factors were selected. After the second Principal Components Analysis, this study extracted 3 factors, each with an eigenvalue over 1. Scree Testing was slack after the third factor, thus, 3 factors were extracted. The total variance explained was 74.069%. Upon rotation, each factor involved five items, and the factor loadings of each item was between .767~.915, which indicates that the scale was proper (Henson and Roberts, 2006). In this stage, 15 items were retained for formal testing, as shown in Table 1.

Study 4: Formal scale study and analysis

Participants

A total of 750 questionnaires of the formal scale are distributed, and 627 effective questionnaires are returned, for a response rate of 82.3%. The respondents are teachers of 75 Taiwan vocational schools and technical university schools, stratified for region and educational networks. In this population, there are 5 public technical universities, 9 private technical universities, 4 public technical institutes, 7 private technical institutes, 28 public vocational schools, and 22 private vocational schools. Table 2 lists the basic information of the technical institutes and universities.

Materials

The formal version of the Measure of Organizational Innovation Climates for Technical Institutes and University Teachers (MOIC-TT) contains 15 items, after pretesting analysis. These items are presented in Table 1. Respondents were asked to rate these items on a five point Likert-scale, ranging from 1 (strongly disagree) to 5 (strongly agree). This study defines organizational innovation climates as organizational members' perceived descriptions of the workplace, which indicate innovation leadership, team cohesion, and working independence. In other words, the better the members' perceived school innovation leadership, team cohesion, and working independence, the higher the school organizational innovation climates will be.

RESULTS

Confirmatory factor analysis of MOIC-TT scales

In the pre-test, confirmatory factor analysis is conducted

with Lisrel 8.52 on the three factors extracted by exploratory factor analysis in pretesting. Hair et al. (2010) suggested examining the estimation errors of the parameters of the model prior to confirmatory factor analysis. Error variances, normalized parameter coefficients, and standard errors of data in this study are proper for fit testing. It is suggested that 200~500 samples are the most suitable for a structural equation model. By SPSS16.0, 200 teachers are randomly selected as samples, including 62% males and 38% females, for confirmatory factor analysis. Fit test results are shown in Figure 1 and Table 3:

1. Absolute Fit statistics: Chi-Square (χ^2) is 247.24, Degrees of Freedom are 87, χ^2 /d.f. is 2.841; Root Mean Square Residual (RMR) is 0.036, Root Mean Square Error of Approximation (RMSEA) is 0.044; Goodness-of-Fit Index (GFI) is 0.90, Adjusted Goodness-of-Fit Index (AGFI) is 0.86, and Expected Cross-Validation Index (ECVI) is 1.32. Measures of absolute fit statistics all meet the criterion (Hair, 2010; Hu & Bentler, 1999).
2. Incremental Fit statistics: Normal Fit Index (NFI) is 0.97, Relative Fit Index (RFI) is 0.97, Incremental Fit Index (IFI) is 0.98, Non-Normed Fit Index (NNFI) is 0.98, and Comparative Fit Index (CFI) is 0.98. Hair (2010) et al. suggested that Incremental Fit measures should be above .9. Data of this study meets the criterion (Bagozzi & Yi, 1988; Bentler & Bonett, 1980).
3. Parsimony Fit statistics: Akaike information criterion (AIC) is 263.40, Parsimony Normed Fit Index (PNFI) is 0.81, Critical N(CN) is 121.39, and Parsimony Goodness of Fit Index (PGFI) is 0.65. Data of this study meets the criterion (Bentler and Bonett, 1980).
4. Factor correlation: there is a correlation among the three factors of organizational innovation climates, with values ranging between .61~.80. All coefficients reach the significance level (.001), indicating high degree of correlation. Moreover, the correlation coefficients are not significantly different. There can be only one latent factor called organizational innovation climates (Chiu et al., 2009).

Internal consistency and descriptive of MOIC-TT scales

This study measures the internal consistency of the three scales with Cronbach's α coefficient. The results (Table 4) show a high internal consistency (>.97) for the three scales. The mean scores of the three scales show that teachers of the total sample are positive towards factors of school organizational innovation climates in Taiwan. According to Table 4, regarding teachers' perceived organizational innovation climates, their agreement to "Team Cohesion" (M=3.89; SD=0.79) is the highest; the second is "Innovation Leadership" (M=3.48; SD=0.87), followed by "Working Independence" (M=3.89; SD=.67).

Table 1. Results of the exploratory factor analysis

Scale Name	Description	Source of literature	Item description	Component			Commonality
				I (working independence)	II (innovation leadership)	III (team cohesion)	
Working Independence	Organizational members are motivated to control accomplished jobs and progress according to their thoughts and cognition.	Chiu, Chen and Lin(2009) ; King, Chemrmont, West, Dawson & Hebl (2007) Mathisen, Torsheim, & Einarsen (2006)	1. I constantly think over innovative teaching materials and approaches	.824*	.381	-.408	.690
			2. I develop students' diverse intelligence and creativity by diverse teaching approaches.	.839*	.418	-.402	.707
			3. Besides regular instructional administration regulations of the school, teachers can freely include creativity in course design.	.767*	.581	-.416	.626
			4. Teachers of the school can implement creative instructional ideas in instruction.	.791*	.649	-.509	.693
			5. I can actively promote and implement instructional innovative ideas.	.825*	.534	-.420	.690
Innovation Leadership	Organizational members perceive work support for active innovation in different sections, and teachers are stimulated to try creative and vital approaches.	Amabile & Gyskiewicz(1989); O'Connor (2008); Mathisen, Torsheim, & Einarsen (2006)	6. The school values human resources and encourages creative thinking.	.575	.825*	-.494	.702
			7. The school financially supports innovative R&D.	.458	.826*	-.521	.686
			8. Supervisors of the school respect different creative ideas and opinions.	.539	.889*	-.550	.794
			9. Exchange and communication are easy in the school.	.444	.899*	-.519	.813
			10. The school advocates freedom and innovative reform.	.514	.876*	-.558	.772
Team Cohesion	Positive communication in teams with diverse members; open and respectful attitudes toward new ideas.	Chiu, Chen and Lin(2009) ; Amabile & Gyskiewicz (1989); Bouckennooghe, Devos & Broeck (2009)	11. Our team has morale and fighting power.	.417	.502	-.909*	.828
			12. Our team can immediately solve problems.	.453	.515	-.905*	.819
			13. Our team has clear and definite goals.	.461	.506	-.915*	.839
			14. I can fulfill my goals in this department.	.426	.582	-.842*	.724
			15. Colleagues of the school share common consensus.	.408	.525	-.853*	.729
Inter-factor Correlations				I	II	II	
I				-	-.579	.550	
II					-	-.480	
II						-	
Eigenvalue				1.260	8.134	1.717	
Explained variance				8.398%	54.225%	11.446%	
Accumulated explained variance				74.069%	54.225%	65.671%	
Cronbach's α of factors				.931	.873	.918	
Cronbach's α of full scale					.939		
Kmo					.938		
Bartlett Sphericity test					.000		

Table 2. Analysis of basic information of technical institutes and universities.

	Basic information	Groups	No of people	%
Technical university schools	Gender	Male	231	69.0%
		Female	104	31.0%
	Educational background	University (or below)	12	3.6%
		Master	105	31.3%
		Doctor	218	65.1%
	Seniority	5 years or less	55	16.4%
		5~10 years	99	29.6%
		10~15 years	87	26.0%
		More than 15 years	94	28.1%
	Current position	Full-time teachers and administrators	159	47.5%
		Full-time teachers	176	52.5%
	Current position	Professor	27	8.1%
		Associate professor	125	37.3%
		Assistant professor	97	29.0%
		Lecturer	86	25.7%
	Background teachers of	Science and engineering, agriculture, and design	135	40.3%
		Business management, tourism, and recreation	134	40.0%
Health and medicine		20	6.0%	
Liberal arts, law, education, and literacy		46	13.7%	
School attribute	Public	122	36.4%	
	Private	213	63.6%	
School classification	Technical university	175	52.2%	
	Technical institute	160	47.8%	
Number of students	5,000 students or less	73	21.8%	
	5,001~10,000 students	159	47.5%	
	More than 10,001 students	103	30.7%	
Vocational schools	Gender	Male	163	55.8%
		Female	129	44.2%
		University (or below)	152	52.1%
	Educational background	Master	136	46.6%
		Doctor	4	1.4%
	Seniority	5 years or less	78	26.7%
		6~10 years	44	15.1%
		11~20 years	90	30.8%
		More than 21 years	80	27.4%
	Current position	Administrators	31	10.6%
		Full-time teachers	127	43.5%
		Teachers and administrators	134	45.9%
	School attribute	Public	195	66.8%
		Private	97	33.2%
	School scale	Less than 15 classes	5	1.7%
		16-30 classes	45	15.4%
		31-45 classes	128	43.8%
More than 46 classes		114	39.0%	
School history	10 years of less	1	.3%	
	11~20 years	13	4.5%	

Tables 2. Contd.

		21~30 years	36	12.3%
		More than 31 years	242	82.9%
General program	Yes		172	58.9%
	No		120	41.1%
Years of general program	Without general program		120	41.1%
	Less than ten years		125	42.8%
	More than ten years		47	16.1%
Percentage of classes of general program	Without general program	Less than 25%	120	41.1%
		More than 25%	100	34.2%
			72	24.7%

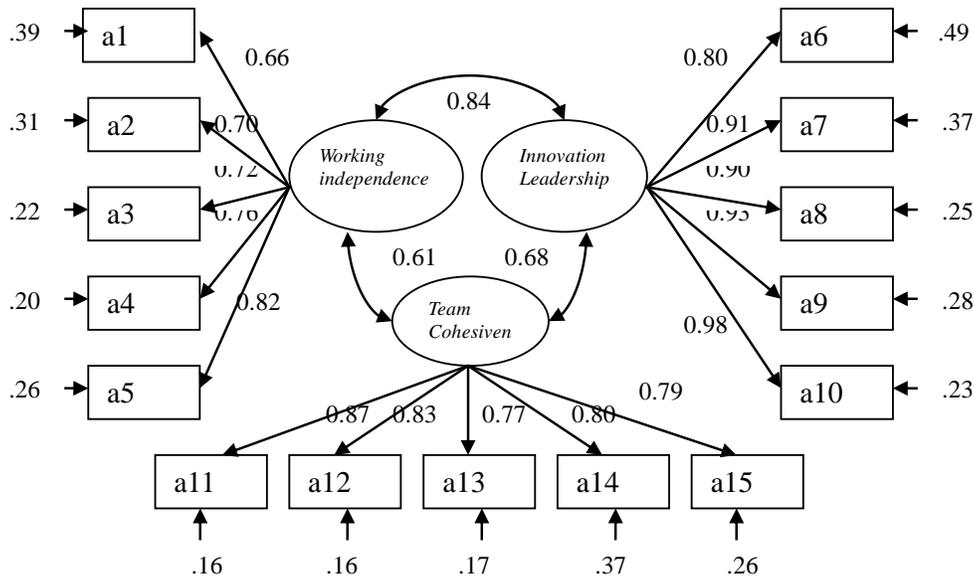


Figure 1. Confirmatory Factor Analysis

Cronbach's α of the three factors are .873, .918, and .931, respectively, and Cronbach's α of the full scale is .968, which demonstrates a high degree of internal consistency.

DISCUSSION AND RESEARCH LIMITATIONS

Dimensions of "Measure of Organizational Innovation Climates for Technical Institutes and University Teachers (MOIC-TT) developed by this study include innovation leadership, team cohesion, and working independence. Results of reliability, validity, and factor analysis are proper. The attitude scale is reliable, and effectively probes into working conditions and organizational operations. Innovations should be accomplished through

both working independence and team work. It demonstrates meanings and uniqueness of the different levels in organizational cultures (Chiu et al., 2009; Fang et al., 2010; Polat, 2010; Shieh, 2010).

Findings of data analysis of MOIC-TT suggest that, regarding technical institutes and university teachers' perceived organizational innovation climates, they tend to agree to "team cohesion" and "working independence", and disagree with "innovation leadership" as the important factors of organizational innovation climates (Bouckenoghe et al., 2009; Chen and Kuang, 2010; Gumusluoglu and Ilsev, 2009; Khaliq et al., Yang and Hsu, 2010). Innovation leadership functions as a potential activator within an organization; moreover, there is a high degree of correlation between members' creative behaviors and working outcomes. Members' innovation

Table 3. Parameter estimation of model.

Parameter	Non-Standard Parameter	Standard Error	t
λ_1	.66	.057	11.63
λ_2	.70	.055	12.9
λ_3	.72	.05	14.3
λ_4	.76	.051	15.0
λ_5	.82	.056	14.57
λ_6	.80	.065	12.25
λ_7	.91	.064	14.24
λ_8	.90	.058	15.38
λ_9	.93	.061	15.22
λ_{10}	.98	.061	16.09
λ_{11}	.87	.053	16.54
λ_{12}	.83	.051	16.25
λ_{13}	.77	.049	15.64
λ_{14}	.80	.06	13.35
λ_{15}	.89	.054	14.51
Φ_{21}	.84	.003	30.91
Φ_{22}	.61	.05	12.35
Φ_{31}	.68	.04	15.86
$\bar{\delta}_1$	.39	.043	9.07
$\bar{\delta}_2$	.31	.036	8.7
$\bar{\delta}_3$	.22	.027	8.07
$\bar{\delta}_4$	.20	.026	7.6
$\bar{\delta}_5$	.26	.033	7.9
$\bar{\delta}_6$	.49	.053	9.17
$\bar{\delta}_7$	.37	.043	8.57
$\bar{\delta}_8$	.25	.032	7.97
$\bar{\delta}_9$	.28	.035	8.08
$\bar{\delta}_{10}$	.23	.032	7.4
$\bar{\delta}_{11}$	.16	.022	7.13
$\bar{\delta}_{12}$	.16	.021	7.44
$\bar{\delta}_{13}$	.17	.021	7.95
$\bar{\delta}_{14}$	.37	.041	8.98
$\bar{\delta}_{15}$	.26	.03	8.57

Table 4. Cronbach's and descriptives for the six scales of the total sample (n=627).

Constructs	α	M	SD
(1) Working Independence	0.873	3.89	0.67
(2) Innovation Leadership	0.918	3.48	0.87
(3) Team Cohesion	0.931	3.89	0.79

and creativity can be stimulated by leaders, allowing organizations to develop creativity and a free and innovative reform culture. Moreover, with financial support and communication of innovative ideas, innovation leadership is key in the construction of organizational innovation strategies and policies (Chen and Huang,

2007; Gumusluoglu and Ilsev, 2009; Imran et al., 2010; Reuvers et al., 2008; Yavuz, 2010). Results of Gumusluoglu and Ilsev (2009) suggested that transformational leadership has important effects on creativity for both individual and organizational levels. At the individual level, the results of hierarchical linear modeling show that there is a positive relationship between transformational leadership and employees' creativity. In addition, transformational leadership influences employees' creativity through psychological empowerment. Since supervisors have greater resources and authority than teachers, they should demonstrate their influence through innovation leadership. In addition to being a model, they should encourage teachers to be creative and break from tradition in order to enhance the creativity and innovation of schools.

This study finds a high degree of correlation between working independence and innovation leadership. Thus, for technical institutes and university supervisors and leaders, when teachers have high individual and team independence, they will be able to control job progress and creativity; and when individuals perceive their options to finish tasks, they would be more creative, such as innovative teaching materials and approaches, using diverse instructional approaches, developing students' diverse intelligence and creativity, teachers' free involvement of creativity in course design, and implementation in actual instruction. Teachers will undertake innovative instruction and innovative responsibility by "self-monitoring" and "self-control" to carry out "working independence" in order to accomplish self-commitment; with working independence, the members will solve problems with high degrees of imagination, intelligence, and creativity (Cassar and Briner, 2011; Meyer et al., 2010; Vinarski-Peretz et al., 2011; Tsai et al., 2010).

Organizational innovation climates emphasize members' perceptions of an organization, and values adventure, challenge, freedom, relaxed atmosphere, resources, undertaking risks, and failure tolerance (Baranik et al., 2010; Chuang et al., 2010; Chen and Kuang, 2010; Neiningner et al., 2010). Through scale results of innovation leadership, working independence, and team cohesion, this study effectively interprets the critical content of innovative climates. Jobs should be psychologically accepted by individuals; individual talent development should be allowed; and individuals should be allowed significant self-determination. In order to result in the self-growth of members and place emphasis on the necessity of organizational openness, trust, communication, and participation, practical applications are as follows: (1) working independence: teachers' knowledge sharing should be enhanced in order to improve efficacy of organizational innovation; (2) team cohesion: school innovation outcomes should be regularly examined and excellent teams should be rewarded to enhance school innovation; schools can encourage different departments to become innovative partners, or to cooperate and exchange ideas with other schools in order to construct an innovation community; (3) innovation leadership: supervisors should enhance the intelligence of innovation leadership, organizational vision, and commitment in order to fulfill school innovative operational outcomes, demonstrate reform attitudes, and administrative support in order to increase school innovation operational performance. Regarding administration management and innovative operations of information technology, approachability of transformational leadership and respect for, and trust in, members should be enhanced.

Conflict of Interests

The authors have not declared any conflict of interests.

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Full Length Research Paper

Organizational performance and readiness for change in public sector undertakings

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The present study makes an assessment of the readiness/resistance to change of employees of State Public Sector Undertakings (SPSUs), compares readiness between executives and workers of SPSUs, employees of SPSUs and Central Public Sector Undertakings (CPSUs), and between employees of Public Sector Undertakings (PSUs) making profits as well as losses. The factors affecting readiness to change were identified from literature. A standard questionnaire was used to explore the factors that contribute to the success/failure of organizational changes. A comparative study of readiness to change among the employees of State and Central PSUs is carried out using statistical measures. The study established that the human factor in the State PSUs of Kerala is less resistant and more favorably disposed to change. The executives of SPSUs are more willing to change than workers. Comparing the readiness to change of employees of SPSUs and CPSUs, the former is found more willing. There is no significant difference in the attitude to change between employees of SPSUs making profits as well as losses. Employees of CPSUs in Kerala that are making losses are more willing and less resistant to change, whereas those making profits are less willing and more resistant to change. The present research makes use of an instrument already developed by a previous researcher in a similar study. Further there is a limitation by the adequacy of samples used. The findings of the present research are of much assistance in developing strategies for the revival of PSUs in Kerala. Resistance to change of employees is alleged to be the militating factor against revival of the PSUs in Kerala. The present study comes out with findings not only to disprove this notion but also that the workers, in general, welcome change.

Key words: Central PSUs, State PSUs, organizational change, business process reengineering, critical success factors, critical failure factors, revival, readiness/resistance to change.

INTRODUCTION

Organizations need to adapt to changes as competition, technology, innovation, international integration etc. contribute to volatility and uncertainty in the industrial

scenario. Organizations that are resistant to change, normally, wither away. Business Process Reengineering (BPR) is offered to be a possible solution to this issue.

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BPR involves drastic improvements in process, process redesign, and radical change in the organization. BPR is a 'fundamental rethinking and radical redesign of business processes to bring about dramatic improvements in performance' (Hammer and Champy, 2001). World-class techniques like Benchmarking, Total Productive Maintenance (TPM), Total Quality Management (TQM), Lean, Six Sigma, etc. are powerful tools in achieving revival of organizations.

Forces of competition are the same for firms in the public and private sector units but the latter adapts quickly and easily to the changing environment. Public Sector Undertakings (PSU) reforms, as a rule, are sluggish. However, public sector reforms have been taking place in developed nations as well as many developing countries in Africa, Asia and Latin America (Jooste, 2008). Internal reform and reforms in governance have been the two broad reform movements. Measuring the performance of PSUs in the context of public sector reforms has been subject to considerable amount of research, in the past 20 years (Modell, 2005). It is obvious that organizational change is channelized through the people - the animating force- in their managerial and operational roles. Naturally, organizational change is to begin with an assessment of the mindset of the people, which should focus on their willingness / resistance to change as well as the probable solutions to alleviate resistance, if any.

Background of the study

Role of PSUs in the development of any nation, especially those that are developing cannot be over-emphasized (AL-Abrow, 2013). Glancing the Indian scenario (Kanungo et al., 2001), observes that PSUs dominated the Indian economy until the early 1990s. PSUs have also occupied a predominant position in the country's economy as it helps industrialization, generation of employment, and dispersal of industries to different parts of the country (Antony, 1992). While the global recession of 2008 rattled the economies of most of the developed countries, Indian economy remained mostly unaffected on account of the special role that PSUs enact (Kareem, 2011). However, the maladies afflicting Indian PSUs leading to low capacity utilization have been subjected to considerable discussion and criticism of experts, and the public at large.

It is a contention that Central PSUs seek havens in other States of the Union on account of unwholesome industrial climate caused by unfriendly labour practices in Kerala. Still the State of Kerala has a considerable number of State Public Sector Undertakings (SPSUs). These units together employed 132,677 personnel during 2012-13. Government of Kerala (GOK) report (MGP: II.2.1, 2005), laments that SPSUs "... in the manufacturing

sector have been plagued by poor standards of Corporate Governance". Reasons adduced are: diffused nature of ownership, lack of synchronization of critical state sponsored interventions for improving its performance, conflicting objectives advocated by trade unions, inadequate incentives for competent personnel, delayed decision making, redundancy of manpower and improper person-task fit, outdated technology and unviable processes. Many SPSUs were closed down due to their inability to survive even after revival trial under the supervision of Bureau of Industrial and Financial Reconstruction (BIFR) of Govt. of India. However, some sick units have been revived after implementing revival package under the supervision of BIFR. There is urgent need for changes and reforms of the nature of Business Process Reengineering (BPR), as the number of PSUs that face the threat of closure due to accumulated losses has increased.

It is very difficult to transform an organization that is constantly in flux and changing due to difficulties in base lining the organization, where the organization was reeling from several years of financial losses, management discord, layoffs, and the possibility of being shut down (Chick, 2000). Public Sector Reform attempts to strengthen PSUs that are poorly organized, with irrational decision-making processes, staff mismanaged; weak accountability, poorly designed public programs and poorly delivered public services (Schacter, 2000). By implementing BPR techniques, it is possible to reduce money cost by 81 per cent, time cost by 74 per cent, human resource involved by 69 per cent and considerable improvement in efficiency and effectiveness enabling the organization to earn itself the envious status of a vibrant, dynamic and progressive concern (Zaheer et al., 2008). On their study about Organizational Change Effectiveness in an Indian Public Sector, Nandan and Verma (2013), identified four change outcomes viz; enhancement in employee involvement, improvement in employees' performance management, improvement in work environment, and improved organizational systems. The key Critical Success Factors (CSFs) for successful BPR in public sector organizations are; top management support, commitment and understanding of BPR, communication; empowerment, alleviation of downsizing fears, preparedness for organizational change, choosing the re-engineering team, and enlisting customer and stakeholder support (McAdam and Donaghy, 1999). In a comparative study on successful Federal Bureaus and unsuccessful Bureaus of United States, Simon (1998) found that a successful group had significantly higher perceived quality in terms of Leadership, Information and Analysis, Strategic Planning, Human Resource Development and Management, Process Management, Business Results, and Customer Focus and Satisfaction. Any strategic change which has impact on the enterprise due to some radical financial, and/or organizational adjustment

and is affecting the majority of the staff or having impact on the financial health of the operation is regarded as significant change by Chrusciel and Field (2006). To Weiner et al. (2008) "... readiness for change is related to and focused on planned and deliberated organizational change (often initiated by management) to move an organization from its present state to more proactive and desirable future, thereby making the organization more effective and efficient". According to Beer and Walton (1987) "readiness refers to the social, technological, or systematic ability of a group or organization to change or try new things".

Employees and organizational change

Organizational change, however, is contingent on the living force of business than on premises, assets and the like. "... employee's readiness for change and employees relationship with their managers was the strongest predictor of readiness for change" (Miller et al., 2006). To Mueller et al. (2012), a key prerequisite for successful change in organizations is to understand and develop the readiness for change of employees and of their organization. Acceptance and cooperation of employees is a sine qua non for implementation of any effort on organizational change. Naturally employee's readiness for change should be assessed. On the specifics of the change Alhaqbani (2013) emphasizes that the organization should include employees in decision-making to obviate resistance to future change and training to be provided to managerial personnel, who apply their new skills and knowledge, and share data. The organization should focus on elimination of errors and commitment to participation in improvement activities and also teamwork, knowledge-sharing and strong culture of informal communication between organization members for implementation of change. Employees who had higher 'margin in life levels' have higher 'overall readiness for change perceptions' (Madson et al., 2006; Armenakis et al., 1993) and readiness for change is significantly related to commitment to change- employees with high commitment to their organization will be more ready to accept and deal with organizational change (Al-Abrow, 2013). Supervisors' perceptions of their own readiness for change and their perceptions of the organization's readiness for change are highly related (Kling, 2003). Cinite (2006) developed a conceptual framework that would link organizational members' attitudes towards transformational change, organizational context and the perceived organizational readiness to change in public sector. The major readiness factors identified are; Commitment of senior management to the change, competence of change agents, and support of immediate managers during the change. The unreadiness factors identified are; Poor communication of

change, adverse impact of the change on work, and lack of employees' involvement in the change process. 'Resistance to change' is a major barrier to the success of BPR. Employees perceive BPR as a threat to their jobs, either directly to their existence or a threat to the quality and content of their jobs, or as causing the lack of promotion (Corrigan, 1996). To Grey and Mitev (1995), resistance of employees to change is mainly due to "fear" or "misunderstanding", which can be overcome through employees' participation in the change process.

The Critical Success Factors (CSF) for implementing a significant change are; planning and analysis, Assessment, Comprehensive communication, Perception of organizational readiness to deal with change, Top management support, User training of application, Perceived utility, and Staff critical mass (Chrusciel and Field, 2006). Holt (2002) identified the readiness factors as; Personal Confidence, Need for change, Personal benefits, Organizationally beneficial, Management support, Personal Confidence, and Need for change. Shah (2011) found that organizational justice factor can be influenced to develop positive employees' attitudes and behaviours for organizational change. To Barrera (2008), readiness for change is significantly related to; organizational commitment, intrinsic and extrinsic job satisfaction, and years employed. The major determinants for readiness for change are resources available for change, the leaders' orientation, the qualification of employees, the quality of supporting systems including information systems and the organization's structure (Elgamal, 2012).

Abdolvand et al. (2008) have given a graphic presentation of the success and failure factors of BPR implementation. The BPR Success Factors, to them are: Egalitarian leadership, Collaborative working environment, Top management commitment and Sponsorship, Change in management systems and Use of Information Technology. There are 17 sub-factors in these five Success factors. Resistance to change explains the failure factor which include; Middle management fear of losing authority, employees' fear of losing job, skepticism about project result, and feeling uncomfortable with new working environment. The BPR Success Factors with their sub factors and the resistance factors with their sub factors given by Abdolvand et al. are used per se in this research study for measuring the readiness / resistance of employees of PUSs in Kerala.

RESEARCH METHODOLOGY

Kerala has at present 93 SPSUs grouped under 13 sectors. However, the population of the present study is limited to the 37 PSUs under the administrative control of Department of Industries, Government of Kerala. In the first place, we analyzed the net profit made by the organizations for the period 2001-02 to 2012-13 on the premise that where profitability is poor or negative, change is mandatory. Profitability data was collected from the Review of

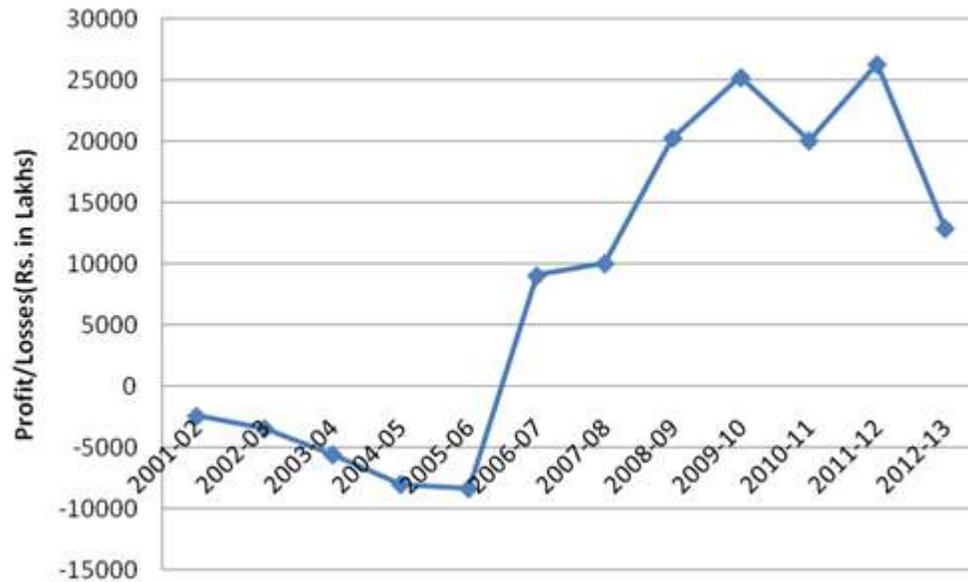


Figure 1. Performance of SPSUs.

Public Enterprises published by Bureau of Public Enterprises, Govt. of Kerala for the years from 2001-02 to 2012-13. The net profit made by these 37 companies during this period is compiled and is given in Appendix 1. A visual presentation of the same is given in Figure 1.

In the second step, we tried to identify the readiness factors applicable to the PSUs in Kerala. For this we examined the literature on organizational change and readiness to change to identify most typical factors. The five critical success factors (with 19 sub factors) and the resistance factors (with 5 sub factors) given by Abdolvand et al. (2008) have been found to be extremely relevant and useful in the present context of research for measuring the readiness of employees of PUSs in Kerala. Using the above mentioned factors, we have developed a questionnaire. On account of the difference in the cultural context of the original and present studies, we conducted a pilot study and collected expert opinion for ensuring reliability to this questionnaire. The test of reliability using Cronbach's Alpha revealed a score of 0.88, denoting high reliability for the tool. In the original study, by Abdolvand et al. (2008) based on which the present questionnaire is developed; the Cronbach's Alpha was 0.76.

Readiness levels of each organization is assessed and compared by collecting data from executives and workers. Comparison is also made on readiness to change between better performing organizations and poor performing organizations. Two Central Public Sector Undertakings (CPSUs) were selected for comparing the readiness of SPSUs with CPSUs in Kerala. Various statistical tools are used for assessing the significance of difference in readiness to change. We place our findings in the order as narrated above.

RESULTS

Figure 1 gives a summary of the performance of the SPSUs for the period 2001-02 to 2012-13.

Performance of the PSUs remained poor during the period 2001-02 to 2005-6. There is an ugly record of 25 SPSUs, out of the 37, making loss during 2001-02. On comparing the profit/loss made by companies in various sectors, it is seen that performance of Chemical and Developmental and Infrastructure sectors was good as they showed positive net profit for the entire study period. The ceramic sector made profit for six out of 12 years, electrical and electronics sector made loss for six out of 12 years and made nominal profits for the remaining years. Engineering and manufacturing sector, textile sector, traditional industries and welfare agencies were making losses for most of the years in the study period. Performance of some of these sectors improved in subsequent years due to conducive steps taken by GOK. To measure the performance of CPSUs in Kerala, two typical organizations Heavy Machine Company and a Health Care Company were selected. The performances of the selected CPSUs are presented in Appendix 2. This is presented in Figures 2 and 3.

It can be seen that the Machine Tools Company (MTC) has been making losses for seven years and the Health Care Company (HCC) has been performing well and making profits for the entire period.

Measurement of readiness/resistance

In the light of the poor performance of the PSUs, it is natural to think about methods of revival, for which readiness of employees is given a serious thought of. Five Readiness factors of change with their respective

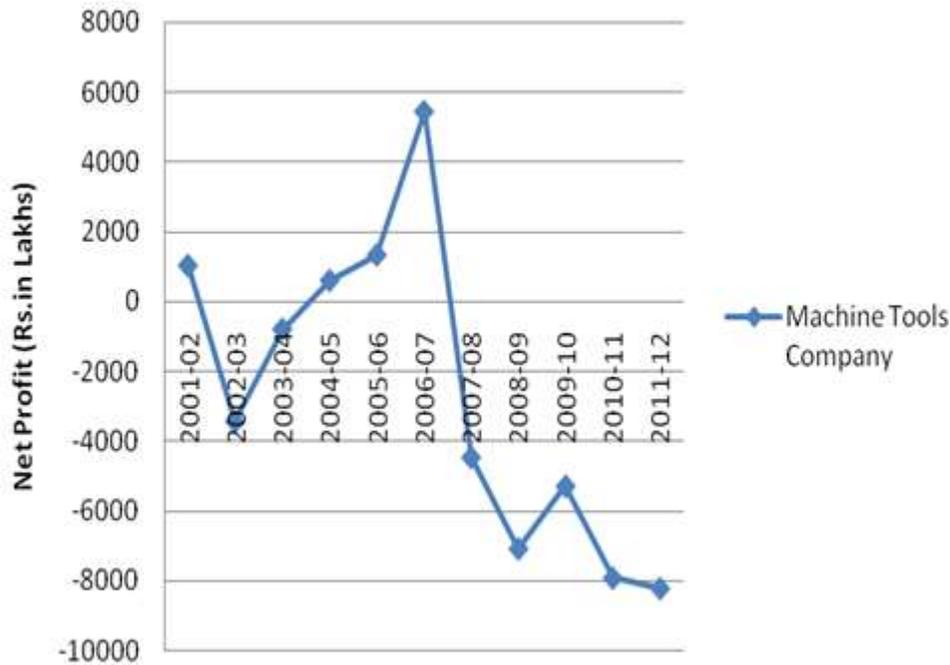


Figure 2. Performance of machine tools company.

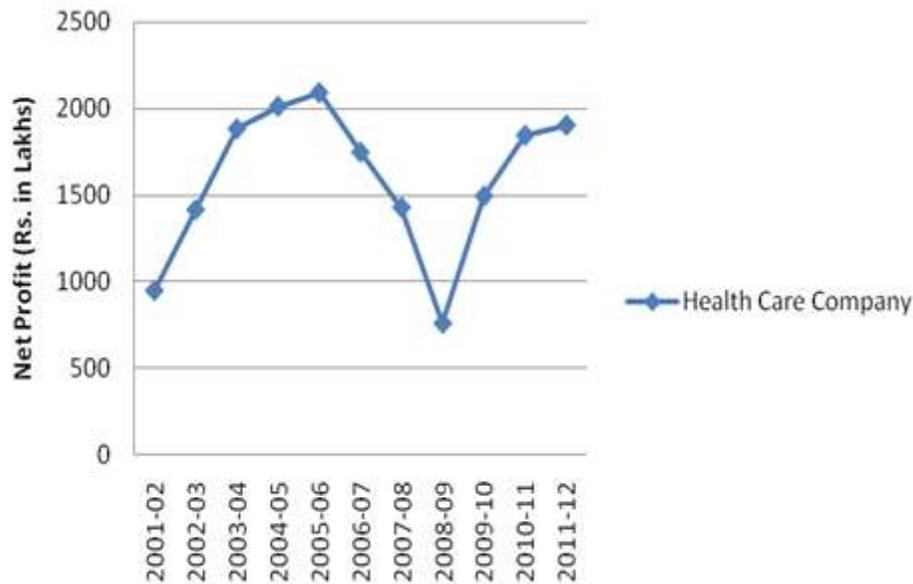


Figure 3. Performance of health care company

sub factors and the resistance factor along with its sub factors are given in Table 1.

We have used Likert type ordinal scale in measuring the level of readiness of employees under five readiness factors. The options given to particular questions are: (a)

always, (b) more, (c) moderately, (d) less and (e) never with values 5, 4, 3, 2 and 1 respectively, assuming an equal interval between choices. With regard to the resistance factors the options measures their worriness towards change.

Table 1. BPR success/failure factors*.

No	Factor	Item
I. Readiness Factors		
1	Egalitarian leadership	Shared vision/information Open communication Confidence & trust in subordinates Constructive use of subordinates' idea Friendly interactions
2	Collaborative working environment	Confidence and Trust Team work performance Corporative Environment Recognition among employees
3	Top management commitment	Sufficient knowledge about BPR project Realistic expectation of BPR result Frequent communication with BPR team and users New reward system
4	Change in management systems	Performance measurement Employee Empowerment Timely training and education The role of IT
5	Use of Information Technology	Use of up to date communication technology Adoption of IT
II. Resistance Factor		
1	Resistance to change	Middle Management fear of losing authority Employees fear of losing job Skepticism about project result Feeling uncomfortable with new working environment

*Abdolvand et al. (2008).

Readiness to change of executives and workers of SPSUs

A comparative study of readiness to change/resistance to change of executives and Workers of SPSUs in Kerala is given in Table 2.

According to the system given above, a value greater than 3 shows that readiness to change is more than moderate. The table shows very clearly that both workers and executives are in favour of change. The group mean of the readiness to change for executives is 3.76 and that of workers is 3.15, which shows that both groups are favourably disposed to change. The mean value of each group tells us the extent of readiness in that factor. It also gives us a comparison of readiness. Therefore it can be stated that the executives exhibit the highest degree of readiness in respect of 'collaborative working environment' (4.04), followed by 'top management commitment' (3.99) and 'egalitarian leadership' (3.95). Similarly the mean values against each readiness factor in respect of the workers tell us the area in which they are more or

less ready to change. Coming to resistance, the values are 2.81 and 2.72 respectively for executives and workers, showing that both groups are less resistant to change.

Table 3 gives the results of t-test comparing the mean values of readiness to change of Executives and Workers of SPSUs. In the case of 'egalitarian leadership', 'collaborative working environment' and 'top management commitment' there is significant difference in readiness to change between executives and workers. On the other hand in factors such as 'change in management system', 'use of information technology', and 'resistance to change' there is no significant difference in readiness between the above two categories.

Table 4 gives the results of t-test comparing the overall mean of readiness to change of Executives and Workers of SPSUs.

In the case of overall readiness, there is significant difference between executives and workers even at 99 per cent confidence, clearly indicating that executives show greater readiness to change than workers.

Table 2. Readiness to change of executives and workers of SPSUs.

Number of Respondents (N)	Executives (35)			Workers (147)		
	Mean	Factor Mean	S.D	Mean	Factor Mean	S.D
A. Egalitarian leadership						
1- Shared vision/ information	3.97		0.95	2.87		1.42
2- Open communication	4.11	3.95	0.83	2.80	2.89	1.33
3- Confidence & trust in subordinates	3.91		0.78	3.12		1.29
4- Constructive use of subordinates' idea	3.80		0.72	2.78		1.32
B. Collaborative working environment						
1- Friendly interactions	3.91		0.89	3.30		1.35
2- Confidence & trust	4.03		0.92	3.13		1.35
3- Teamwork performance	4.57	4.04	0.56	3.44	3.19	1.80
4- Cooperative environment	4.06		0.87	3.22		1.35
5- Recognition among employees	3.63		0.84	2.87		1.38
C. Top Management Commitment						
1- Sufficient knowledge about the projects	3.97		0.79	3.20		1.41
2- Realistic expectation of results	3.91	3.99	0.78	3.22	3.23	1.57
3- Frequent communication with project team and users	4.09		0.82	3.27		1.41
D. Change in Management Systems						
1- Good reward system	3.40		0.88	2.93		1.51
2- Performance measurement	3.46	3.32	0.85	3.01	3.00	1.48
3- Employee empowerment	3.23		0.88	3.01		1.44
4- Timely training & education	3.20		0.80	3.04		1.45
E. Use of Information Technology						
1- The role of IT	3.46		0.95	3.31		1.40
2- Use of up-to-date communication technology	3.46	3.50	0.85	3.44	3.44	1.45
3- Adoption of IT	3.57		0.95	3.58		1.58
Readiness to Change Mean		3.76			3.15	
F. Resistance to change						
1- Middle management fear of losing authority	3.03		0.98	2.79		1.58
2- Employees fear of losing job	2.74		1.04	2.62		1.67
3- Skepticism about project result	2.74	2.81	0.78	2.80	2.72	1.52
4- Feeling uncomfortable with new working environment	2.71		0.99	2.68		1.58
Resistance to change Mean		2.81			2.72	

Source: Primary Data.

Readiness to change between SPSUs and CPSUs

A comparative analysis is made on the readiness to change between employees of SPSUs and that of CPSUs as given in Table-5.

An analysis based factors on willingness to change bet-

ween employees of State and CPSUs is done in Table 6.

From Table 6 it can be seen that, between SPSUs and CPSUs there is no significant difference in readiness in the factor 'egalitarian leadership', but there is significant difference in other readiness factors.

The overall readiness to change among employees of

Table 3. t-test of readiness to change of executives and workers of SPSUs.

Readiness factors	Employees' grade	N	Mean	Std. Deviation	t-value	Sig. (2-tailed)
Egalitarian leadership	Executives	35	15.8000	2.67670	5.57	0.000*
	Workers	147	11.5646	4.30047		
Collaborative working environment	Executives	35	20.2000	3.35892	4.34	0.000*
	Workers	147	15.9660	5.52753		
Top management commitment	Executives	35	11.9714	2.05062	3.63	0.000*
	Workers	147	9.6871	3.58613		
Change in management systems	Executives	35	13.2857	2.78199	1.56	0.121**
	Workers	147	11.9864	4.73111		
Use of Information Technology	Executives	35	10.4857	2.52483	0.24	0.807**
	Workers	147	10.3197	3.81415		
Resistance to change	Executives	35	11.2286	3.20005	0.39	0.694**
	Workers	147	10.8912	4.80458		

Note: * Significant at 95% confidence level; **Not significant.

Table 4. t-test of total readiness of executives and worker.

Employees' grade	N	Mean	Std. Deviation	t-value	Sig. (2-tailed)	Sig. (1-tailed)
Readiness Total	Executives	35	60.514	10.703	3.648	0.00034*
	Workers	147	48.633	18.521		

Note: * Significant at 99% confidence level.

Table 5. Readiness to change of SPSUs and CPSUs in Kerala.

Number of Respondents (N)	State PSUs (182)	Central PSUs (56)
	Factor Mean	Factor Mean
A. Egalitarian leadership	3.70	2.87
B. Collaborative working environment	3.36	2.78
C. Top Management Commitment	3.38	2.79
D. Change in Management Systems	3.06	2.62
E. Use of Information Technology	3.45	2.59
Readiness to Change Mean	3.39	2.69
F. Resistance to change	2.74	3.38

SPSUs is higher than that of CPSUs in Kerala, with values respectively of 3.39 and 2.73 and is found significant by the t- test. In the case of resistance to change, the State PSUs have a moderate value of 2.74, whereas that of CPSUs is 3.38 indicating less willingness to change. This finding is also supported by the t-test. In short employees of SPSUs are more inclined to change

than that of CPSUs.

Comparison of readiness of SPSUs making profits and those making losses

In order to analyze the readiness of employees in SPSUs

Table 6. t-test for readiness to change factors of SPSUs and CPSUs in Kerala.

Readiness factors	Public sector category	N	Mean	Std. Deviation	t - value	Sig.(2-tailed)
Egalitarian leadership	SPSU	182	12.38	4.37	0.65	0.519**
	CPSU	68	11.97	4.66		
Collaborative working environment	SPSU	182	16.78	5.44	2.46	0.014*
	CPSU	68	14.78	6.41		
Top management commitment	SPSU	182	10.13	3.46	2.92	0.004*
	CPSU	68	8.68	3.58		
Change in management systems	SPSU	182	12.24	4.45	2.17	0.031*
	CPSU	68	10.93	3.68		
Use of Information Technology	SPSU	182	10.35	3.60	4.58	.000*
	CPSU	68	8.04	3.39		
Resistance to change	SPSU	182	10.96	4.53	-3.52	.001*
	CPSU	68	13.18	4.17		
Readiness Total	SPSU	182	50.92	17.90	3.55	0.000*
	CPSU	68	41.22	22.33		

Note: * Significant at 95% confidence level; **Not significant at 95% confidence level.

making profits and those making losses, one of the SPSUs from Electronic Sector, which is running at profit for past few years and one of the SPSUs from Ceramics Sector which is running at loss for almost all years in study period are selected and the findings are given in Table 7.

Only in 'collaborative working environment' and 'change in management systems' significant difference is shown between SPSUs making profits as well as losses. On no other factor the difference in readiness to change is significant. This result shows that in almost all SPSUs readiness to change is mostly positive. Therefore it is proved that employees in all SPSUs welcome change.

Comparison of readiness to change of employees of CPSUs making profits as well as losses

A comparative statement of the analysis of the readiness to change of employees of CPSUs making profits as well as losses is given in Table 8.

From Table 8 it is seen that readiness to change is low (2.29) in the case of employees of CPSU making profit - Health Care Company (HCC), compared to (3.44) that of CPSU making loss viz. Machine Tools Company (MTC). Likewise resistance to change is more (3.76) for CPSU

making profit than that of CPSU making loss (2.86). It is found that employees of CPSU making loss are more in favour of initiating change than employees of CPSU making profit. And in the case of resistance to change, employees of CPSU making loss are less resistant. This is confirmed by the result of the t-test given in Table 9.

DISCUSSION

The study aimed at identifying the scope for implementing change in PSUs of Kerala. From the performance evaluation, it is found that most of the SPSUs are poor performers and require change for survival. Organizational readiness for change is influenced by individual readiness for change (Armenakis et al., 1993). Supervisors' perceptions of their own readiness for change and their perceptions of the organization's readiness for change are highly related (Kling, 2003). In the present study overall readiness for change of executives is 3.76 and that of workers is 3.25 indicating high readiness of employees for change. Standard deviation of the readiness for workers is more than that of executives which shows that there is more variation in opinions of workers than that of executives. From Table 3 it is seen that there is no significant difference in

Table 7. Readiness/resistance to change of SPSUs making profits and those making losses.

Readiness Factors	Type of SPSUs	N	Mean	Std. Deviation	t-Value	Sig. (2-tailed)
Egalitarian leadership	Making Profits	31	10.00	4.06	-1.86	0.067**
	Making Losses	29	11.97	4.11		
Collaborative working environment	Making Profits	31	18.90	4.77	7.69	0.000*
	Making Losses	29	10.62	3.41		
Top management commitment	Making Profits	31	9.06	3.86	-0.65	0.516**
	Making Losses	29	9.66	3.07		
Change in management systems	Making Profits	31	11.35	4.83	-2.13	0.037*
	Making Losses	29	13.90	4.38		
Use of Information Technology	Making Profits	31	10.16	4.02	-0.96	0.342**
	Making Losses	29	11.17	4.15		
Resistance to change	Making Profits	31	13.03	4.44	1.64	0.106**
	Making Losses	29	11.03	4.97		
Readiness Total	Making Profits	31	46.45	19.96	0.38	0.970**
	Making Losses	29	46.28	15.14		

Note: * Significant at 95% confidence level; **Not significant.

Table 8. Readiness/resistance to change of CPSUs making profits as well as losses.

Readiness/Resistance Factors	Health Care Company Making Profit (N=33)	Machine Tools Company Making Loss (N=35)
	Factor Mean	Factor Mean
A. Egalitarian leadership	2.35	3.60
B. Collaborative working environment	2.12	3.75
C. Top Management Commitment	2.43	3.32
D. Change in Management Systems	2.33	3.11
E. Use of Information Technology	2.23	3.42
Readiness to Change Mean	2.29	3.44
F. Resistance to change	3.76	2.86

readiness to change between executives and workers in certain factors, whereas in certain other factors and in total of readiness to change there are significant differences. The p-value of 0.00068 in one tailed t-test shows that the overall readiness to change of executives is more than that of workers. Readiness for change of executives and workers are good and the figures of executives are comparatively more than that of workers. The argument that readiness for change is significantly related to managerial commitment is supported by Al-Abrow (2013), Madsen et al. (2005), Shah and Shah (2010) and Cinite (2006). So there is better scope for

change in the PSUs in Kerala.

We have attempted a comparison of the readiness / resistance of the employees of the SPSUs with CPSUs in Kerala and it is found that there is significant difference in the readiness and resistance to change of the employees of SPSUs and CPSUs. It is also our finding that readiness to change of employees of SPSUs is better than that of CPSUs and resistance is less in SPSUs than CPUs.

We further attempted a comparison of the readiness / resistance of the employees of SPSUs and CPSUs making profits and losses. In the case of SPSUs there is

Table 9. t-test of CPSU Making Profit and Making Loss.

Readiness Factors	Company Name	N	Mean	Std. Deviation	t-value	Sig. (2-tailed)
Egalitarian leadership	HCC	33	9.39	4.79	-5.23	0.000*
	MTC	35	14.40	2.94		
Collaborative working environment	HCC	33	10.58	5.91	-6.79	0.000*
	MTC	35	18.74	3.85		
Top management commitment	HCC	33	7.30	4.24	-3.29	0.002*
	MTC	35	9.97	2.19		
Change in management systems	HCC	33	9.33	3.93	-3.80	0.000*
	MTC	35	12.43	2.73		
Use of Information Technology	HCC	33	6.70	3.65	-3.43	0.001*
	MTC	35	9.31	2.59		
Resistance to change	HCC	33	15.03	4.42	-3.93	0.000*
	MTC	35	11.43	3.06		
Readiness Total	HCC	33	28.27	24.40	-5.48	0.000*
	MTC	35	53.43	10.31		

Note: * Significant at 95% confidence level.

no significant difference in readiness and resistance, whereas in the case of CPSUs there is significant difference in readiness and resistance to change between those making profits and those making profits. The employees of the CPSU making loss are found to be more ready for change than that of CPSU making loss. These facts establish that there is good scope for implementing change in SPSUs in Kerala.

Conclusion

The study aimed at identifying the scope for implementing change in PSUs of Kerala. A preliminary investigation established that most of the SPSUs are poor performers and require substantial changes to survive. The overall readiness for change of executives and workers was encouraging. Further, no significant difference in readiness to change was observed between executives and workers in certain factors, whereas in other factors and in total of readiness to change there are significant differences. A comparison was also done between the readiness / resistance of the employees of the SPSUs and CPSUs. A significant difference in the readiness and resistance to change was found between employees of SPSUs and CPSUs. The readiness to change of

employees of SPSUs is better than that of CPSUs and resistance is less in SPSUs than CPSUs. Another significant finding was that the employees of the CPSU making loss were more ready for change than that of CPSU making loss. This establishes that there is good scope for implementing change in SPSUs in Kerala.

The study established that the human factor in the State PSUs of Kerala is less resistant and favorably disposed to change. The executives of SPSUs are more willing to change than workers. Comparing the readiness to change of employees of SPSUs and CPSUs, the former is found more willing. No significant difference was observed in the attitude to change between employees of SPSUs making profits as well as losses. Employees of CPSUs that are making losses are more willing and less resistant to change, whereas in those making profits they are less willing and more resistant to change.

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Full Length Research Paper

Effect of knowledge management practices (KMPs) and the moderating role of interpersonal trust (IPT) on firm's performance (FP): A study in software industry of Pakistan

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The purpose of this study is to analyze the effect of knowledge management practices on the firm's performance in software industry of Pakistan. A co relational research design using a multiple regression was used to test the causal relationships among the knowledge management practices, firm's performance and the moderating role of interpersonal trust. Hypotheses were tested through field research study carried out on 38 firms in information technology industry of Pakistan. Quantitative data using convenient sampling technique were collected through questionnaires. The important finding of this paper is that the presence of IPT as a moderator changes the direction or strength of relation between KMPs and FP. This study contributes to the growing body of literature linking knowledge management and the resource base view and knowledge base view and determines practices that have a positive incidence on firm's performance. The paper concludes that developing interpersonal trust among employees can lead to effective implementation of KMPS which increases the firm's performance. Future cross-cultural research would be valuable and may reveal details about the phenomena in a broader context.

Key words: Knowledge Management Practices (KMPs), Firm Performance (FP), Interpersonal Trust (IPT), Resource Base View (RBV), Knowledge Base View (KBV).

INTRODUCTION

In the last decade, knowledge management (KM) has become a line of research attracting much interest. Although the literature had already worked implicitly with knowledge, the increasing spread of theoretical works on

KM is due to the importance it has for the firm, as well as the development of the knowledge-based view (Marques, 2006). The aim of this research is to study the importance of KMPs as a source of sustainable competitive

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advantages for firms and to analyze how the introduction of IPT enables FP to improve. The practices that have a more positive influence on firm performance are also obtained. Knowledge is considered as power by most of the writers in the contemporary environment. Bock et al. (2005) use the word power for knowledge to explain the importance of knowledge. The value of knowledge and learning in improving organizational competence has increased in the current climate of increasing global competition and there is no doubt about it (Prieto and Revilla, 2004). Knowledge management is taken as a pillar for improving the performance of the firm and for providing the competitive advantage. Knowledge management initiatives have enabled the organizations to experience successes by proper utilization of knowledge in the form of best practices that lie within the firm. But knowledge management practices are not given much importance in developing countries like Pakistan where literacy rate is not very high (Abass et al., 2011). In the 21st century, those who master knowledge will control their competitive future. However, failed programs far outnumber successful ones because most companies experience unexpected challenges in developing knowledge management strategies and practices. These challenges include measuring knowledge management and identifying its effect on organizational performance (Darroch and McNaughton, 2002).

Knowledge management is an intangible concept, and much of the literature continues to explore these intangible issues. Employees in software industry hesitate to share knowledge among each other because of the fear of loss of confidential data when an employee leaves the organization. Due to this employees can not develop interpersonal trust among each other. Literature provides many examples of such organizations where all the learning and knowledge is lost when employees are moved to new roles or they leave the organization. Pakistan's software industry comes under the ministry of information technology. The major advantage the software industry offers to developing countries like Pakistan is that most of the software development projects are from international market, while all the expenses and salaries are paid at local rates, which are considerably lower as compared to other countries. Therefore in Pakistan, doubtlessly, software industry has currently the highest profit making potential. The study of introducing KM in the firm and its effects revolves around determining whether it is able to carry out quantifiable improvements.

The aim of this research is to find out the link between knowledge management practices and firm performance taking interpersonal trust as a moderator in software industry of Pakistan. General question asked by this research paper is what are the levels of knowledge management practices and the firm performance of Software industry in Pakistan? Specific questions that

this research paper aims to answer include the following:

1. What is the relationship between knowledge management practices and firm performance?
2. What role does interpersonal trust play in knowledge management practices and firm's performance?

Currently, IT industry is a fastest growing industry in Pakistan. It plays a vital role in a country's economic growth. Thus, the information about the relationship between KMPs, FP and IPT gained from this study can assist software employers in sustaining their FP through improved KM practices. It also highlights the role of two important ignored variables; KMPs and IPT in improving the FP.

LITERATURE REVIEW

There is a great deal of literature conceptualizing the terms of knowledge management, interpersonal trust and firm's performance.

Knowledge management

To Davenport and Prusak (1998), knowledge management is an ability that is built on information that is gained from bunch of opportunities that people have with respect to any context. Management of an organization's intellectual capital and strategic relationships is termed as knowledge management by Quible (2001). This management involves creating or acquiring knowledge, storing and protecting it, updating and maintaining it, and its application and use whenever required. Suzana (2010) discussed that knowledge possess by a firm is an asset in its own right and the manner by which an organization uses it directly affects its functionality. She explains that it is a resource that plays an important supporting role within the firm.

Performance measures of a firm can be seen with respect to the speed of developing competencies based on knowledge. Major competitive advantages of firm reside in knowledge. Intellectual capital and knowledge are considered among the competencies based on knowledge Nonaka (1994). Decarolis and Deeds (1999) showed that knowledge management involves acquiring, converting and applying the knowledge and its use to improve the social capital, finally improving the overall performance of the firm. It gives rise to the first hypothesis that,

H₁: Knowledge management practices are directly and significantly related to firm's performance

Knowledge Management Practices (KMPs)

Studies conducted in recent times indicated that effective

knowledge management can be resulted by the mix of three things which are appropriate organizational culture, integrated technical infrastructure and employees' willingness to create, share and apply knowledge (Alavi and Leidner, 2001; Silva et al., 2007). There are found no models that explain the knowledge management practices relationship with the performance of the organizations. According to Decarolis and Deeds (1999) and Davenport (1999) this gap is due to the fact of problems in knowledge management area to appropriately measure the most important concepts. Competitive advantage can be created by firms through managing social capital systematically using knowledge management practices, which involve knowledge acquisitions, conversion and application.

Knowledge acquisition

Knowledge acquisition is referred to as seeking new knowledge entirely or new knowledge creation from the existing one. A study by Gold et al. (2001) found that new knowledge can be created out of existing knowledge through collaboration between business partners and employees. Process of creating, generating, building and knowledge construction is involved in knowledge acquisition. During the process of knowledge acquisition, employee acquires, collects, seeks, creates, generates and captures the knowledge and consequently cooperates with other employee to utilize that knowledge. Nonaka and Takeuchi (1995) described the spiral process of knowledge creation while individual in an organization searches for and generates knowledge.

To Morten et al. (1999), the most important thing about acquisition of knowledge is to observe it how it is acquired and applied, irrespective of the type of knowledge. It means that it is not important whether it is explicit or tacit knowledge or it is de-codification strategy or codification strategy, but it should reflect a firms' competitive strategy to achieve the target goals. The findings of a study conducted by Salina and Fadzilah (2010) concluded that managers and owners of small and medium size enterprises need to create and acquire excessive knowledge to enhance firm's performance because previous studies confirmed that the key contributor to better performance is knowledge acquisition. The creation and acquisition of data into information and information into knowledge can be achieved through social capital. Based upon this, a new hypothesis is;

H_{1a}: The way an organization acquires knowledge is directly related to its performance

Knowledge conversion

Gold et al. (2001) found that those activities which make

existing knowledge useful are referred to as knowledge conversion. It includes organizing knowledge which is created or acquired already and using it in a manner that allows knowledge to become accessible and formalized (Szulanski, 1996). During the process of knowledge conversion, acquired knowledge which may be tacit or explicit or both is converted, distributed and incorporated, controlled and then structured. There is need to have structuring and integration of knowledge through standards otherwise it would become difficult to manage the asset effectively due to the lack of common representation standards and there will be no consistency of knowledge (Gold et al., 2001). Additionally, it is quite possible that knowledge resides in different segment or departments or systems within the organization. Effective integrations of such knowledge enhance the consistent representations, improve efficiency by ruling out too much editions (Balogun and Jenkins, 2003).

In the words of Gold et al. (2001), some of the commonly used means to facilitate incorporations are sequencing, commands and rules, decision making and problem solving. So next hypothesis can be developed as,

H_{1b}: The way an organization converts knowledge is directly related to its performance

Use or responsiveness to knowledge/ knowledge application

Process that involves storage, recovery, use and distribution is referred to as knowledge applications (Gold et al., 2001). Knowledge is of little use if employees fail to share it properly, and there is no point of collection and storage of knowledge without having a use of it. In this process of knowledge application, explicit or tacit knowledge is used and shared in the employees of the organization. Storage of knowledge during the process of application is for retrieval purpose in the future. An organization needs to explore and exploit the knowledge regarding application of knowledge. It is because of the fact that knowledge exploration enables the organization to push itself into a new niche, while exploitation aids in the financial capital to fuel the successive rounds of innovations and explorations (Al-Alawi et al., 2007).

Park (2006) gave a model in which he classified knowledge management process capability into four components. These components are knowledge creation/acquisition, knowledge transfer/conversion, knowledge application/use, and knowledge protection. Summary of the findings of his study was that knowledge management performance might be able to impact on the knowledge management process capability (knowledge creation, knowledge transfer, use of knowledge, and knowledge security) through a feed-back mechanism.

Next hypothesis can be structured as follows,

H_{1c}: The way organizations use knowledge is directly related to its performance

Firm's performance

After the introduction of knowledge management in the organizations, conceptions of the organization as an important successful factor is acknowledge by Dibella and Nevis (1998). Knowledge management can be viewed comprehensively by taking together not only the organizational function and its members as well as its directly related organizations. A study conducted on impact of knowledge management process on processes, people products and firm's performance discussed by Becerra et al. (2004) showed that knowledge management processes can affect the four areas of the organizations in two main ways:

1. Knowledge management can directly cause enhancements in people, process, products and performance of the firms,
2. Knowledge is created through the use of knowledge management which then improves the performance of the organizations.

Gold et al. (2001) conducted a study which revealed a positive relationship between knowledge creation, use of knowledge and FP. Mohrman and Finegold (2003) found similar results and examined that when organizations create and use their knowledge, firm's performance is improved. Marques and Simon (2006) working on SMEs in telecommunication and biotechnology found that knowledge creation, its conversion and protection lifts up firm's performance. A study by Davenport and Prusak (1998) found that performance of the firm is perked up through proper identification and distribution of required knowledge.

Interpersonal trust

It is the trust that individuals place on the opposite individuals (Rempel and Holmes, 1986). According to Dingsoyr (2002), use of knowledge creation and knowledge application tools requires motivation and trust among employees. Hamid (2008) found that studies have revealed that interpersonal trust is associated with organizational variables such as communication quality, organization performance, organization citizenship behavior, decision making, problem solving, individual risk taking, and cooperation. According to Andrews and Delahaye (2000), when there is lack of trust then formal practices of knowledge-sharing are insufficient to encourage employees in the organization to share knowledge with others. To Prusak and Cohen (2001),

through high levels of employee trust, the benefits of better shared goals, knowledge sharing and low transaction costs could be achieved.

A study by Jandia (2009) proposed that interpersonal trust moderates the relationship between knowledge management processes and knowledge management effectiveness with medium effect size. His findings were consistent with the findings of Smith and Shoho; (2007 and Hamid (2008) that interpersonal trust exerts a positive moderating effect on the relationship between knowledge management processes and knowledge management effectiveness.

H₂: Interpersonal trust will moderate the relationship between KMPs and firm's performance

Ribiere and Tuggle (2005) cited in *Knowledge Management capabilities and the Moderating effect of Interpersonal trust on km Effectiveness* describe that without trust, knowledge management will be a failure, regardless of how carefully it is supported by the technology infrastructure and knowledge transferring processes.

RBV and KBV

The RBV of the firm considers that resources are not limited to the traditional economic productive factors. They also include socially complex resources, such as interpersonal relationships within firm managers, the firm's culture, or its reputation near the suppliers or clients (Barney, 1991). This view emphasized that primary focus of firms should be on its most important and fundamental intangible resource that is knowledge (Kalling, 2003). Intangible resources are more likely than tangible resources to generate competitive advantage. Such advantage is developed over time and cannot easily be imitated (Hitt et al., 2001). The KBV of the firm considers knowledge as the most important strategic resource and, in that sense; this perspective is an extension of the RBV of the firm. The interpretation of knowledge as a resource establishes the theoretical connection between the RBV and the KBV. The RBV of the firm literature justifies the existence of differences in performance between organizations as a consequence of knowledge asymmetries (capabilities and competences). As a result, an important KBV of the firm proposition states that the organization exists to create, transfer and transform knowledge into competitive advantage (Kogut and Zander, 1992).

CONCEPTUAL FRAMEWORK

The research model is given in Figure 1.

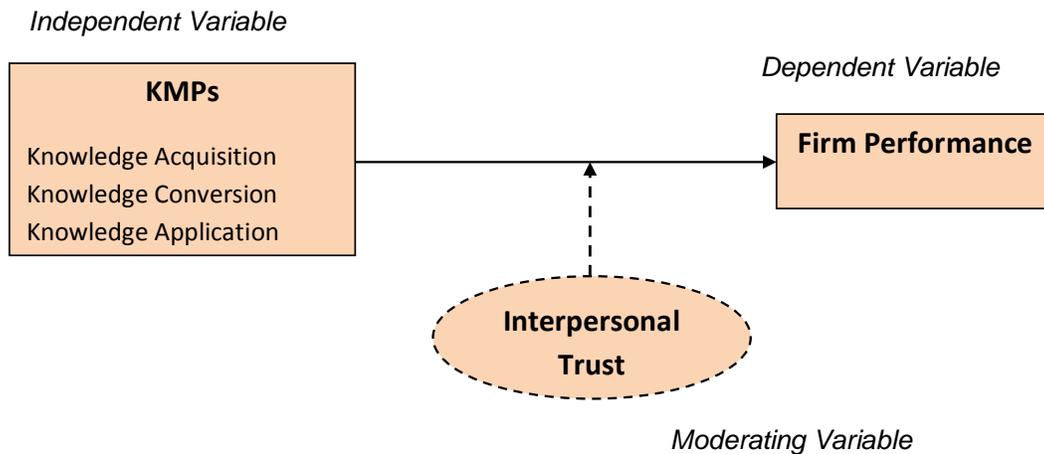


Figure 1. Research model.

RESEARCH METHODOLOGY

The information technology industry has been chosen for the research because the management of intangibles is appreciated more clearly than in other types of industries. Knowledge is not a simple asset but it focuses on other assets. To be successful, firms must be able to learn continually and apply their knowledge, anticipating market changes (Alvesson, 2000). In this environment, the ability to create and apply knowledge becomes an important source of competitive advantages.

The study posed two research questions and 2 hypo-theses. The three sub hypotheses test for the main effects of each of the independent variables on dependent variable, FP. For hypothesis 1, the independent variable is KMPs and dependent variable is FP and for hypothesis 2, KMPs is independent variable, IPT is moderating variable and FP is dependent variable. The research is quantitative in nature because its aim is to determine the relationship between KMPs, an independent variable and FP, a dependent variable in a population. Primary data through questionnaires were collected for this purpose.

Population and sample

The population targeted for this study was those companies of Islamabad and Rawalpindi which are member of the Pakistan Software House Association. Their information is available at P@SHA. The names and e-mail addresses of chief executive officers and managers of software companies were available from the web site. A total of 38 software houses of Islamabad are listed at P@SHA. Convenient sampling was used based on those individuals who were the key providers of the information and those individuals who were willing to participate in the study. Online as well as self administered questionnaires were distributed among employees. 74 questionnaires were sent online to all the executives and managers of the listed organizations. 90 questionnaires were mailed to employees of selected organizations through personal contacts. 250 self administered questionnaires were distributed among 12 organizations. In this regard, a total of 414 questionnaires were distributed and 318 were answered with a response rate of 76%. The statistical debugging of the questionnaires meant 31 of them had to be eliminated for various reasons (existence of items without answers, doubts about the

reliability of the responses, respondents do not fulfill the requirement of being employed in the organization for at least 6 months etc.). The sample finally included 287 questionnaires. The estimated average number of employees in the organization was 110.

Instruments and statistical techniques used

After reviewing the literature, the first step was to develop measurements and scales for Knowledge Management Practices (KMPs), Interpersonal trust and FP. For measuring Knowledge management practices, scale developed by Park's (2006) 26-item Knowledge Management Process Capability Scale was used. Part 1, 2 and 3 of the questionnaire measured the independent variable KMPs. Part 4 measured the FP and for this, the scale developed by Deshpande et al. (1993) was used. Part 5 of the questionnaire measured interpersonal trust. The scale for measuring this variable was adapted from Rempel and Holmes (1986). The last part of the questionnaire was based on controlled variables.

Each dimension and the total scale was measured by a five-point semantic differential agreement/disagreement scale anchored with 1=strongly disagree to 5=strongly agree. A high score indicates a strong agreement on this item and a low item score indicates strong disagreement.

The data collected from the survey through mail or self administration were analyzed using the statistical software package SPSS 17.0. The methods used for data analysis to answer the research questions and test hypotheses include descriptive statistics, correlation and multiple regressions. According to Jaccard et al. (1990) a multiple regression analysis is the appropriate statistical technique for this purpose, in order to determine whether a relationship exists between the predictor and the moderator variables. A number of researchers used these techniques in measuring KMPs and FP. For example, Salina and Fadzilah (2010), Suzana (2010), Azaze (2009), Chuang (2004), Lee and Choi (2003) used correlation, multiple linear regression, ANOVA, and F-statistics.

Data analysis and interpretation

The analysis and interpretation of the data is as follows. To measure estimates of internal consistency, coefficient alpha is used. The

Table 1. Estimates of internal consistency.

Construct	No of items	α coefficient
KMPs	20	.866
KACQ	6	.796
KCON	8	.823
KAPP	6	.797
FP	5	.894
IPT	5	.746

Table 2. Frequency distribution of the respondents according to their gender, age, experience, education and designation.

	F	Percent
Gender		
Male	238	82.9
Female	49	17.1
Age		
26-31	111	38.7
32-37	94	32.8
38 & above	82	28.6
Education		
PhD	1	.3
MS(CS)	16	5.6
MCS	92	32.1
BCS	98	34.1
Other	80	27.9
Designation		
Software Engg.	12	4.2
Sr. Software |Engg.	89	31
Team Lead	41	14.3
Manager	31	10.8
Technical Writer	25	8.7
HOD	22	7.7
VP	16	5.6
President	3	1.04
Graphic Designer	48	16.72
Experience		
1-2 years	85	29.6
2-4 years	110	38.3
4-6 years	38	13.2
7 years & above	54	18.8

calculated coefficients indicate that the scales of the measuring instruments provide high internally consistency measures (Table 1).

Data Overview

Frequency distribution of the respondents according to their gender,

age, experience, education and designation are given in Table 2.

Correlations

Regression

According to Katherin and Sanford (2009), Regression analysis is a technique used to identify the nature of the relationship between the dependent and the independent variables. KMPs and FP are independent and dependent variables respectively.

Model 1: Direct effect of KMPs on Firm’s performance

In the words of Stephen and Thomas (1985), correlation is a technique used to test a linear relationship between the variables. The results of this study were to draw on the resource-based perspective and knowledge-based perspective of the firm to explicate the firm’s KMPs, its relationship to FP and the moderating role of IPT.

Table 3 contains correlations among the Knowledge Management Practices (KMPs), Firm Performance (FP) and interpersonal Trust (IPT). Significant correlations were found between KMPs and FP (0.462 and $p=.000$), which indicates a positive relationship between the two constructs; this supports the first Hypothesis (H1). There is also a strong correlation among other variables e.g. correlation between KMPs and IPT is 0.518 and correlation between FP and IPT is 0.721. All these correlations indicate significant positive relationship. Correlation among knowledge acquisition, knowledge conversion, knowledge application and firm performance was also found. The results of correlation indicate strong, positive relationship between Knowledge Acquisition (kacq) and FP (.661), Knowledge Conversion (kcon) and FP (.587) and Knowledge Application (kapp) and FP (.669). These results provide the evidence of acceptance of the sub hypothesis (H_{1a} , H_{1b} , and H_{1c}).

First of all direct effect of independent variable on dependent variable is checked by holding constant all intermediate variables between the two. Table 4 shows that KMPs has direct and significant effect on FP. This model is statistically significant, $F = 77.219^{***}$, $R^2 = .213$, $\Delta R = .213$, adjusted $R^2 = .210$, $\beta = .462^{***}$ and $t = 8.787^{***}$. This value of R^2 indicates that 21% of the variability in the dependent variable can be accounted for by all these three predictors together. This confirms our first hypothesis that KMPs has direct and significant relationship with FP.

Also the table shows that kacq has direct and significant effect on FP with $F = 102.204^{***}$, $R^2 = .317$, $\Delta R = .317$, adjusted $R^2 = .314$, $\beta = .563^{***}$ and $t = 11.39^{***}$. This value of R^2 indicates that 31% of the variability in the dependent variable can be accounted for by knowledge acquisition practice. This confirms our first sub hypothesis that kacq is directly related to FP.

Also the table shows that kcon has direct and significant effect on FP with $F = 81.749^{***}$, $R^2 = .223$, $\Delta R = .223$, adjusted $R^2 = .22$, $\beta = .472^{***}$ and $t = 9.042^{***}$. This value of R^2 indicates that 22% of the variability in the dependent variable can be accounted for by Knowledge conversion practice. This confirms our second sub hypothesis that kcon is directly related to FP.

Finally, the table shows that kapp has direct and significant effect on FP with $F = 112.67^{***}$, $R^2 = .358$, $\Delta R = .358$, adjusted $R^2 = .355$, $\beta = .598^{***}$ and $t = 12.597^{***}$. This value of R^2 indicates that 35% of the variability in the dependent variable can be accounted for by Knowledge application practice. This confirms our third sub hypothesis that kapp is directly related to FP.

To test the interaction, an interaction term named `ipt_kmps` is created. A stepwise hierarchical multiple regression analysis is employed to build a model for predicting effect of KMPs on FP

Table 3. Correlations.

	Mean	S.D	Kacq	Kcon	Kapp	KMPs	FP	IPT
Kacq	3.24	.627						
Kcon	3.38	.632	.780**					
Kapp	3.02	.604	.634**	.774**				
KMPs	3.149	.626	.514**	.534**	.568**			
FP	3.22	.675	.661**	.587**	.669**	.462**		
IPT	3.28	.597	.682**	.656**	.672**	.518**	.721**	

Table 4. Direct effect of KMPs on Firm performance.

	Kacq	Kcon	Kapp	KMPs
R ²	0.317	0.223	0.358	.213
Adj. R ²	0.314	0.22	0.355	.210
ΔR	0.317***	0.223***	0.358***	.213***
F Stat	102.204***	81.749***	112.677***	77.219***
B	0.563***	0.472***	0.598***	.462***
T	11.39***	9.042***	12.597***	8.787***

Table 5. Introduction of a moderator.

	Model 1	Model 2	Model 3
KMPs	0.462***		
KMPS		0.121***	
IPT		0.658***	
KMPs			0.207*
IPT			0.307***
ipt_kmps			0.592**
R ²	0.213	0.53	0.695
Adj. R ²	0.21	0.527	0.687
ΔR	0.213***	0.317***	0.16**
F Stat	77.219***	145.004***	157.015**

taking interpersonal trust as a moderated variable.

Model 2: Introduction of a Moderator

In addition, moderator variable interpersonal trust (IPT) is also used in study. Moderating relationship occurs when a third variable plays an important role in governing the relationship between dependent and independent variables. Louis (2008) gave definition of the moderator variable. According to him, moderator is such a variable that changes the relationship between an independent variable and a dependent variable (Table 5).

In the first, KMPs are added. This model is statistically significant, $F = 77.219^{***}$, $R^2 = .213$. Moderator variable Interpersonal Trust (IPT) is entered in the second step. Addition of this predictor significantly increased the fit of the model to the data, $F = 145.004^{***}$, R^2 change = .527 and adjusted $R^2 = .527$. It shows that

52% of variability in dependent variable is accounted for by IPT and together with other predictors, it accounts for 53% of the variability. The change in R^2 is a way to evaluate how much predictive power was added to the model by the addition of another variable in step 2. These results confirm second hypothesis that IPT moderates the relationship between KMPs and FP. The third and final step consisted of adding an interaction term, coding the interaction between KMPs and IPT. Addition of this predictor significantly increases the model R^2 , $F = 157.015^{**}$ R^2 change= .160 and adjusted $R^2 = .687$. It shows that 16% of variability in dependent variable is accounted for by interaction term and together with other predictors, it accounts for 69% of the variability. These results confirm that the model is statistically significant and F is continuously enhancing. The significant and positive relationship tells that organizations who reported higher levels of KMPs also reported higher levels of FP.

FINDINGS

There is found a direct and significant effect of knowledge management practices on Firm Performance. The first hypothesis of the study, H_1 : *Knowledge management practices are directly and significantly related to firm performance* supports the findings reported by Decarolis and Deeds (1999). Knowledge management is taken as a pillar for improving the performance of the firm and for providing the competitive advantage. Knowledge management initiatives have enabled the organizations to experience successes by proper utilization of knowledge in the form of best practices that lie within the firm.

The sub hypothesis, H_{1a} : *The way an organization acquires knowledge is directly related to its performance* is consistent with the findings of Morten et al. (1999), who found that the most important thing about acquisition of knowledge is to observe it how it is acquired and applied, irrespective of the type of the knowledge. It means that it is not important whether it is explicit or tacit knowledge or it is de-codification strategy or codification strategy, but the way it is acquired should increase its competitive position.

The second sub hypothesis of the study, H_{1b} : *The way an organization converts knowledge is directly related to its performance* is supported by Gold et al. (2001) who found that effective conversion of knowledge enhances the consistent representations, improves efficiency by

ruling out too much editions and provides opportunities to innovate. During the process of knowledge conversion, acquired knowledge which may be tacit or explicit or both is converted, distributed and incorporated, controlled and then structured. There is need to have structuring and integration of knowledge through standards otherwise it would become difficult to manage the asset effectively due to the lack of common representation standards and there will be no consistency of knowledge.

The third sub hypothesis of the study, H_{1c} : *The way organizations use knowledge is directly related to its performance* is supported by Al-Alawi et al. (2007) who found that organization needs to explore and exploit the knowledge regarding application of knowledge. It is because of the fact that knowledge exploration enables the organization to push itself into a new niche, while exploitation aids in the financial capital to fuel the successive rounds of innovations and explorations.

The second main hypothesis of the study, H_2 : *Interpersonal trust moderates the relationship between KMPs and firm performance* is consistent with the findings of Smith et al. (2007), Hamid (2008) and Jandia (2009) that interpersonal trust exerts a positive moderating effect on the relationship between KM processes and KM effectiveness. According to Dingsoyr (2002), use of knowledge management practices requires motivation and trust among employees. It is easy to postpone knowledge management activities because of lack of time; confidentiality of information or that employee does not see how others can value their knowledge. In addition to it, if management requires such tools and employees on the other hand, are not motivated or willing, it is easy to do fake reporting of knowledge.

Conclusion

Software companies located in Rawalpindi and Islamabad have implemented and follow all knowledge management practices and recognize that their knowledge is an important asset that gathers over time and assists the organizations to become successful. Knowledge management practices help organizations capture knowledge across different skill sets and a strong positive relation is found among knowledge management practices and FP. The findings of this study provided strong support for the relationship between KM processes, social capital and firm performance. Interpersonal trust as an independent variable is strongly positively related to firm performance but when it is taken as a moderator, it seems to exert positive medium moderating effect on firm performance. In this present information age, it becomes very difficult for companies to replace their employees rather organizations start considering their employees a source of competitive advantage. Employees in present age are recognized by their ability to deal with new kinds of situations day every day occurring in their organizations.

They are recognized by their knowledge, experience and ability to perform unique tasks. Now organizations put a great attention towards saving employees knowledge as well as knowledge stored in their databases. Implementation of proper Knowledge management practices are very important for the success of organizations as well as for the knowledge workers and those organizations that are agreed with this statement are enjoying its unlimited and seamless benefits. The software industry is resource-based industry and it is very important for software employers to ensure that knowledge stored in the minds of resources is updated, valuable and protected. A study by Dingsoyr (2002) revealed that 42 percent of knowledge in the average organization is stored in employees' heads. History is full of such examples where all the learning and knowledge is lost when employees are moved to new roles or they leave the organization. Interpersonal trust is a pre-requisite for the effective implementation of KMPs. Introduction of interpersonal trust among employees of software industry puts a positive effect on firm performance. Developing interpersonal trust among employees can lead to effective implementation of KMPS which increases the firm's performance.

RECOMMENDATIONS

This paper suggests some future research recommendations where additional investigation may be fruitful. Future cross-cultural research would be valuable and may reveal details about the phenomena in detail. Secondly, future studies should be directed toward examining the behavior of personnel from different ethnic backgrounds. Thirdly, future studies may add other variables, such as reward systems and top management support, into the knowledge management model and make the model more complete. Another recommendation is that future studies should add socio-demographic characteristics of participants. This information can be used to explore other intervening variables such as ethnicity, length of service, etc. Research also can determine whether the variables and their relationship are consistent over time in a longitudinal study.

Referring to the generalizability of the scale, it can be used in other knowledge-intensive industries such as telecommunication or consultancy, since there are no items specific to the industries analyzed in the study. In the same way, the findings of Pakistan-based organizations are equally applicable to organizations in the same sectors located in other developing countries, regions, since there are no items specific to Pakistan-based organizations.

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Full Length Research Paper

Can training and career development be considered best practices using the universal and contingency approaches?

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Because human resource management is a challenge for most organizations, many companies seek practices that will enable them to compete with other companies. In our work, we examine the study of training and career development and their consideration as high-performance practices by considering the universal and contingency approaches for a sample of 560 companies. If practitioners know the effects of these practices, they can apply it in their firms. The results show that both training and career development can be considered to be best practices and that they influence organizational performance either as isolated practices or as practices that are aligned with other best practices. Thus, we conclude that both approaches can be used in a complementary manner, depending on the nature of the investigation.

Key words: Training, development, high performance, configurational, universal approach.

INTRODUCTION

Interest in human resource management-related activities has increased in recent decades amongst both researchers and practitioners (Wright et al., 2001; Becker and Huselid, 2006). This interest is largely due to the influence of people management on organizational success (Becker and Gerhart, 1996; Becker and Huselid, 1998; Huselid, 1995; Bhattacharya et al., 2005).

Increasing attention within human resources is paid to training and new practices of employee development; and organisations currently devote significant effort and

investment to these areas. Undoubtedly, training and career development are an important contribution to the success of an organization by strengthening the competitive advantages that are supported by human resource management (Gurav and Mudalkar, 2011; Barba, 2002; Fernández et al., 1997, Núñez-Cacho et al., 2012). Therefore, investments in training have a clear, positive effect on individuals and organizations and are considered strategic activities for companies.

A substantial amount of literature exists regarding the

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investigation of high-performance practices or “best practices,” but the results of this research lack a consensus. Therefore, the goal of this study is to examine the literature to determine which human resource practices are considered by researchers to be high-performance practices and to determine whether training and career development can be considered as such.

With regard to the structure of this paper, we first conduct an analysis of the question to determine the theoretical approaches that are most commonly used when investigating human resource practices. Subsequently, we explore whether we can consider training and career development to be high-performance practices by establishing the hypotheses, the research problem, and the methodology. Finally, we present the discussion and conclusion.

Theoretical background and hypotheses

Thus far, human resource management research has followed a primary direction in which authors have endeavored to analyze the relationships between various human resource practices and organizational performance (Chand and Katou, 2007).

There is little literature that directly relates training and new practices of employee development practices to companies' performance. Moreover, current research is advancing slowly and sometimes produces confusing results. Research has generally been made in single industrial sectors or activities, or a single type of business, and few studies have been cross-sectional and examined various sectors or family businesses. In addition, many of the previous studies have introduced methodological inconsistencies that make it difficult to ensure the causality of the relationship between training, employee development, and organisational performance. These factors emphasize the need to make further studies in this area.

The foundation of this line of research is the existence of a direct effect between human resources practices (both individually and internally consistent with a company's human resource system) and organizational performance (Schuler and Jackson, 1999). To investigate this topic, researchers have primarily utilized two theoretical approaches that will be examined below: the universal and contingency approaches.

The universal approach indicates that there always exists a set of practices that is superior to other sets of practices and that influences organizational performance, irrespective of other internal and external factors, and these practices are known as “high-performance practices” or “best practices” (Pfeffer, 1994; 1998; Huselid, 1993; Ostermann, 1994; Terpstra and Rozell, 1993). The universal approach is based on two premises.

The first premise concerns the existence of direct

relationships between human resource practices and organizational performance and is supported by theories that include resources and capabilities theory and human capital theory (Youndt et al., 1996). According to the second premise, the effect of these practices on organizational performance is independent of the strategy that is adopted by a company (Arthur, 1992; Pfeffer, 1994; Huselid, 1995; Chand and Katou, 2007, Núñez-Cacho and Grande, 2012).

Thus, the logical questions that are posed using this approach are as follows: what are the high-performance practices in the field of human resources, and do these practices include training and career development? To answer these questions, we analyzed the existing literature on this subject and found a lack of consensus regarding which practices can be considered to be high-performance practices, as shown in the studies of Pill and McDuffe (1996), Walton (1985), White (1986), Schuler and Jackson (1987), Pfeffer (1998), and Ordiz (2002). This lack of consensus is one of the most criticized aspects of the universal approach.

Table 1 illustrates that training (shown in column 6) and career development (shown in column 4) are high-performance practices according to numerous authors. Therefore, from the perspective of the universal approach, training and career development practices will influence the development of companies.

In contrast, the contingency approach is based on structural contingency theory and assumes that the effect of human resource practices on organizational performance is determined by the alignment of these practices with business strategies (Miles and Snow, 1987; Delery and Doty, 1996). Moreover, there is not a single manner by which to efficiently organize these practices; rather, there are multiple organizational methods that relate to the variables or critical factors that have a major effect on organizations (Schuler and Jackson, 1987; Gómez-Mejía and Balkin, 2001; Huselid, 1995).

Thus, for a particular practice to be effective, it must conform to these critical contingency factors. First, an external adjustment must be maintained (i.e., a human resources strategy must be aligned with a particular environment). Second, there must be an internal fit (i.e., the practices that are developed must be consistent with one another) (Bonache and Cabrera, 2004). This notion of a fit between resources and strategy is also included in the resource and capability-based theories (Barney, 1991; Barney and Hansen, 1994; Leiblein, 2011; Molloy et al., 2011), and this interaction has been highlighted for its positive effect on organizational performance (Hitt et al., 2001).

Independent of the approaches that are used to analyze human resource practices, the majority of researchers, including researchers who adopt either the universal or contingency approaches, have accepted the existence of a relationship between “best practices” and organizational

Table 1. List of best practices in human resources in different empirical studies.

Authors	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Akdere (2007)						x							x			
Alleyne et al. (2006)		x				x	x						x			
Barba et al.(2007)						x										
Bayo and Merino (2002)	x		x	x		x	x			x	x	x	x	x	x	x
Beaver and Hutchings (2005)				x		x										
Birdi et al. (2008)						x				x			x			
Bontis and Serenko (2007)				x		x										
Carlson et al. (2006)				x		x	x									
Carbery and Garavan (2007)				x		x										
Chand and Serenko (2007)		x		x		x	x						x			
Delaney and Huselid (1996)		x		x		x	x	x	x		x					
Delery (1996)	x			x		x	x									
Gittleman et al. (1998)							x									x
Harris et al. (2004)							x									
Hernández and Peña (2008)		x		x		x	x									
Huselid (1995)		x	x	x		x	x	x	x							x
Huselid et al. (1997)		x			x	x				x	x					x
Ichniowski et al. (1997)	x	x	x			x	x		x	x		x			x	x
Koch and McGrath (1996)		x		x		x										
Martell et al. (1996)		x	x			x	x	x								
McDuffie (1995)		x				x	x			x	x	x		x	x	
Mothersell et al. (2008)																
Ordiz (2002)			x	x		x	x		x	x	x			x	x	
Pfeffer (1994)						x	x			x	x					
Roca et al. (2002)											x					x
Roche (1999)														x		
Uysal (2008)				x		x										
Wood and Albanese (1995)	x		x	x									x			x

Meaning of numbers: 1. Job security. 2. Targeted recruitment, search for certain skills. 3. Personality as a basic criterion for recruitment. 4. Internal promotions and career development. 5. Succession plans for management positions. 6. Formation. 7. Compensation contingent. Incentive schemes and share results. 8. Using the results of performance evaluations. 9. Promoting cooperation. 10. Work teams. 11. Autonomy in organizing and planning work. 12. Rotation of tasks. 13. Quality control by the operator, total quality. 14. Suggestion systems. 15. Groups of improving quality circles, problem-solving groups. 16. Information meetings with employees, staff recruitment needs. Source: authors adapted from Sastre and Aguilar (2003).

performance. However, the empirical verification of this relationship is complex, and there is not a unanimously accepted approach in this regard. Therefore, we found studies in which this relationship is considered positive: Arthur (1992); McDuffie (1995); Huselid et al. (1997); Delery and Doty (1996); Huselid (1995); and Guthrie (2001). Other studies concluded that this influence depends on aspects that include strategy (Youndt et al., 1996; Guthrie et al., 2002; Ordiz, 2003), culture (Bae et al., 2003), capital intensity in an industry (Koch and McGrath, 1996), company size (Way, 2002), or technology used (Larrazza-Kintana et al., 2004). Finally,

some authors, such as Fey et al. (2000) have not discovered any such relationship.

The consideration of training and career development as high-performance practices

We must emphasize the scarcity of research on the relationship between training and career development practices and organizational performance. Because published works have generally pertained to a single industrial sector, a single activity, or a particular type of

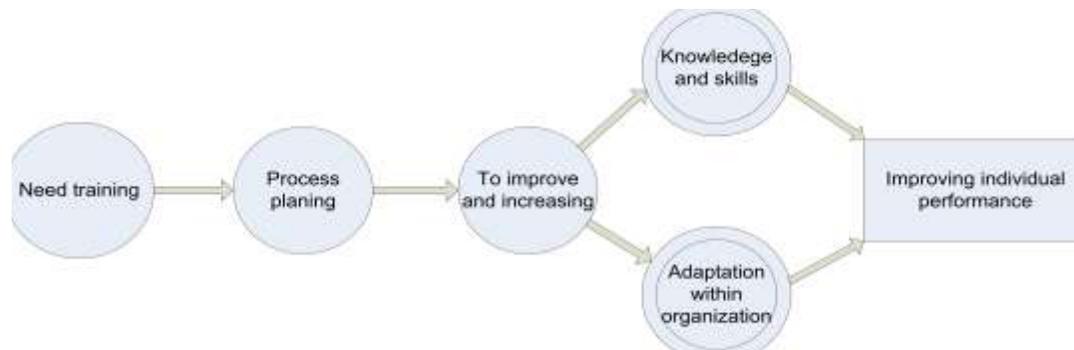


Figure 1. Training definition. Source: authors.

company, transversal and intersectional studies are scarce. Furthermore, few empirical studies have been conducted in Spanish (Hernández and Peña, 2008). These limitations in the existing research indicate the need to undertake new studies that link human resource practices, especially those of training and career development, with performance. Such research will enable us to ascertain the status of training and career development as high-performance practices that will undoubtedly contribute to the advancement of human resource research (Westhead and Cowling, 1998) and will justify the development of the current research topic.

Based on the given definitions and the dimensions that were identified by Garcia-Tenorio and Sabater (2004), we define company training as the process that begins with the study of worker needs and includes plans to increase and improve the attitudes and skills of employees and their adaptation within an organization. All of these elements are designed to facilitate the goal of improving individual performance. Figure 1 illustrates this definition graphically.

The influence of training on performance has been documented by numerous authors, and its effect on organizational performance has been recorded in studies such as the work of Salinero and Muñoz (2007), who consider training to be a high-performance practice and emphasize its specific weight within organizations. Similarly, Uysal (2008) notes the effect of training programs on organizational performance and posit that training can also increase the quality of processes and the innovation capabilities of companies.

Further, Siswo (2004) states that training is one of the most relevant practices within an organization, especially concerning its effects on technological activities. Akdere and Schmidt (2007) indicate that training enables the staff within an organization to gain knowledge and skills that will assist in improving a company's position in the market. In a similar vein, Birdi *et al.* (2008) highlight the existence of a relationship between the introduction of training practices and the improvement of performance measures, such as productivity, and they claim that

employee training is the second-most important management practice. Similarly, Schultz (1997) provides empirical evidence of the influence of training on organizational performance, employee productivity, and economic performance. Hansson (2007) states that investment in training is one of the most important factors in determining the profitability and efficiency of an organization.

Therefore, consistent with the observations of the universal approach, we intend to test whether training practices, when independently applied, influence a company's performance (i.e., whether the effectiveness of training practices is independent of the context in which they are applied) (Ordiz, 2003). Consequently, we formulate the following hypothesis:

H₁: Training can be considered a high-performance practice

Employee career development is one of the greatest challenges of human resource management (Reid and Adams, 2001). A career development system is a planned effort within an organization that includes investments in structures, activities, and processes that result from mutually coordinated efforts between employees and organizations (Leibowitz and Schlossberg, 1982). Career development is considered a high-performance human resource practice because its use affects organizational performance. Therefore, greater policy-making investments in this area will lead to better outcomes and will assist companies in creating sustainable competitive advantages (Tadic and Barac, 2009). Similarly, Lai (2007) indicates that career development policies create more competent and productive employees and thus improve companies' performance. Consistent with these approaches, Azmi (2009) designed a conceptual framework that enabled him to test the effect of human resource development on organizational performance.

Additionally, Bambacas and Bordia (2009) indicate the existence of relationships between organizations, career

development, and positive perceptions of employees that enhance their loyalty and commitment, thereby contributing to the success of a company. Hassan (2007) notes that human resource development practices assist in creating competitive advantages for companies and identify the potential of employees and their needs. According to Hatch and Dyer (2004), these practices assist in creating and sustaining competitive advantages; therefore, using the resource and capabilities approach, these authors discovered that these practices affect organizational performance.

Accordingly, Vloeberghs et al. (2005) suggest that career development policies are likely to create competitive advantages because they add value to an organization and contribute to its success. Therefore, career development policies may constitute crucial investments that are relevant to the survival of a company, and the planning of these policies must be emphasized. Hassan et al. (2006) relate the application of career development practices with productivity and organizational performance and observe a direct, positive effect in their research. Furthermore, Sánchez (2004) states that employee career development is among the practices that contribute to improve organizational performance. According to observations from the universal approach, we propose that career development influences organizational performance regardless of the alignment of this practice with other business practices. Based on these approaches, we intend to test the following hypothesis:

H₂: Career development is a high-performance practice

Moreover, many researchers who advocate the contingency approach in human resource management argue that there is complementarity between the various practices in this area such that the influence of these practices should be coordinated (Schultz, 1997; Huselid, 1995; MacDuffie, 1995). In this view, the coordination of human resource management practices causes the effect of such practices on organizations to be more pronounced than the sum of the effects of each of these practices independently (Milgrom and Roberts, 1994). When programs are implemented collectively, their mutual reinforcement contributes to achieving the objectives of an organization. Therefore, the development and implementation of these practices produces a greater effect on the attainment of the strategic objectives of companies compared with the implementation of such practices in isolation (Schultz, 1997; Ichniowski et al., 1996).

Baird and Meshoulam (1988) indicate that practices are organized in a functional manner in human resource systems, and their strategic coordination will create additional effects on an organization that will be specific

to this coordination. Furthermore, Schuler (1992) affirms that the strategic performance of an organization can be improved by implementing consistent human resource practices whose coherence encourages employees to achieve the objectives of an organization.

Thus, the human resources literature suggests that high-quality human resource practices positively affect company's performance, and efficiency will be increased if such complementary practices function together (Arthur, 1992; Huselid, 1995; MacDuffie, 1995; Ichniowski et al., 1997; Singh, 2003). As a result, we seek to consider the proposals of the contingency approach to determine whether the alignment of training and career development practices has a combined effect on organizational performance. To test for this effect, we designed a second model to measure the unique, joint effect of both dimensions on business performance. According to the contingency approach, the hypothesis to be tested is as follows:

H₃. When employed together, training and career development can be considered high-performance practices

METHODS

The empirical component of the research begins with the description of the target population, which consists of Spanish companies. After determining the sample size, we proceed to the selection of the sample under investigation, which includes 560 companies. We collected information using a questionnaire that employs a Likert scale and from the balance sheets and profit and loss accounts of companies. After defining the target population, we explain below how we have operationalized the variables that are involved in the model. We used items employees in previous studies for the construction of the model, and we have adapted it to the specific context of this study. We have grouped these different constructs or dimensions as presented in Table 2.

Following the presentation of our research model, we will now examine our hypotheses and address any research questions that arise. We will begin by describing the target population, then the method used to obtain information and, finally, we will describe the variables used.

Selection of target population

The study population was composed of medium size firms. The sample belong to various economic sectors and the average size was 188 employees and the average age of the companies was 41. The sampled companies have an average productivity of 4.8%. The

Table 2. Variables used for the preparation of training, career development and performance measurement scales.

	Variable description
Training	Is an analysis made of individual training needs?
	Is an analysis made of the training needs for processes?
	Is an analysis made of the training needs of the company?
	Are training plans essential for the company?
	Are there are more training programs each year?
	Does the company have a detailed written training plan?
	Does the company have formal training objectives?
	Does the company evaluate training results?
	Does the company monitor the effects of training on the performance of tasks?
	Do employees rotate between jobs to improve their skills and knowledge of the company?
Career development	Does the company train employees to work in various posts?
	Has the company informally raised the issue of succession?
	Are there formal plans for succession?
	Are the candidates for succession highly qualified?
	Does the company sometimes employ a personal trainer for a short-term process to improve employee performance?
	Is coaching scheduled by the company?
	Is the coach from outside the company?
	Does the company occasionally employ mentors so that in the medium-term an employee can develop as an employee and a person?
	Is mentoring organised by the company?
	Does the company set goals in mentoring programs?
Performance	Are participants in the mentoring process highly committed to the process?
	Is the profile of the mentor carefully studied?
	Are there real opportunities for promotion in the company?
	Are there real opportunities for developing skills?
	Does the company train employees for promotion?
	Are employees committed to the company?
	Are employees satisfied with the company?
	What is the level of absenteeism?
	Is it very rare that an employee resigns?
	Has there been an improvement in the rate of employee productivity over the last three years?
What has been the rate of sales growth over the last three years?	
What has been the growth in market share over the last three years?	
What is the profit margin?	

Source: own work adapted from Núñez-Cacho (2010).

variables of firm age, number of workers, and generation were used as control variables. The information was gathered using a telephone survey as this method enabled us to obtain accurate and completed questionnaires and a high response rate. We achieved a response rate of 32% obtained from 560 completed questionnaires from different Spanish family businesses. The sample size enabled us to use any method of estimation while maintaining the stability of the covariance structure, as proposed by Tanaka (1987).

Measurement of variables

In the development of the variable measurement scales we took previous works as a reference and adapted the content to the specifics of our research. The groupings used are shown in Table 2.

Scales validity

To analyze whether training and development can be

Table 3. Results of analysis factorial exploratory.

Factor	Variable	Weight in factor	KMO/BARLETT/ NIVEL SIG.	% Variance explained
Training	Training1	0,877		
	Training2	0,886		
	Training3	0,848		
	Training4	0,575		
	Training5	0,671	0,721	
	Training6	0,772	606,75	75,757
	Training7	0,686	0,000	
	Training8	0,571		
	Training9	0,727		
	Training10	0,575		
	Training11	0,683		
Career development	Career1	0,862		
	Career2	0,848		
	Career3	0,914		
	Career4	0,919		
	Career5	0,863		
	Career6	0,886	0,625	
	Career7	0,696	163,65	67,131
	Career8	0,915	0,000	
	Career9	0,895		
	Career10	0,909		
	Career11	0,915		
	Career12	0,924		
	Career13	0,781		
	Career14	0,915		
Performance	Perfor1	0,755		
	Perfor2	0,912		
	Perfor3	0,884		
	Perfor4	0,755	0,648	
	Perfor5	0,912	480,36	56,513
	Perfor6	0,884	0,000	
	Perfor7	0,979		
	Perfor8	0,853		

considered high-performance practices, we used measurement scales that have been validated by Núñez-Cacho (2010) and whose dimensionality we have analyzed through an exploratory factor analysis (Table 3). appropriateness of the grouping of the variables with respect to the corresponding dimensions or constructs.

With regard to the reliability and validity of the measurement scales, we offer two indicators (Cronbach's α coefficient and the composite reliability index of each construct, which identifies the internal consistency of a construct measurement), for which values are

recommended to be above 0.7. In the results that are shown in Table 4, we observe that both Cronbach's α coefficient and the composite reliability index (CRI) are consistent with the recommendations offered by Bagozzi and Yi (1988).

Analysis of the results and estimation of the SEM model

Following an analysis of the reliability and validity of the

Table 4. Scales reliability CRONBACH α and CRI.

Factor	Cronbach α	CRI
Training	0,825	0,864
Development	0,911	0,952
Performance	0,610	0,672

Source: authors.

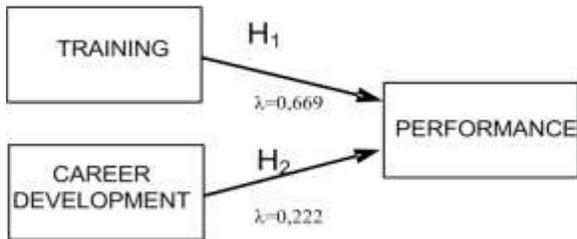


Figure 2. Structural Equation Model re-specifying individual effects. Source: authors.

measurement scales we note that the Kaiser–Meyer–Olkin(KMO) index values justify the application of the exploratory factor analysis, and the factor loading in each case (the weight of each variable observed in the corresponding dimension) is above 0.5. In addition, the results of Bartlett’s test of sphericity and the explained variance emphasize the measurement scales we can confirm their scientific validity and test the hypotheses. For this purpose, we propose the corresponding causal model, through structural equation model, which includes the effects of employee training and new development practices on the performance of family businesses, and we continue with the methodological stages of the structural equations. Once specified, we proceed with identification and estimation by calculating unique values for the parameters included in the model relationships. The result of the estimate, once the model has been re-specified, is shown in Figure 2 and Table 5.

The second causal model is responsible for determining the joint effect of both practices on performance. With this estimation, we intend to obtain the objective that we proposed in relation to the joint, positive effect of training and development on the performance of family companies (that is, the test of H_3). To confirm this hypothesis, we proposed the causal model that is shown in Figure 3 and Table 6, in which we introduced a new factor that explains the combined effect of training and development on performance.

DISCUSSION, CONCLUSION AND FUTURE PROSPECTS

The aim of our study was to determine which human

resource practices are considered by the literature to be best practices and to empirically test whether training and career development can be included in these practices. We have supported our theoretical argument based on the universal and contingency approaches and compared the outcomes. The literature review showed that selective recruitment, internal promotions, career development, training, contingent compensation, promotion and cooperation among employees, and the use of teamwork are considered by researchers to be high-performance practices for human resource management.

With regard to training and career development, the causal model results have permitted us to confirm the first hypothesis. We concluded that human resource training can be considered a best practice because of its influence on organizational performance, regardless of whether training is aligned with other business practices. The second hypothesis concerned the relationship between career development and performance. Based on these results, we can conclude that there is a direct and positive causal relationship between the implementation of career development and performance; therefore, we can include this practice in the high-performance group. Both hypotheses have been tested by a theoretical model based on the universal approach, and the influence of these practices on performance remains clear, regardless of other business practices that are utilized.

A third hypothesis was also tested to examine the existence of a combined effect of training and career development practices on organizational performance. The theoretical model that supported this hypothesis was based on the contingency approach, which was used to measure the effect of the combined implementation of these practices.

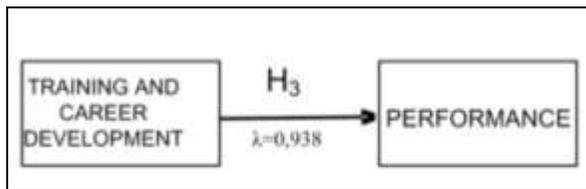
Therefore, the results enable us to confirm that both the universal and contingency approaches are useful and complementary, in accordance with the arguments offered by Youndt et al. (1996); thus, research maybe supported based on either approach, depending on the specific hypotheses that are proposed by the research. Therefore, we must consider that the universal approach will justify general or intersectoral cases and that the contingency approach will more accurately analyze specific situations that are unique to each sector and organizational type (Ordiz, 2003). Sánchez (2004) also examines both complementary approaches and concludes that both isolated human resource practices and joint practices that are internally consistent with one another can influence organizational performance. Sánchez also emphasizes that the influence may be greater when these practices are aligned with a business strategy and that, although the universal approach assists in documenting the benefits of human resources practices in all settings, the contingency approach assists in elucidating the phenomenon and provides more specific recommendations for management practices.

Table 5. Results of re-specifying causal model fit individual effects.

χ^2	g.l.	p	NFI	NNFI	CFI	IFI	MFI	RMSEA
534	482	0,047	0,702	0,954	0,958	0,962	0,706	0,038

Table 6. Results of re-specifying causal model fit combined effects.

χ^2	g.l.	P	NFI	NNFI	CFI	IFI	MFI	RMSEA
534,28	481	0,046	0,703	0,953	0,961	0,959	0,704	0,039

**Figure 3.** Structural equation model re-specifying combined effects. Source: authors.

This paper has certain limitations. The use of questionnaires for gathering information implies the specific constraints arising from the subjectivity implied in using this tool. When using questionnaires, the researcher does not directly approach the phenomenon under study and respondents have a margin of freedom of interpretation that may distort the objective set. Furthermore, the answers of respondents may reflect their own biases as many items are based on the perception of the respondent. To circumvent this problem, we turned to secondary sources of data on organisational performance. Another limitation originates in the horizontal nature of the research. The information was gathered at one point in time, except for certain performance indicators. It would be worthwhile analysing the effect of training and development on the performance of organisations from an evolutionary perspective. Such an approach would use extended periods to isolate temporal phenomena that could distort the outcome.

The limitations and the depth of the study have led to a series of future research proposals that are set out below. We believe it would be interesting to analyse the influence of training and new practices of employee development, not for a specific moment in time, but over a broader period of time and using longitudinal analysis to observe the evolution of the variables. We specifically consider it worthwhile measuring the impact of training and development on business performance in the medium to long-term. We have also considered the possibility of integrating variables into the model that moderate the impact of training and development

practices on performance. This suggestion was raised by Becker and Huselid (2006), when discussing the integrated implementation of variable moderators between human resource systems and performance.

Conflict of Interests

The authors have not declared any conflict of interests.

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Full Length Research Paper

The next frontier: Open innovation and prospecting of knowledge for value co-creation in complex environments based on new business models by 3D modeling and additive manufacturing

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This article aims to contribute to a policy of innovation management. To do so, it presents the influence of practices of open innovation in the prospecting of knowledge for value creation in highly complex environments under 3D modeling and additive manufacturing. The research was conducted in the light of theoretical excerpts and application of a survey to specialists, with knowledge about the investigated object, selected by scientific and technical criteria. A case study of multiple products was elaborated in a traditional segment of pewter in Portugal. The data were extracted by means of a matrix of judgment in which experts made their judgments about the variables investigated. In order to reduce subjectivity in the results achieved, the following methods were used: multicriterial analysis, artificial neural networks and neurofuzzy technology. The produced results were satisfactory, validating the presented proposal.

Key words: Open innovation practices, prospecting of knowledge, value co-creation, complex environments, and 3D modeling and additive manufacturing.

INTRODUCTION

Recently, relevant changes have made organizational boundaries more fluid and dynamic in response to the rapid pace of knowledge diffusion (Abrahamson, 1991; Griliches, 1990; Teece, 1986; Teece et al., 1997), and innovation and international competition (Chesbrough and Rosenbloom, 2002; Christensen, 2003; Damanpour, 1996). This helps to reconsider how to succeed with innovation (Teece, 1986; Teece et al., 1997; Wheelwright

and Clark, 1992). Innovation events, such as the introduction of a new product or process, represent the end of a series of knowledge and the beginning of a value creation process that can result in improvement in business performance marked by the ability to counteract the vulnerability of the globalization of business. However, the ability to design and provide innovative products with great incremental value to customers in a

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specific issue requires technical expertise of different knowledge derived from internal and external sources of knowledge (Chesbrough, 2003). But it is also true that organizations need to properly use the knowledge derived from different sources and check the business status of their activities and therefore, innovations should be used as increments of the process of interaction of knowledge. Different innovations depend on different types and sources of knowledge. This way, it is believed that assessing the relative importance of the different sources of knowledge for the performance of innovation is relevant because it informs the companies in their strategic decisions about the development of different channels for knowledge acquisition (Frenz and Ietto-Gillies, 2009).

The sources of knowledge (P&D, Universities and research Centers among others) have multifaceted nature (Kline and Rosenberg, 1986; Von Hippel, 1988) and show different impacts on a company's business, since the innovation performance is strongly dependent on and boosted by knowledge and its respective sources (Frenz and Ietto-Gillies, 2009). With the widespread diffusion of knowledge, all the knowledge necessary for creating innovations is no longer present within the firm's boundaries. They need to acquire knowledge from other sources. In fact, knowledge expands the potential for creating business value (Roper et al., 2008). However, the capacity of prospecting of knowledge is a complex challenge. Several studies have referenced the importance of the collaboration from knowledge and innovation generation (Chesbrough, 2003). This takes to evaluate the influence of innovation practices, in particular open innovation in the prospecting of knowledge. Open innovation is a new way of thinking of innovation for firms, where firms explicitly cooperate with others to create new innovations (Chesbrough, 2003). Open innovation is a model that assumes that firms can and should use external as well as internal ideas and internal and external paths to market, as they look to advance their technology (Chesbrough, 2006). Open innovation can be thought of as systematically exploring a wide range of internal and external sources for innovation opportunities, consciously integrating that exploration with the firm's capabilities and resources, and broadly exploiting those opportunities through multiple channels (West and Gallagher, 2006; Grotnes, 2009).

In this dichotomy, technical efficiency is a parameter of the developing capacity of innovative products, which translates into one of the most remarkable logical arguments to potentialize and encourage competitive advantage (Wheelwright and Clark, 1992). Companies make use of its innovative capacities to achieve sustainable competitive advantage and value co-creation. The introduction of new technologies is clearly evident in innovative products and it is considered one of the most remarkable ways of promoting new functionalities and improving the performance of existing products (Niosi et

al., 1995; Sehror and Arteaga, 2000; Madu, 1989), in addition to being one of the inducers to create competitive advantages in the global market (Baranson, 1970; Caves, 1974; Contractor, 1980; Dunning, 1979; Kojima, 1975; Lai and Streeten, 1977; Mason, 1981; Morley and Smith, 1977; Negandhi, 1975; Prasad, 1983; Wells, 1973).

In this sense, the incorporation of 3D modeling and additive manufacturing technologies, when used in an appropriate way and based on projective methodology, enables innovation, regardless of the complexity of the object intended to be designed (Zhang et al., 2014; Zhang et al., 2013a, b). In this perspective, new technologies emerge as one of the most important strategic resources for the companies in product development product and value co-creation for the business. The use of additive manufacturing techniques has been effective in the reduction of time of product development. The additive manufacturing is an innovative mechanism for the PDP, which enables time reduction between the conception and the placement of this product on the market, translating into reduction in investment costs and improvement in the quality of the final product. As such, it enables to create business value.

Thus, this article aims to contribute to a policy of innovation management. To do so, it presents the influence of practices of open innovation in the prospecting of knowledge for value creation in highly complex environments under 3D modeling and additive manufacturing. The case study of multiple products was elaborated in a traditional segment of pewter in Portugal. The article is divided according to the following sections: Methodology, verification of the conceptual model and subjacent analyzes, and conclusions and implications.

DESIGNER OF RESEARCH

Conceptual Model framework: Constructs and hypotheses

This section examines the conceptual model (Figure 1) and presents the hypotheses to be tested throughout this work.

The open innovation paradigm (Chesbrough, 2003) can be characterized by its porous innovation process, and the strong interaction of the company with its environment. By integrating a large number of individuals into the innovation process, new creativity and know-how are brought into the organization (inbound open innovation). Von Hippel (1988) suggested using lead users and other stakeholders as external sources of innovation (Schroll and Mild, 2011). Not only can this attract more talent, it can also transfer idle innovative ideas and R&D technology externally to other companies. Enterprises use the concept of open innovation, in which

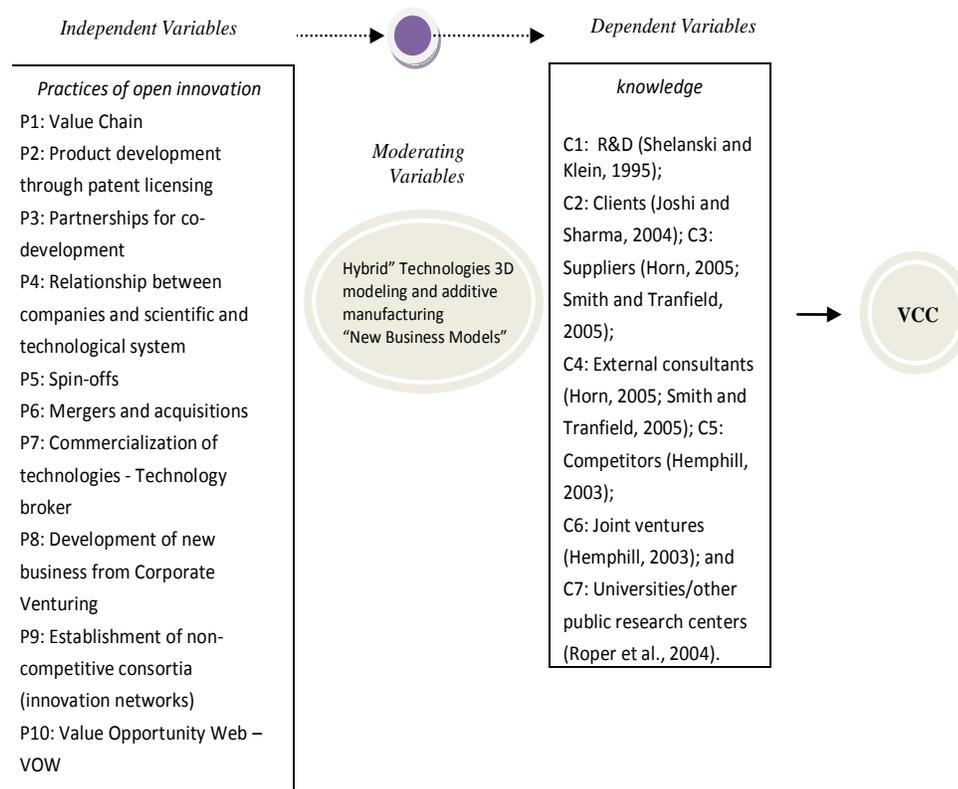


Figure 1. Conceptual model.

internal innovative ideas can flow outward and external ideas and technologies can flow inward within an enterprise. Chesbrough (2003) proposed the concept of open innovation which indicated that businesses should become more open to innovation processes and value creation. Value is generated by nurturing informal relations and encouraging a free, horizontal flow of knowledge across organizational boundaries by opening new channels of communication and sustaining propagation of new ideas (Grimaldi and Cricelli, 2012). In this perspective the knowledge has forced firms to ground their value creation. The open innovation approach explores knowledge acquired from external sources (competitors, universities, partners) (Grimaldi and Cricelli, 2012). Business exposure to internal and external knowledge promotes the generating value (St-Jean and Audet, 2012; Fosfuri and Tribo, 2008; Norman, 2004). In contexts where knowledge is a crucial asset, companies increase their dependency on external sources to improve firm performance (Morgan and Berthon, 2008). Knowledge emerges as one of the most important strategic resources for the companies. One of the basic premises of dominant logic is that knowledge is a fundamental source of competitive advantage. To raise the capacity of value and innovation creation, the organizations must be able to create this value. Kotler and Keller (2006) use the term "customer perceived

value" and define it as "the difference between the prospective customer's evaluation of all the benefits and all the costs of an offering and the perceived alternatives". Value can be examined from two perspectives: customers and firms. It is important to recognize that value resides with customers. In addition, customers use products or services in a wide range of activities. Thus, value needs to be examined from a customer's perspective (Kim and Mauborgne, 2000; MacMillan and McGrath, 1997) and, more specifically, from their experience with the products or services.

Co-creation is advocated as a means to expand the innovation and value creation capability of the firm [...] (Sawhney et al., 2005; Prandelli et al., 2006; von Stamm, 2004). Creation refers to the process of integrating different resources from different actors in order to actualize their value potential. It captures the activity or way; the mechanism through which the resources provided by different actors are integrated into value creation processes and then developed into value-in-use. Mechanisms are firm, customer, or even community led activities through which additional resources are offered for the use of other actors. In relationships between firms and customers, co-production, co-design, and co-development (Sheth and Uslay, 2007) are examples of mechanisms through which customer resources are engaged in the value creation for a firm. Here, that value

creation is supported by the customer. However, mechanisms can also be designed through which additional firm resources are provided for the support of the customer and the firm (B2B and B2C). Technology is often seen as facilitating the emergence of different types of mechanisms by enabling the transfer of new resources effectively and efficiently for the use of other actors. In this perspective, new technologies emerge as one of the most important strategic resources for the companies in product development product and value co-creation for the new business. In this context, the use of 3D modelling and additive manufacturing techniques has been effective in the reduction of time of product development. The 3D modeling and additive manufacturing is an innovative mechanism for the PDP and a new business model. In recent years, the business model concept has been used as a general construct explaining how a firm is interacting with suppliers, customers, and partners (Zott and Amit, 2007). Business model includes customer value creation as one of the core elements. Business model should explain how the firm creates value for its customers, with terms such as “profit potential,” “revenue model,” “revenue logic,” “capture value,” “profit formula,” or “returns for stakeholders”. Thus, it can be concluded that the business model should also explain how the firm yields a profit from its operations. The business model construct should be also externally oriented and illuminate the relationships that the firm has with the various actors in its value network. Business model is an underlying economic logic that explains how we can deliver value to customers at an appropriate cost” (Nenonen and Storbacka, 2010; Magretta, 2002).

Rapid prototyping systems offer the opportunities to make products faster and usually at lower costs than using conventional methods. Since rapid prototyping and manufacture can substantially reduce the product development cycle time, more and more businesses are taking advantage of the speed at which product design generated by computers can be converted into accurate models that can be held, viewed, studied, tested, and compared (Yan and Gu, 1996). Rapid prototyping generally refers to techniques that produce shaped parts by gradual creation or addition of solid material, therein differing fundamentally from forming and material removal manufacturing techniques (Kruth et al., 1998). Prototyping and modeling remain the main forms of investment and growth for 3D printing, although this is changing with investors and technologists growing increasingly excited about the wider possibilities of 3D technologies (Birtchnell and Urry, 2012). Capacities and the potential of rapid prototyping technologies have attracted a wide range of industries to invest in these technologies and value create to industries (Yan and Gu, 1996). Thus, from the theoretical excerpts, the following variables and hypotheses of this study were raised.

Independent Variables: from the findings in the

literature (Lopes and Teixeira, 2009; Moreira et al., 2008) the following open innovation practices were identified (Trentini et al., 2012):

Value Chain: the value chain of innovation is one of the most popular practices, because it increases significantly the incremental value of business. Chesbrough (2006) shows that open innovation assumes that useful knowledge is widely distributed and that even more capable of organizations of R&D should identify, connect and boost external sources of knowledge as an elementary process for innovation.

Product development through patent licensing. It is a very common practice. The occurrence of technology licensing has been mainly concentrated in the chemical industry - pharmaceutical, electrical and electronic equipment, computers and industrial machinery.

Partnerships for co-development. It is a practice that has become business model that enables increasing innovation reducing P&D costs and facilitates the expansion and dissemination of innovation.

Relationship between companies and scientific and technological system. It is a practice that enables the research developed at universities and research centers supports the industrial requirements, allowing the specialization of each entity with return for both parties. Moreira et al. (2008) report some of the challenges to be overcome, such as: relationship difficulties, lack of communication, divergent goals and visions, deadline mismatches, the distribution model of knowledge in universities that hinders the identification of researchers and research made, and the steps of assessment and valuation of technologies.

Spin-offs are companies created to develop opportunities generated by the parent company. They aim to explore new business conditions in order to minimize negative impacts on the parent company. In this kind of practice, projects that do not have any internal interest may generate new business.

Mergers and acquisitions. Mergers and acquisitions are aimed at absorbing knowledge and external technology, allowing a faster establishment in new markets and impeding the entry of new competitors, as well as reducing costs and increasing the possibility of releases.

Commercialization of technologies via Technology broker. It is a practice of open innovation in which a professional assists in finding, rating, marketing and managing the transfer of certain technology / knowledge through a network of contacts.

Development of new business from Corporate Venturing. It is a form of investment in which companies invest capital in new-born businesses with innovations that may or may not be related to the business and have a high level of risk, but with great potential for growth.

Establishment of non-competitive consortia (innovation networks). It is a collaborative practice in which P&D companies associate with universities, research centers

or competing companies with the goal of generating knowledge and products that would hardly be possible in an individual way.

Value Opportunity Web – VOW, is a practice of capturing and analyzing potentially valuable data on the external environment and transforming that information into winning products for consumers. The goal of a VOW is to analyze the data obtained taking into account new needs, new ways of doing things, new product features and new models the company may deliver value to the customer.

Moderating Variables: The moderating variables were extracted from the specialized literature and assessed by experts for confirmation. The following moderating variables were identified: Hybrid” Technologies 3D modeling and additive manufacturing.

Dependent Variables: The independent variables were extracted from the specialized literature and assessed by experts for confirmation. The following independent variables were identified: Stakeholders’ knowledge: C1: R&D (Shelanski and Klein, 1995); C2: Customers (Joshi and Sharma, 2004); C3: Suppliers (Horn, 2005; Smith and Tranfield, 2005); C4: External consultants (Horn, 2005; Smith and Tranfield, 2005); C5: Competitors (Hemphill, 2003); C6: Joint ventures (Hemphill, 2003); and C7: universities/other public research centers (Ropper et al., 2004). For the Customer dimension, the construction used is based on Joshi and Silva (2004). For the suppliers variable (Horn, 2005; Smith and Tranfield, 2005), the content was derived from the construction used by Dow et al. (1999) and Forza and Filippini (1998). For the R&D variable, the construct was mainly derived from Shelanski and Klein (1995); Gupta, Wilemon, and Atuahene-Gima (2000) and Chiesa et al. (1996), which capture two important R&D aspects: capabilities and connections. As for the variable External Consultants, the construct is based on Horn (2005); Smith and Ranfield (2005). The variable Competitors is based on Hemphill (2003). Finally, the variable Joint Ventures is based on Hemphill (2003).

From the conceptual model, the following hypotheses were made:

Hypothesis - H1: The practices of open innovation influence to a greater or lesser degree the prospecting of knowledge for value creation in highly complex environments under 3D modeling and additive manufacturing.

H2: The optimal rate of value creation depends on the combination and interaction of the influence of the practices of open innovation in the prospecting of knowledge in highly complex environments under 3D modeling and additive manufacturing.

RESEARCH METHODOLOGY

Background to the case study and data collection

The case study of multiple products was elaborated in a

traditional segment of pewter in Portugal. The objective of this study is to present the effects of the advanced systems of additive technologies in the performance of company. The study was designed, based on the literature and confirmed by the assessment of experts. The data collection was performed using a scale/matrix assessment questionnaire. The technique used was the stated preference, taking into account that these methods work with the preferences of the decision makers, revealed by the choice made among the alternatives selected from a set of real alternatives, or not. In this classification framework, the research interviews and consultations with the experts are highlighted. The experts issued their judgments through a scale questionnaire for the first external validation. Before applying the final collection instrument, a pretest was conducted with experts to clarify whether the instructions were clear and objective; to verify that the questions were objective and without interpretation ambiguity; and to investigate possible comprehension problems by the experts on the expected responses. There were few adjustment suggestions. Next, a survey was conducted with experts, selected according to their technical-scientific criteria. The researcher regarded the new product project managers, experienced product planning personnel, innovation managers, engineers, designers, organizational managers, R&D managers, technology managers, planning, technological innovation and modeling managers. The phases and steps of the model were based on the following methods: (i) Thurstone’s Law of Categorical Judgment psychometric scaling; (ii) multivariate analysis; and (iii) multicriteria: Compromise Programming, Promethee II, and Electre III, and neurofuzzy technology. Next, these procedures were detailed.

The case study of multiple products: Implementation and results

In this section, a case study is developed in the light of an innovative experience in product and process. It was performed by a multidisciplinary team consisting of designers, engineers and production technicians who have worked together to develop new products that were intended to be introduced into the national and international market through a partnership between two institutions of higher education and a pewter product company in, Portugal, whose traditional products developed by this company were in discontinuity of the innovation process. This project allowed to combine additive manufacturing techniques and traditional processes of production of pewter components and the incorporation of other components in composite materials and other metallic alloys, allowing to develop innovative products in very short time frames and contributing to an increase in the creation of business value. The multiple products investigated (Parts “Synesthesia”, Effect in Candlestick - wax, M. Packaging, Identification L. Products, Cover Catalog, Candlesticks “Cube”, Candlesticks “Lágrimas”, Fruit Bowl Symbiosis and Gutta, Parts “Unda”, Fruit Bowl “Nirvana”, Solitary Spiral and Bellevalia, Parts Cube and Bateau, and Parts Spiral and Synesthesia, others) in this research are innovative for the company and for the market. From the first initial sketches to the introduction of products in the market, it took little more than five months. The company introduced a whole new line of products on the market, more innovative, within a short period of time, through the adoption of new methods and new product development technologies, such as 3D CAD modeling, use of virtual “prototypes”, additive manufacturing technologies to obtain prototypes for viewing, conversion technologies and rapid manufacturing of tools for production of functional prototypes and final pieces. The innovation and introduction of design and new projective methodologies in this type of enterprise of traditional nature allow a more efficient return of funds, definition of more innovative, more aggressive and of higher quality strategies of product and market in order to increase business value and gain



Figure 2. Silicon Mold - Centrifugation Process.

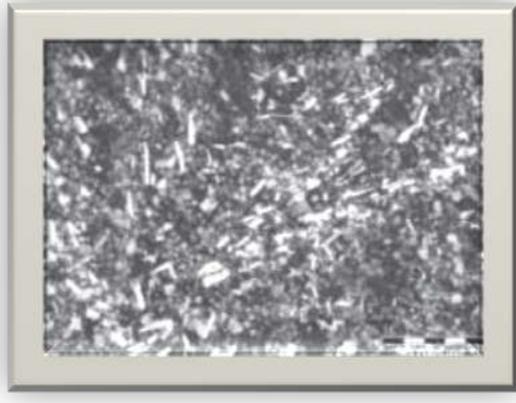


Figure 3. Microstructure of tin alloy used by the company.

sustainable competitive advantage in the global market. The study presents the PDP, the manufacture and placement on the market of pewter products aimed at innovating developed products and, simultaneously, it introduces new methods and product development technologies in the referred company. Thus, it was possible to know the details of the PDP of this company.

RESULT

Product development

Centrifugal Casting

This is one of the most used processes in the company, as it allows large production output. In the centrifugation casting, the silicon mold is placed in a centrifuge where the centrifugal force generated by the rotation of the dish of the machine allows the liquid metal poured into the center of the mold to completely fill the most intricate cavities. Figure 2 shows a mold used in the process.



Figure 4. Part of mechanical lathe.

The pewter alloy, often the type Sn-4.5Cu-4.5Sb, is poured at temperatures between 300 and 380° C, depending on the type of part being produced. Centrifugation facilitates the flow of heat flow, reducing the time of solidification, thereby increasing productivity. Figure 3 shows the microstructure of this alloy after polishing and metallographic etching (2ml HCl, 5ml HNO₃ and 93ml H₂O).

This structure is composed of a tin-rich solid solution containing needles of small particles of Cu₆Sn₅ (white color). The tightness in mechanical lathe (Figure 4) uses wood or bakelite molds that are more durable and long lasting. A pewter plate is fixed on the lathe and spun by the operator to acquire the forms of the mold.

The purpose of this section is to present the *underlying analyses* of the results of the study.

Manufacture of pewter tube: The company has equipment for metal spinning. Through this equipment, pewter is conducted in a sequence to get to a tube shape.

The 3D CAD Modeling: All of the objects made were modeled in Solid Works 2007 software. The use of this tool allowed to build virtual simulations of the objects, their adjustment and correction whenever necessary. Once the phase 3D CAD modeling was completed, the files were converted in the format *.vrmI to make its reading in Cinema 4D software possible. This program achieved more realistic renders of the developed parts (Figure 5).

From the 3D modeling it was possible to create the technical drawings of all the parts to create a technical file to be consulted by the employees of the company during the manufacturing process. The files of some of the pieces developed were converted to the format *.stl to make prototyping in the stereolithography possible (additive manufacturing).

Prototypes in Stereolithography: Stereolithography is a



Figure 5. Simulation of object Estamine by software CAD 3D.



Figure 6. Prototypes in Stereolithography in building platform.

process that provides for the production of three-dimensional prototypes by photopolymerization, layer by layer, of a liquid resin (epoxy, polyester or vinyl ester) through the incidence of a laser beam of ultraviolet rays. The Cube, Bateau and Stroke pieces were selected to be manufactured by this process.

The *.stl files, created from SolidWorks 2007 software, were introduced into the equipment software and then the process was started. The photopolymerization lasted for about ten hours. Once this period was finished, the prototypes were introduced into a solvent bath for construction waste disposal and cleaning of adhesive resin (Figure 6), being later removed from the building platform and having their supports removed.



Figure 7. Prototypes in Stereolithography: -Cube and Bateau.



Figure 8. Prototypes in Stereolithography, a final product in pewter.

The models were placed in an oven for a post curing of the resin by ultraviolet rays and increase its mechanical resistance (Figure 7).

Finally, the pieces were polished and painted in order to simulate the superficial aspect of pewter (Figure 8). Some of the prototypes were used to produce silicone and resin molds to cast away resins loaded with different types of particles. The pieces obtained through this process were applied in some of the pewter pieces. In other cases, the prototypes were used in the company for display and the manufacture of molds for different production processes that involve casting/foundry (by gravity and by centrifugation) and the formation of pewter plates.

Developed products

Figure 9 shows a piece obtained by plastic deformation where the spiral shape functions as an extension of a



Figure 9. Solitary Spiral and Bellevia.



Figure 10. Casting resin in silicon mold obtained from a model of PR



Figure 11. Fruit Bowl "Nirvana".

flower (Solitary).

The other single one involved casting/foundry and welding process. In both cases, glass test tubes are used to count the flower and the water. Although the company does sand casting, due to its slowness and cost involved, this process is only used in the manufacture of parts that cannot be obtained by other more cost effective

processes.

Fruit Bowls: In this product segment, the piece is made of pewter with two elements in epoxy resin or polyurethane, which can be varied from object to object to the formal and the material level, with the possibility of mixing it with pewter powder, sand, mica, coconut fiber or other materials (Figures 10 and 11).

Candlesticks: This project was conceived with the intention to use a base in carbon fiber, where the pieces of pewter supporting the candles are glued. The parts of pewter were obtained by spinning pewter plates, using a mold obtained from the additive manufacture model (Figures 12 and 13).

In summary, the process of product development was backed by the theoretical clippings: development of the concept of product, development of project scope, production preparation, launch and post-launch of product.

Conceptual model verification and underlying analyses

To solve the research problem and achieve the desired



Figure 12. Candlesticks: "Lágrima", based on carbon fiber in the company's stand in Ceranor 2008.



Figure 13. Effect in candle holder.

goal, the practices of open innovation of the traditional segment of pewter were identified and then evaluated according to their influence on the prospecting of knowledge according to the respective sources of knowledge. Finally, the optimal rate of value is modeled from the interaction between all dependent variables.

Phase 1: Modeling of the influence of the Open Innovation practices in the prospecting of knowledge of the actors (sources)

This phase is systematized in the following steps:

Step 1) identification of the practices of open innovation. Thus, the following practices of open innovation from the specialized literature were identified and confirmed by experts: Value Chain; Product development through patent licensing; Partnerships for co-development; Relationship between companies and scientific and

technological system; Spin-offs; Mergers and acquisitions; Commercialization of technologies via Technology broker; Development of new business from Corporate Venturing; Establishment of non-competitive consortia (innovation networks); and Value Opportunity Web – VOW.

Step 2) identification of the sources of knowledge and their respective knowledge: The identification is systematized in the following: C1: R&D (Shelanski and Klein, 1995); C2: Clients (Joshi and Sharma, 2004); C3: Suppliers (Horn, 2005; Smith and Tranfield, 2005); C4: External consultants (Horn, 2005; Smith and Tranfield, 2005); C5: Competitors (Hemphill, 2003); C6: Joint ventures (Hemphill, 2003); and C7: universities/other public research centers (Roper et al., 2004).

Step 3) Evaluation of the influence of practices of open innovation in the prospecting of knowledge in high tech industries. This procedure was developed using the multicriteria analysis Electre III, Promethee II e Compromise Programming and Artificial Neural Network (ANN). Next, these procedures were detailed. The methods used were Compromise Programming, Electre III and Promethee II. The results achieved confirm *Hypothesis 1*: The practices of open innovation influence to a greater or lesser degree the prospecting of knowledge of the actors, and assigning values to each criterion, we arrive at a matrix of Criteria x Alternatives that together with the vector weights provides the necessary support to apply the multicriteria methods. In other words, one applies the selection and classification methodology of alternatives, using the Compromise Programming, Promethee II and Electre III methods. The Compromise Programming due to its wide diffusion and application simplicity and understanding renders it an alternative to evaluate problems as referenced in this application. The problem solution compromise is the one that comes closest to the alternative. This method was designed to identify the closest solution to an ideal one; therefore it is not feasible, using a predetermined pattern of distances. In Promethee II there is a function of preferences for each criterion among the alternatives which must be maximized, indicating the intensity of an alternative to the other one, with the value ranging from 0 to 1. Of the Electre family (I,II,III,IV and V), Electre III is the one considered for the cases of uncertainty and inaccuracy to evaluate the alternatives in the decision problem. All these methods enable one to analyze the discrete solution alternatives, and taking into consideration subjective evaluations represented by numerical scores and weights. As these are problems involving subjective aspects, the methods that best fit the situation of this research are the methods of the family Electre and Promethee. It should be mentioned that although the Compromise Programming method is not part of this classification, it has similar characteristics, showing much

Table 1. Assessment of preferences – Influence of practices of open innovation in the prospecting of knowledge for value creation in highly complex environments.

	Multicriteria analysis		
	Promethee II	Compromise programming	Electre III
Value Chain / Partnerships for co-development	1 ^a	1 ^a	1 ^a
Relationship between companies and scientific and technological system	1 ^a	2 ^a	2 ^a
Product development through patent licensing	3 ^a	2 ^a	2 ^a
Value Opportunity Web – VOW / Spin-offs	4 ^a	4 ^a	3 ^a
Commercialization of technologies via Technology broker	4 ^a	4 ^a	3 ^a
Development of new business from Corporate Venturing	4 ^a	4 ^a	3 ^a
Mergers and acquisitions / Establishment of non-competitive consortia (innovation networks)	3 ^o	3 ^o	4 ^o

simplicity in order to understand its operation, which makes it feasible for this application.

Within this perspective, the multicriteria methods are viable instruments to measure the performance of the practices of open innovation in the prospecting of knowledge for value creation in the high tech enterprises. The results produced by this prioritization enable managers to better focus their efforts and resources on managing the practices of open innovation that perform best, which results in achieving the goals sought by the companies. The structure of this prioritization (classification by hierarchical analysis) is proposed at three planning levels in a judgment matrix, in which at the first hierarchical structure level it defines the goal, which is to achieve the value creation of the companies that will feed the system; the criteria are in the second level, which are the knowledge (prospecting) of actors: K1: R&D (Shelanski and Klein, 1995); K2: Clients (Joshi and Sharma, 2004); K3: Suppliers (Horn, 2005; Smith and Tranfield, 2005); K4: External consultants (Horn, 2005; Smith and Tranfield, 2005); K5: Competitors (Hemphill, 2003); K6: Joint ventures (Hemphill, 2003); and K7: universities/other public research centers (Roper et al., 2004). The practices of open innovation of the companies are in the third level, the alternatives, which are: P1: Value Chain; P2 Product development through patent licensing; P3: Partnerships for co-development; P4: Relationship between companies and scientific and technological system; P5: Spin-offs; P6: Mergers and acquisitions; P7: Commercialization of technologies via Technology broker; P8: Development of new business from Corporate Venturing; P9: Establishment of non-competitive consortia (innovation networks); and P10: Value Opportunity Web – VOW. The prioritization process obeys the judgment of the evaluators (experts). With the results of the judgment matrix, the methods were applied: Promethee II, Electre III and Compromise Programming to evaluate the innovation capacities in relation to the performance of the companies. Table 1 shows the results produced.

Open innovation networks introduce highly complex and multifaceted inter-organizational relationships (Jarvenpaa and Wernik, 2011). The results produced by the methods demonstrate the value chain and partnerships practices of open innovation as the most significant ones to ensure the knowledge prospecting and value creation for the companies. In today's competitive global market, enterprises must possess the capability to design and deliver innovative products with great value to customers in a timely matter. Each organization must focus on its own strong area where it will be uniquely competitive. Hence, all partners should ruminate about where and how values are created, and what contribution they can make based on their core competencies.

In addition, interorganizational relationships must be rapidly built up or dismantled among dynamically networked organizations. Once value chains are composed, all partners hold a definite vision of the coherence within the industry value system to become a collaborative value chain. All members of a given value chain must work together to respond to the changes of market demands rapidly (Chiang and Trappey, 2006). In this kind of environment, enterprises not only must reach out and enhance their relationships with each others, but also need to integrate their business processes (Chiang and Trappey, 2006). In fact, value chain provides enterprises with the opportunity to identify their core competencies and position themselves in the marketplace according to their competitive abilities (Al-Mudimigh et al., 2004; Chiang and Trappey, 2006). Firms benefit from engaging in a range of co-creation activities across the value chain, involving various touch-points and domains, rather than just one way of co-creating value with a particular type of co-creator (Ramaswamy, 2009). This paper presents value co-creation specifically business-to-consumer (B2C). B2C co-creation is rooted in relational marketing theory (Maklan et al., 2008). Atividades de co-criação de B2C são mais propensas a enfatizar formas de mercado como governança co-criação, porque esses empreendimentos estão criando

um mercado para soluções aos desafios co-criação específicas. Perspective on co-creation in management is the study of open innovation (Chesbrough, 2003). Open innovation is characterised by the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively. Open innovation assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as they look to advance their technology (Chesbrough et al., 2006; Roser et al., 2013).

Once value chains are composed, all partners hold a definite vision of the coherence within the industry value system to become a collaborative value chain. Many business model definitions discuss the value network of the firm with terms such as “structure of value chain,” “partner network,” “value network,” “links to external stakeholders,” or “transactional links to exchange partners” (Nenonen and Storbacka, 2010). “Business is fundamentally concerned with creating value and capturing returns from that value, and a model is simply a representation of reality. We define a business model as a representation of a firm’s underlying core logic and strategic choices for creating and capturing value within a value network” (Shafer et al., 2005). “We offer an interpretation of the business model as a construct that mediates the value creation process” (Chesbrough and Rosenbloom, 2002).

All members of a given value chain must work together to respond to the changes of market demands rapidly (Chiang and Trappey, 2006). Organizations create values for themselves and their customers via executing primary and supporting tasks. In the 1980s, value creation mainly depended on cost reduction and industry automation, but modern companies focus on value chain integration to achieve time-to-market and to enhance customer satisfaction (Garetti et al., 2005; Chiang and Trappey, 2006). Thus, the value chain concept offers management a means by which they can evaluate both existing and new strategic opportunities to create customer and partner value (Walters and Rainbird, 2007). Essentially the value creation system is an analytical tool; it facilitates the identification and evaluation of strategic alternatives (Walters and Rainbird, 2007). Value chain analysis identifies the flow of added value through the value creation processes within both the industry and the firm. In the business model of the future, value chains compete rather than individual companies, and the connectivity and process excellence are key challenges (AeIGT: 2003 cited in Johns et al., 2005). In addition, the cooperation in the value chain requires a complex repertoire of behaviors in that members organizations need to learn to mitigate the risks stemming from the other’s opportunism and also to avoid lapses in their respective knowledge-sharing (Jarvenpaa and Wernik, 2011). Increasingly, it has been argued, innovative capacity is dependent upon building linkages through collaborative relationships

(Coombs et al., 1996) [...] this enables learning which adds to an organization’s existing knowledge base and the creation of completely new knowledge (Inkpen, 1996) and also contributes to “novelty and variety in the economic system” by creating “new economic resources which otherwise simply would not exist” (Coombs et al., 1996). Such collaboration might involve sub-contracting, strategic alliances or joint ventures [...] (McLoughlin, 1999; Walters and Rainbird, 2007). Partnership/co-operative innovation combines elements of process innovation management and product innovation management within a network structure that neither partner can create using its own resources to meet customer/market determined expectations for product and/or service performance at an economic (viable) cost. Thus, the value chain concept offers management a means by which they can evaluate both existing and new strategic opportunities to create customer and partner value. Essentially the value creation system is an analytical tool; it facilitates the identification and evaluation of strategic alternatives (Walters and Rainbird, 2007).

When comparing the results in terms of performance, the Compromise Programming and Promethee II methods did not differ in their classifications. For Electre III, the results were incompatible. And this is because the p , q and v veto thresholds, respectively, of indifference, strong preference and veto or incomparability have a discrepancy in the structure of their results (classification). Electre III presents a set of solutions with a more flexible hierarchical structure. This is due to the conception of the method, as well as the quite explicit consideration of the indifference and incomparability aspect between the alternatives. The results referenced by the Promethee II and Compromise Programming methods reflect the preference, according to the experts, for value chain and partnerships. The essence of the practices of open innovation is the accumulation of knowledge over time. Next is the influence of the practices of open innovation in the knowledge prospecting. For this ANN was used. The technique adapts to the case in question.

Prospecting of knowledge using the artificial neural networks – ANN

The artificial neural networks - ANN is understood to simulate the behavior of the human brain through a number of interconnected neurons. A neuron executes weighed additions for the activations of the neurons representing nonlinear relations. The ANN has the capacity to recognize and to classify standards by means of processes of learning and training. The training of the net is the phase most important for the success of the applications in neural network. The topology of the net can better be determined of subjective form, from a principle that consists of adopting the lesser intermediate number of possible layer and neurons, without

Table 2. Classification of practices of open innovation using artificial neural networks and multicriteria analysis methods.

	Multicriteria analysis			
	Promethee II	Compromise programming	ELECTRE III	ANN
Value Chain / Partnerships for co-development	1 ^a	1 ^a	1 ^a	1 ^a
Relationship between companies and scientific and technological system	2 ^a	2 ^a	3 ^a	2 ^a
Product development through patent licensing	3 ^a	3 ^a	2 ^a	2 ^a
Value Opportunity Web – VOW / Spin-offs	4 ^a	4 ^a	2 ^a	3 ^a
Commercialization of technologies via Technology broker	4 ^a	4 ^a	3 ^a	4 ^a
Mergers and acquisitions / Establishment of non-competitive consortia (innovation networks)	3 ^o	3 ^o	4 ^o	3 ^a

compromising the precision. Thus, in this application, the layer of the entrance data possess 10 neurons corresponding to the 10 variable referring to practices of open innovation. The intermediate layer possesses 8 neurons, and the exit layer possesses 1 corresponding neuron in a scale value determined for the ANN. The process of learning supervised based in the Back propagation algorithm applying software Easy NN determines the weights between the layers of entrance and intermediate, and between the intermediate and exit automatically. The training process was finished when the weights between the connections had allowed minimizing the error of learning. For this, it was necessary to identify which configuration that would present the best resulted varying the taxes of learning and moment. After diverse configurations to have been tested, the net of that presented better resulted with tax of an equal learning of 0.45 and equal moment 0.92. The data had been divided into two groups, where to each period of training one third of the data is used for training of net and the remaining is applied for verification of the results. The net was trained for attainment of two results' group for comparison of the best-determined scale for the networks. In the first test the total of the judgment of the agents was adopted; however, only in as test was gotten better scales, next of represented for method of the multi-criteria analysis. With this, the last stage of the modeling in ANN consisted of testing the data of sequential entrance or random form, this process presented resulted more satisfactory. The reached results were satisfactory, emphasizing the subjective importance of scale's methods to treat questions that involve high degree of subjectivity and complexity. How much topologies are used in the networks; the results showed some confi-gurations of the ANN and compared to the multicriteria analysis, it was observed that ANN 1 is better if approached with the classification obtained from the multi-criteria analysis. Thus, even other topologies do not Tenaha been the best ones, it had been come however close in some practices of open innovation of the multi-criteria analysis. The results can be observed in Table 2 that follows.

In fact, the goal of knowledge is to create value from organizational and individual knowledge. The benefits derived from good knowledge are multiple, and include: reduced duplication of effort, creation of new knowledge, and increased efficiency and productivity. Knowledge and innovation are the building blocks of sustainable competitive advantage (Porter, 1985), and therefore are a source for sustainable development and growth for enterprises. Co-creating means extending the value chain (Helm and Jones, 2010). Hence, involving co-creators leads to an expansion of organizational boundaries and management of new and different relationships (Sawhney and Prandelli, 2000). In addition, firms require a flexible yet systematic integration and alignment of processes and stakeholder activities across business processes, particularly where customer encounters take place (Payne et al., 2008, 2009; Clarke and Nilsson, 2008). Indeed, the challenge in building a more service oriented and customer centred business model relates to the type of relationships and interactions to be utilized in co-creating value (Roser et al., 2013).

Thus, an innovation is the use of innovative knowledge so as to create effective value for the stakeholders in the value chain. From the perception of the innovation, the innovation value chain may be represented differently. Indeed, innovation starts from an idea that is often embedded with an innovative knowledge, to become somehow a prototypical invention, to finally become an innovative product or piece of technology that is industrially exploited or even commercialized. Porter (1985) argues that firms that optimize their value chain activities vis-a-vis competition stand a better chance of leveraging valuable capabilities into sustainable competitive advantage (Prajogo et al., 2008). Clearly any partnership innovation must be beneficial to all parties (Walters and Rainbird, 2007). The results produced in the light of artificial neural networks confirm value chain and partnerships as the practice of open innovation that shows the most (in greatest degree) influence in the prospecting of knowledge. The value chain is supported by a particular value that creates a logic and its

application results in particular strategic postures. Adopting a network perspective, a new economic value is configured to the organizations. Traditionally, value chain has been used as a concept and a tool to understand the analysis of industries and proved to be a useful mechanism for portraying the threaded engagement of traditional activities in industries (Porter, 1980). Moreover, it also shaped the thinking about value and value creation.

The value chain of a company relates to other chains and knowledge coming from different sources (suppliers, competitors, channels and customers, among others), which then become a value chain of the industry. At the same time, a company can make analyses of the links in the value chain between its suppliers, manufacturers and customers' chain in order to find ways to increase the competition. For the concept of value network, value is co-created by a combination of actors in the network. Business networks are independent. After all, how is value created? A traditional answer to this question is simply the value chain. In this perspective, the knowledge is certainly one of the best resources and the only sustainable competitive advantage. In this context, Additive Manufacturing technologies create parts layer by layer. Thereby, lots of benefits are offered. Especially extended design freedoms provide new potentials for the design of technical parts. To make these benefits accessible to different user groups (Adam and Zimmer, 2014). Recently, important technological and material developments increasingly enable Additive Manufacturing's applicability for the creation of end-use parts (Hague et al., 2004).

Thus, Additive Manufacturing more and more turns to a production capable technology (Kruth et al., 1998). Using Additive Manufacturing in terms of Direct Manufacturing – to manufacture end-use parts – new benefits can be gained due to the layer by layer manufacturing (Adam and Zimmer, 2014). Thereby the extension of design freedoms is one of Additive Manufacturing's most noteworthy potentials (Levy et al., 2003). It enables the manufacturability of highly complex parts which cannot be produced with conventional technologies like milling or casting. Additionally, Additive Manufacturing decouples parts manufacturing costs from its complexities (Adam and Zimmer, 2014). This increases the industrial relevance of Additive Manufacturing significantly, too (Hague et al., 2003). Here, Additive Manufacturing provides lots of potentials and benefits (Adam and Zimmer, 2014). Thus, in order to be able to enhance both value creation (the consumer's valuation of the benefit of consumption) and innovation, organizations must be able to create such value. We believe that the enabling factors are these three: individualized immediate feedback, a new organizational logic, and new cooperation structures (Johannessen and Olsen, 2010). Currently, the global products industry finds itself faced with many challenges. These challenges are multifaceted and complex, and the

need for the application of innovative ideas and solutions is obvious (Van Horne et al., 2006). Hence, new technology facilitates network logic in the global. Thus, the innovation and economic growth are created. And the innovation of products and processes is seen as a promising answer to many of the challenges faced by the products industry.

Phase 2: Modeling of the optimal effectiveness rate of value creation in the light of the influence of the practices of open innovation in the prospecting of knowledge of the actors under 3D modeling and additive manufacturing

This phase focuses on determining the optimal efficiency rate (OERVC) for value creation in the company using Neurofuzzy modeling. It is a process whose attributes usually possess high subjectivity characteristics, in which the experience of the decision maker is very significant. Thus within this spectrum there is the need for a tool that allows adding quantitative and qualitative variables that converge towards a single evaluation parameter (Cury and Oliveira; 1999; von Altrock, 1997). This model combines the Neural Networks and Logic Fuzzy technology (neurofuzzy technology). Here this model supports the planning of the practices of open innovation on the knowledge and value creation of high-tech companies, as it allows one to evaluate the desirable rate toward the acceptable performance of high-tech companies. The model shown here uses the model of Cury and Oliveira (1999). Based on the Neurofuzzy technology, the qualitative input data are grouped to determine the comparison parameters between the alternatives. The technique is structured by combining all attributes (qualitative and quantitative variables) in inference blocks (IB) that use fuzzy-based rules and linguistic expressions, so that the preference for each alternative priority decision of the optimal rate of value creation determinants, in terms of benefits to the company, can be expressed by a range varying from 0 to 10. The model consists of qualitative and quantitative variables, based on information from the experts. The Neurofuzzy model is described below.

Determination of Input Variables (IV): This section focuses on determining the qualitative and quantitative input variables (IV). These variables were extracted (10 variables: Value Chain; Product development through patent licensing; Partnerships for co-development; Relationship between companies and scientific and technological system; Spin-offs; Mergers and acquisitions; Commercialization of technologies via Technology broker; Development of new business from Corporate Venturing; Establishment of non-competitive consortia (innovation networks); and Value Opportunity Web – VOW) from the independent variables (dimensions of results Influence of practices of open innovation in the prospecting of knowledge for value creation in highly

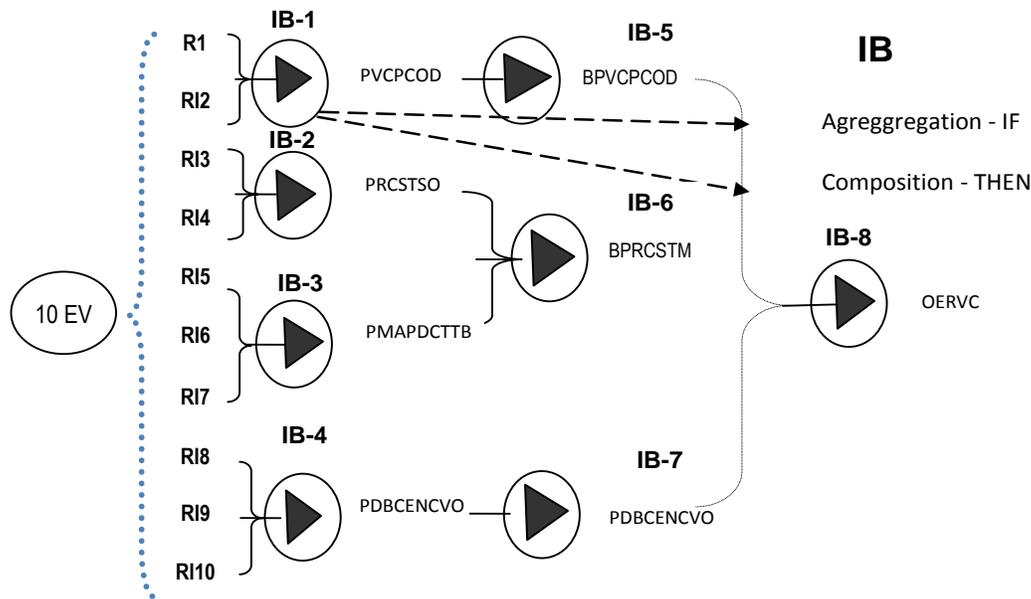


Figure 14. Neurofuzzy model.

complex environments. The linguistic terms assigned to each IV are: High, Medium and Low. Accordingly, Table 1 shows the IVs in the model, which are transformed into linguistic variables with their respective Degrees of Conviction or Certainty (DoC), with the assistance of twenty judges opining in the process. The degrees attributed by the judges are converted into linguistic expressions with their respective DoCs, based on fuzzy sets and IT rules (aggregation rules), next (composition rules) (Figure 14).

Determination of Intermediate Variables and Linguistic Terms: The qualitative input variables go through the inference fuzzy process, resulting in linguistic terms of intermediate variables (IVar). Thus, the linguistic terms assigned to IVar are: Low, Medium and High. The intermediate variables were obtained from: Performance of the value chain and partnerships for co-development: PVCPCOD; Performance of relationship between companies and scientific and technological system and Spin-offs: PRCSTSO; Performance of mergers and acquisitions, product development through patent licensing and commercialization of technologies via Technology broker: PMAPDCTTB; Performance of development of new business from corporate venturing, establishment of non-competitive: DNBENC consortia (innovation networks); and Performance of Value Opportunity Web – VOW: PDBCENCVO. The architecture proposed is composed of eight expert fuzzy system configurations, four qualitative input variables that go through the *fuzzy* process and through the inference block, thus producing an output variable (OV), called intermediate variable (IVar).

Then, the IVars₂ which join the other IVar variables

form a set of new IVars, thereby configuring a sequence until the last layer in the network. In the last layer of the network the output variable (OV) of the Neurofuzzy Network is defined. This OV is then subjected to a defuzzification process to achieve the final result: Optimal Efficiency Rate of Value Creation of High-Tech Companies. In summary, the fuzzy inference occurs from the base-rules, generating the linguistic vector of the OV, obtained through the aggregation and composition steps. For example, when the experts' opinion was requested on the optimal efficiency rate for the technological innovation capacity performance of company A, the response was 8.0. Then the fuzzification (simulation) process was carried out, assigning LOW, MEDIUM and HIGH linguistic terms to the assessment degrees at a 1 to 10 scale. Degree 8, considered LOW by 0% of the experts, MEDIUM by 55% and HIGH by 45% of the experts. In summary, the expert's response enabled one to determine the degree of certainty of the linguistic terms of each of the input variables using the fuzzy sets. The results confirm the *H2*: The optimal efficiency rate depends on the combination and interaction of the innovation capacities of the high-tech companies. The generic fuzzy sets were defined for all qualitative IVars, which always one to exhibit three levels of linguistic terms: a lower, a medium and a higher one. After converting all IVars into its corresponding linguistic variables with their respective DoC, the fuzzy inference blocks (IB), composed of IF-THEN rules, are operated based on the MAX-MIN operators, obtaining a linguistic value for each intermediate variable and output variable of the model, with the linguistic terms previously defined by the judges. With the input variables (features extracted

from product development projects), the rules are generated. Every rule has an individual weighting factor, called Certainty Factor (CF), between 0 and 1, which indicates the degree of importance of each rule in the fuzzy rule-base. And the fuzzy inference occurs from the rule-base, generating the linguistic vector of OV, obtained through the aggregation and composition steps.

Determination of Output Variable – Optimal Efficiency Rate of Value Creation

The output variable (OV) of the neurofuzzy model proposed was called Optimal Efficiency Rate of Value Creation in high-tech companies. The fuzzification process determines the pertinence functions for each input variable. If the input data values are accurate, results from measurements or observations, it is necessary to structure the fuzzy sets for the input variables, which is the fuzzification process. If the input variables are obtained in linguistic values, the fuzzification process is not necessary. A fuzzy set A in a universe X, is a set of ordered pairs represented by Equation 1.

$$A = \{(\mu_A(x), x) | x \in X\} \tag{1}$$

Where (x) is the pertinence function (or degree of pertinence) of x in A and is defined as the mapping of X in the closed interval $[0,1]$, according to Equation 2 (Pedrycz and Gomide, 1998).

$$\mu_A(x): X \rightarrow [0, 1] \tag{2}$$

Fuzzy Inference: The fuzzy inference rule-base consists of IF-THEN rules, which are responsible for aggregating the input variables and generating the output variables in linguistic terms, with their respective pertinence functions. According to Von Altrock (1997), a weighting factor is assigned to each rule that reflects their importance in the rule-base. This coefficient is called Certainty Factor (CF), and can vary in range $[0,1]$ and is multiplied by the result of the aggregation (IT part of inference). The fuzzy inference is structured by two components: (i) aggregation, that is, computing the IF rules part; and (ii) composition, the THEN part of the rules. The Degree of Certainty (DoC) that determines the vectors resulting from the linguistic processes of aggregation and composition are defined with Equation 3.

$$DoC_i = \max\{FC_1, \min\{GdC_{A11}, GdC_{A12}, \dots, GdC_{1n}\}, \dots, FC_n\} \cdot \min\{GdC_{An1}, GdC_{An2}, \dots, GdC_{Ann}\} \tag{3}$$

Defuzzification: For the applications involving qualitative variables, as is the case in question, a numerical value is required as a result of the system, called defuzzification. Thus, after the fuzzy inference, fuzzification is necessary, that is, transform linguistic values into numerical values,

from their pertinence functions (Von Altrock, 1997). The IT Maximum Center method was popularized to determine an accurate value for the linguistic vector of OV. Based on this method, the degree of certainty of linguistic terms is defined as “weights” associated with each of these values. The exact value of commitment (VC) is determined by considering the weights with respect to the typical values (maximum values of the pertinence functions), according to Equation 4 presented below (Von Altrock, 1997; Cury and Oliveira, 1999).

$$OV = \frac{\sum_{i=1}^n DoC_i \cdot X_i}{\sum_{i=1}^n DoC_i} \tag{3}$$

Where i DoC represents the degrees of certainty of the linguistic terms of the final output variable and i X indicates the end of the typical values for the linguistic terms, which correspond to the maxima of fuzzy sets that define the final output variable. By way of demonstration, using assigned IT (average) hypothetical (Company A) enters-IT into the calculation expression of TPCITj with GdCi of the following linguistic vector of the output variable, also hypothetical: LOW=0.20, MIDDLE=0.53, HIGH=0.17. The numerical value of OERVC at a 0 to 1 scale corresponds to 0.9417, resulting from the arithmetic mean of the values resulting from the defuzzification of each of the simulated twenty judges. This value corresponds to an average value for OERP. With this result (optimal efficiency rate: 0.9417) produced for a better combination and interaction of strategic practices of open innovation that converged toward a single parameter, it is feasible to assert that this combination of technological innovation activities of the firm at this time, can at least ensure the performance desired by the firm at that time. It is plausible that the company maintains at least this value (0.9417), which ensures the desired performance. It is also plausible to state that, to some degree, there is efficiency in the management of those planning innovation in this category of companies. To illustrate this, assuming that the study-object companies demonstrate the following optimal effectiveness rate of value creation in the light of the influence of the practices of open innovation in the prospecting of knowledge of the actors under 3D modeling and additive manufacturing, in the perspective of multiple products of company (Figure 15):

The expected reference for value creation for firm (mean) is 0.6596 (Figure 3). It is concluded that: “Synesthesia” Product (0.8442) shows efficiency in the combination of their practices of open innovation in prospecting of knowledge and value co-creation for firm based on the 3D modeling and additive manufacturing. The priorities of practices of open innovation for value creation are dynamic and dependent on constraints and uncertainties that come from the environment at any

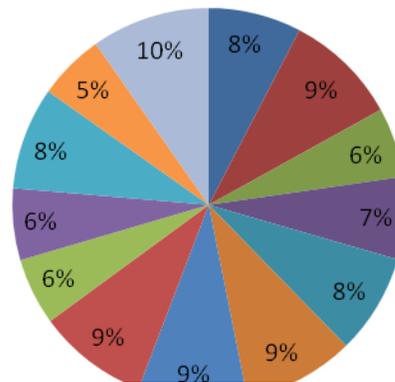
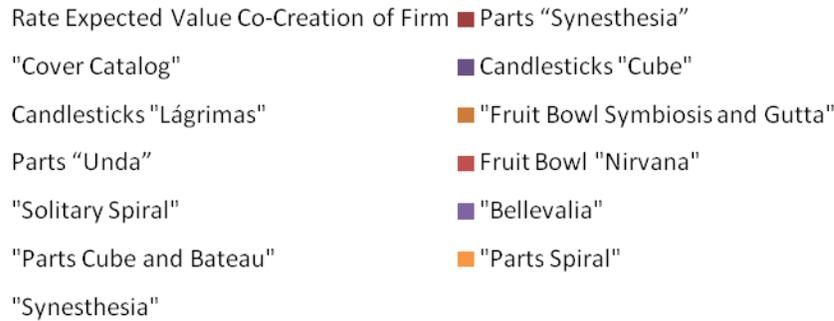


Figure 15. Optimal efficiency rate of value creation

given time. The environmental contingencies are crucial and essential to adapt the strategies. The modeling approach presented here enables this sophistication refinement for every contingency presented. Thus, it is important to look at the practices of open innovation in the prospecting of knowledge and value creation. Value capture implies focusing on getting the biggest possible cut of the pie, whereas value creation involves innovation that establishes or increases the consumer's valuation of the benefit of consumption (Priem, 2007). This research investigated the influence of practices of open innovation in the prospecting of value and value creation enhancing innovation and value creation. The knowledge is the recipient for success of open innovation. We have also seen a change in focus on how value is created. This leads us toward a long-ignored knowledge (and sources of knowledge) lens on both innovation and value creation in company.

CONCLUSIONS, IMPLICATIONS, AND LIMITATIONS

This article aims to contribute to a policy of innovation management. To do so, it presents the influence of practices of open innovation on the prospecting of knowledge for value creation in highly complex environments, based on the 3D modeling and additive manufacturing. The study attempted to cover an existing space in the

literature about innovation management based on the practice of open innovation in the prospecting of knowledge and value creation for highly complex environments based on the 3D modeling and additive manufacturing, which is the case of multiple products in a traditional segment of pewter in Portugal. Product features, quality, cost and time to market are important factors for a manufacturer to remain competitive (Yan and Gu, 1996). In fact, the company object of this research introduced a whole new and more contemporary line of products on the market in a short period of time. This was due to the adoption of new methods and new product development technologies, such as 3D CAD modeling, the use of virtual "prototypes" in the perspective of meeting customer expectations, the use of additive manufacturing technologies to obtain prototypes for visualization and conversion technologies and rapid manufacturing of tools for producing functional prototypes and final pieces. From different dimensions, the results refer to the additive technologies as a mechanism that leads to increasing business value from the perspective of the project, consistency with the strategy, production capacity, strength of the client/market need, technical competence and cost. It is also evident that the technological innovation is a dynamic list of priorities, depending on the essential and desired existing capacities that emerge over practice time, always bringing new concepts and demanding new behaviors, new

content and technical implementations, thus fundamentally requiring to permanently reconfigure the new capacities for the new innovation performances.

There are a couple of interesting managerial conclusions that can be drawn based on the present research. Firms can radically improve value co-creation, and thus increase their share of the co-created value, by designing business models that have a high degree of internal and external configurational fit. Here, a new business model connotes the compatibility of the firm's business model with its customers, suppliers and other business partners. Higher degree of external configurational fit can be achieved both by modifying the firm's own business model and by altering the firm's customer, supplier, and partner portfolios. In addition, the business model framework can be used as a tool in strategy work. Such detailed understanding of the business model is especially valuable when the firm seeks to alter its strategic position in the value network (e.g. moving from product business to solution business) or attempts to enter new geographical markets (Nenonen and Storbacka, 2010).

Thus, open innovation has been defined as "both a set of practices for profiting from innovation and also a cognitive mode, for creating, interpreting and researching those practices" (Chesbrough, 2006), "the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively" (Chesbrough et al., 2006) and "systematically performing knowledge exploration, retention, and exploitation inside and outside an organization's boundaries throughout the innovation process" (Lichtenthaler, 2011). Open innovation practices, in general, provide greater opportunities for firms to advance and commercialize their technologies and, hence, enhance their innovation capability and international competitiveness (Chesbrough, 2003; Laursen and Salter, 2006; Clausen and Pohjola, 2009; Gassmann et al., 2010; Wynarczyk et al., 2013). In addition, open innovation allows for internal ideas to be taken to market through external channels, outside the firm's internal mechanisms, in order to generate additional value (Wynarczyk et al., 2013).

Thus, according to Huizingh (2010), open innovation practices are the processes that managers start when deciding "when, how, with whom, with what purpose, and in what way should they cooperate with external partners". Here, the practices of open innovation support the external knowledge prospecting and value creation in high tech industries. In fact, the benefits derived from good knowledge management are multiple, and include: reduced duplication of effort, creation of new knowledge, and increased efficiency and productivity. Knowledge and innovation are the building blocks of sustainable competitive advantage (Porter, 1980), and therefore are a source for sustainable development and growth for enterprises. The innovation is the use of innovative knowledge

so as to create effective value for the stakeholders of the industry (Van Horne et al., 2006). Here, the best practices of open innovation have been the value chain and partnerships and collaborations. In fact, all value chain activities are equally important as firms strive toward specific strategic goals. Porter (1980) suggests that achieving competitive advantage begins with an effort to develop deeper organizational expertise in performing certain competitively critical value chain activities (Prajogo et al., 2008).

In the research, cross-sectional data used in this study may not be appropriate to establish fundamental relationships between variables, but as referenced by Kenny (1979), the relationships that use cross sections are satisfactory and popularly accepted in relationship tests. Furthermore, a case of multiple products was developed in a traditional segment of pewter in Portugal, in a static context, which may represent a limiting factor. Therefore, it is recommended to reproduce and replicate the model in companies from other countries in order to confirm the results. It is also recommended that the practices of open innovation dimensions should be extracted from the state of the art, but strongly confirmed by the state of practice, by the judgment of other experts (from other countries), taking into account that values, beliefs, cultures and experiences are determinants in the assessment, which can overturn the effects on the results. It is also underscored that the methodologies and technical basis of this modeling should undergo evaluation by a multidisciplinary team of specialists permanently and periodically, hence proposing possible additions or adjustments to these methodologies. And also replace some of the technical implementations used herein by others, in order to provide a similar role to verify the robustness of the model. Of the research findings, the industries undertake the ever-fast changes, intense competition and a highly uncertain and risky environment. The effect produced by technology on the development of new products is equally intensive. Prospecting of knowledge of R&D is crucial for practices of open innovation. It confirms the state of the art. Shanklin and Ryans (1984) suggest that high-tech companies anticipate potential technical and scientific capabilities that provide quick responses to the existing techniques, enabling to meet the market demands to be constructed or altered. It is reasonable to focus efforts on knowledge of R&D, thereby creating an internal stock of scientific knowledge (Feinberg and Majumdar, 2001; Griliches, 1979; Hall and Mairesse, 1995), which enables one to develop and introduce new products, lower production costs, more competitive prices and greater financial return (Kafourous, 2008a, 2008b). Knowledge of R&D has indirect effects on increasing the organizational learning, enables one to understand external ideas and technologies and apply them to the ultimate business outcome (Cohen and Levinthal, 1989) and also contributes to identifying areas that are still technologically unexplored (Miller et al.,

2007). This logic will be maintained, however only through opening spaces for the various strata: partners, suppliers and customers. Nevertheless, the practices of open innovation in the prospecting of knowledge of companies will have to be anchored in efficient planning policies.

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Full Length Research Paper

Assortment planning: Strategic perception of retail owners and managers in Brazil

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The goal of the Assortment Planning (AP) is to specify an assortment that maximizes sales and profits which counterbalance the offer of products based on the decisions made about sales; it also increases the probability for consumers to find their own favorite product without increase in storage costs or risk of stock out. This work aims to investigate the strategic perception of retail owners and managers about assortment. Specifically, this study will analyze the impact of assortment, clients' fidelity, level of service and profits on the vision of the retailer. It is an exploratory investigation of retailers' perception about assortment management. The results of this research allow one to interfere with the inadequate knowledge of the interviewees about the theme, mainly the smaller stores. Generally, it was verified that the owners and managers evaluated assortment planning as a primordial strategic tool and considered important a system of information. Although recognizing the strategic importance of AP in the control of unproductive variety, the consumer of retail goods, mainly the small retailer uses the intuitive judgment related to the use of analytic methodology.

Key words: Management by category; assortment planning; strategic perception.

INTRODUCTION

A significant number of innovations in the 90s were developed by retailers. Among them are management by category (MC), using a set of techniques to offer the supplier solutions of purchasing that meet the needs of the clients at each point of sale, defining assortment and organizing as well as grouping the products based on the consumers (Santos and Gimenez, 1999; Holmström et al., 2002; Czapski, 2012).

An analysis of the tactic strategies of the MC used by the industry focuses on investing in sales point (Czapski,

2012). The decisions around assortment (prices, promotions, and other variables of marketing) are processed in a holistic way, so the manufacturer has to consider the profits of the category as a whole and not only the brands (McDonald and Wilson, 2011).

Different from the management by brands, this new concept transfers the power of the fabricant to the retailer because of the concentration of the retail sector and the detention of information on the comportment of the consumer (Santos and Gimenez, 1999). The MC also

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maximizes the profits of the retail space and profit margin (Basuroy et al., 2001; Holmström et al., 2002) due to the coordinated and/or cooperative character of the prize according to the competitive character of the management by brands.

Among the practices of the MC, the assortment planning (AP) is one of the most used, because it allows, for example, the elimination of articles of low profits that occupy the physic space that could be used for the exposition of other products. Generally, the AP helps to make decisions about the limitation of space in the gondolas, about the investment for storage, about the quantity of launchings and about the progressive number of categories (Cadeaux, 1997; Santos and Gimenez, 1999; Arkader and Ferreira, 2004). On the consumers' perspective, the preference is for extensive assortment due to the needs for more options and attraction generated by various assortments (Boyd and Bahn, 2009). However, the costs associated with the disposing of big assortments are expensive and the retailers, knowing that costs do not want to be responsible for these expenses (Oppewal and Koelemeijer, 2005).

The new present scenario has favored and evoked the need of adoption of retailers, suppliers and manufacturers, a new reality on which collaborated and integrated decisions can benefit all involved in the chain (Attaran and Attaran, 2007). This way, the decisions about the AP become a strategy essential for achieving balance in the control of unproductive variety. In assortment management, mainly small retail unit, considers intuitive judgment to the detriment of the use of analytic method (Fisher and Vaidyanathan, 2013). Establishing and achieving an ideal AP is considered an art (i.e. intuition) and not science (i.e. analytic models); so the retailer loses the opportunity of using a strategic tool important for the maximization of profits and level of services with low investment in information system (Fisher et al., 2000; Fisher and Vaidyanathan, 2013).

Innovation in assortment of products represents a crucial aspect in the MC, since location and price determine the preference and fidelity of the consumers (Broniarczyk and Hoyer, 2006). The literature on the size and variability of assortment and its influence on consumers' perception, purchasing conduct and consequently the volume of sales and profits of retailers has contradictory results. Most of the researches on the subject were made in Brazil and did not consider the cultural and social intrinsic characteristics of the country. Also, besides the importance of the subject, only a few studies evaluated the perception of the retailer (owners and managers) about AP, the analytic tools used and the strategies necessary for achieving the balance in assortment, depth, and level of service.

With these, the current work aims to investigate the strategic perception of the owners and managers of retail food about AP. Specifically, the study analyzes the effect of assortment, clients' fidelity, level of service and profits

on retailers' vision. It intends to show the knowledge of the retail professionals of AP and to contribute to the decision-making process in space limitation on the gondolas, storage investment, quantity of launchings and the progressive increase of the number of categories.

Thus, this paper aims to provide a statistically valid tool for assessing the knowledge of retail professionals of this subject, contributing to the management of inventories. With this purpose, the work is divided into four sections beyond the introduction part and the definition of the research problem. The next section is the theoretical and empirical aspects; and also the subsections that expose the concepts of the MC as the AP. The third section contains the methodological procedures. The fourth section contains the presentation and analysis of the results followed by section five which has the final considerations and suggestions for future researches.

MANAGEMENT BY CATEGORY

As an initiative of management and innovation of the retailer, the MC seeks to increase development in a certain category of products through the adoption of strategies more coordinated for purchase, promotions, assortment, and marketing (Basuroy et al., 2001). This management tool is a strategic unit of business and establishes for each unit goals of profits clearly defined (Meldrum and Mcdonald, 2007).

The MC emerges from the concept of Efficient Customer Response (ECR) on which the volume of sales is replaced with profits (Arkader and Ferreira, 2004; Mcdonald and Wilson, 2011). On this model, the suppliers, distributors, and retailers share information and work together, which brings more efficiency to the chain as a whole, better attendance to consumers, reduction of costs and total storage (Santos and Gimenez, 1999). The innovation of the MC emerged in middle of the 90s as contrast to the traditional management that centered on brands (Meldrum and Mcdonald, 2007), on which the price of the products were defined and imposed on the retailers independently by the diverse manufacturers. Contrarily, the MC recognizes the interdependence of the products on the same category. This new model focuses on the holistic result of the category to the detriment of the result of the individual brands. That is why it demands that the manager of the category defines the prices of all brands belonging to the category together, what allows a global increase of prices in a category and the optimization of the profits of the retailers (Basuroy et al., 2001).

Different from the traditional practices of the management by brands, the MC stops the manufacturer to direct the decision-making process around the assortment offered (Holmström et al., 2002). For this reason, some researches consider this new model as a symbol of the evolution of retailers, which migrate from passive

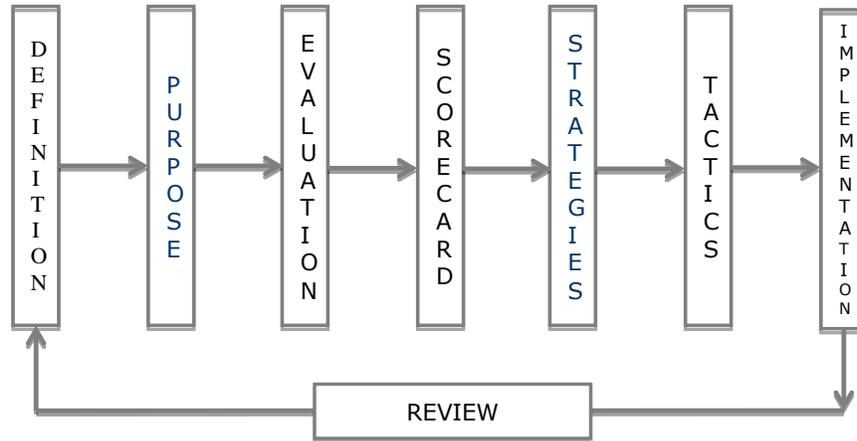


Figure 1. Eight steps necessary for the correct implementation of the MCO.
Source: Adapted from Basuroy et al. (2001).

distributors to active members of the supply chain (McDonald and Wilson, 2011). For suppliers/manufacturers, this new model generates a big challenge; it provides convincing arguments so the retailers highlight their brands and, in the meantime, adapt, refine, or make changes to the strategies and management tactics, benefitting the category as a whole (Johnson, 1999).

In practical terms, the MC involves *front-end* activities for increased demand as well as activities of *back-office* for the development of the management of supplies of the logistic coordination (Dhar et al., 2001). For the implementation of the MC, the retail activities must pass through strategic changes, tactics and operations as shown in Figure 1. On the first step, it is determined what products will build the category, subcategory and the main segmentation. The second step (the purpose) considers the consumer, distributor, supplier and the market and analyzes each category; while the third step (evaluation) reunites and analyzes the historic data and important information for the category management. The fourth step (scorecard) establishes measures of performance to evaluate the execution of the program and the assertiveness of the strategies (step five), of the tactics (step six) and of the plan of implementation (step seven). The last step involves the continuous monitoring of results obtained and the possible need of modification of the initial plan (Basuroy et al., 2001).

It is important to highlight that the detailed process in Figure 1 must be applied to each category individually, since the impact of the variables associated with the management by category (price, promotion, assortment, etc.) varies significantly according to the role exercised by the category in the retailers' integral book (Dhar et al., 2001). Usually, in the implementation of the process, different strategies can be used for different categories. The criterion of choice considers as a final goal the increase of profits and sales and the coordination of wide

range of variables of marketing. From these factors, the AP and the balance of the assortment in a specific category are fully important for the retailers. These matters are given in details as follows.

Assortment planning

AP, in the literature, is really explored based on the retailers' point of view (Broniarczyk et al., 1998; Grewal et al., 1999; Iyengar and Lepper, 2000; Boatwright and Nunes, 2001; Rajaram, 2001; Agrawal and Smith, 2003; Oppewal and Koelemeijer, 2005; Campo and Gijbrecchts, 2005; Kök et al., 2006; Yucel et al., 2009; Mantrala et al., 2009; Parente, 2010; Bauer et al., 2012; Cadeaux and Dubelaar, 2012; Agrawal and Smith, 2013; Fisher and Vaidyanathan, 2013). That happens, probably, because the exposition of products and the moment of decision of purchase of the final consumer happen in the retail environment.

Assortment is defined as a number of SKUs (Stock Keeping Units) offered in a unique category of products (Broniarczyk and Hoyer, 2006). Usually, they are characterized by two components: (i) width, which refers to the number of different brands offered by the retailers and (ii) the depth, which refers to the average number of SKUs offered by brand in a determined category (Dhar et al., 2001). Besides these two main components, other variables that integrate the MC are symmetry, organization strategy, level of organization, disposal, compatibility of structures (Broniarczyk and Hoyer, 2006) and market-share (Dhar et al., 2001).

All these components and variables have direct influence on the perception of the client in relation to the offered assortment; therefore, they impact significantly the volume of sales, gross margins and the profits of the retailers and other members of the chain (Kök et al.,

Table 1. Impact of the retailer in front of the unavailability of the product wanted by the consumer.

Answer of the customer	Retailer	Manufacturer
Change of retailer	Represents the most problematical answer to the retailer	It is not impacted
Advance of purchase	Indirectly, because of cash-flow and storage	Indirectly, because of cash-flow and fluctuation of demand
Substitution – Same brand	Eventually, in case of Exchange for an alternative with lower value or margin	Eventually, in case of Exchange for an alternative with lower value or margin
Substitution – Different brand	Eventually, in case of Exchange for an alternative with lower value or margin	Represents the most problematical answer to the manufacturer
Desistence	Direct Loss	Direct Loss

Source: Adjusted from Gruen et al. (2002).

2006; Mantrala et al., 2009). Despite the fact that the assortment is defined as quality of SKUs offered, the perception of the consumers about assortment frequently distinguishes the objective reality. This way, the perception of the consumer can be affected: (i) by the number of SKUs offered (ii) by the heuristic of the space available for the products category and (iii) by the availability of the favorite products for the clients (Broniarczyk et al., 1998). This way, a reduction of assortment may present some null or positive results in the perception of the consumer if the distribution of distinctive attributes of SKUs is constant or distinct to become more apparent (Hoch et al., 1999; Van et al., 2002; Morita, 2010).

The goal of the AP is to specify an assortment that maximizes the sales and profits, which counterbalance the offer of product based on the decisions of purchase of the consumer (Saure and Zeevi, 2009) that increases the probability for the consumers to find their favorite products without the increase of storage costs or risk of stock out (Broniarczyk and Hoyer, 2006; Sloot et al., 2006; Morita, 2010). In this context, we can say that the goal of the AP is to achieve a balance between the good assortment besides the limitations in the purchasing budget, the physical space of the shelf, and the storage (Salles, 2010). A great assortment invariable involves the trade-off between the benefits to include certain product in the assortment and the costs of that inclusion (Cachón et al., 2005; Yücel et al., 2009).

The strategy to keep, increase or reduce the assortment depends and can oscillate according to many variables associated to the profile of the consumer, of the product and/or of the category. A wide set of benefits coming from the point of balance for a better AP can be glimpsed in the literature. The AP is seen as a tool for managing the space in the shelf for the SKUs with a high volume of sales (Food Marketing Institute, 1993; Drèze et al., 1994), as well as for the reduction of costs, through the elimination of items of low prices and low participation (Borle et al., 2005). These factors influence directly the reduction of costs of storage, but can increase the

probability of unavailability of the product wanted by the consumer (Broniarczyk and Hoyer, 2006). In that case, the consumer can change the retailer, substitute the SKUs by a product of the same brand, delay the purchase or give up (Zinn and Liu, 2001; Gruen et al., 2002). Due to the unavailability of the product wanted by the consumer, the retailer loses sales with consequent oscillation of the cash-flow, storage and demand (Gruen et al., 2002; Yücel et al., 2009). The manufacturer, in turn, has the product substituted by the competitor or by the direct loss by the purchase desistence. All the members of the channel are impacted by this process, as shown in Table 1.

The negative effect of a bad management of AP is often justified by the fact that clients do not find their favorite product, due to the removal of SKUs of assortment offered (Broniarczyk et al., 1998; Broniarczyk and Hoyer, 2006; Sloot et al., 2006). The removal of the favorite product tends to show a more significant effect in short term, since after a certain period of time the consumer should opt to change the retailer in order to buy the favorite product or to buy a substitute product.

It is important to highlight that big assortments can attract consumers initially, but the difficulty when making a decision among many SKUs becomes demotivating, generating regrets and desistence of purchase (Broniarczyk et al., 1998; Botti and Iyengar, 2004; Gourville and Soman, 2005; Sloot et al., 2006). Big assortments have an oppressive effect on the consumers, whose preferences are not well defined; the big assortments increase the probability of finding the product with the combination of attributes that they judge ideal (Chernev, 2003).

Defining the variety and appropriate quantity of products, relating the needs of the client and the operational costs are a complex task and determinant of the competitiveness of retailers. Consequently, they pose a challenge for the retailer to generate the ideal AP that maximizes the total profits of business. From the pessimistic perspective of reduction of assortment, if the reduction of SKUs does not impact the volume of sales (neither positively, nor

Table 2. Corresponding characterization.

1	Number of employees of the company: () until 19 () 20 to 99 () 100 to 499 () More of 500
2	Type of organization: () Hypermarket () Supermarket () Grocery Store () Bakery () Convenience Store
3	Position in the Company: () Owner () Manager () Head of sector () Others
4	Gender: () Male () Female
5	Age: () 20 or less () 21 to 25 () 26 to 30 () 31 to 35 () 36 to 40 () 41 or more
6	Level of education: () Elementary School () High School () Superior () post graduated
7	Currently, what kind of information do you use to keep yourself updated () Books () Newspapers and Magazines () Internet () Digital Medias () Others _____

Source: The authors.

negatively), the general result is positive for the retailer, because of the reduction of logic costs in the purchase, *setup*, storage, among others. In that case, the final result shows the increase of profits.

The limited spaces available in the gondolas and shelves, as well as the annual increase of products and increased investment necessary for storage imply the adoption of strategy necessary for the selection of spaces for the exposition and storage of SKUs (Morita, 2010; Salles, 2010). The conflicts between the retailers and industries give space for the practice of tax payment, funds, agreements, and benefits, called slotting fees (Kök et al., 2006). Due to the transfer of the power of industry to the retailer, the practice of slotting fees represents a strategy for the fabricant to influence the retailer to have the products distributed, exposed, or stored at the sales point. This value is paid by the industry, and it can be funded with money or as subsidy, discounts in the orders or bonus of products (Wilkie et al., 2002). However, the conflicts between retailer and supplier can generate greater volume of sales, greater profitability and reduction of time of supplying to every member of the chain. The more the industry learns about the needs and preferences of the final consumers, the more they will be able to preview in a precise and accurate way the demand of the market. The retailer, in turn, is the only link of the chain that dominates the information of the consumers' behave, their desires, needs, and preferences (Attaran and Attaran, 2007; Bertaglia, 2009). An adequate infrastructure for the exchange of information can contribute to the reduction of the lasting effect of chicote (Lee et al., 1997), the reduction of storage (Campos et al., 2002), and in order to achieve economic and strategic advantages (Kim, 1999; Attaran and Atitaram, 2007).

METODOLOGY

The current research is an exploratory investigation (Mattar, 1996) of the perception of retailers about assortment management. As a survey, the research sought the direct knowledge by interrogating directly retailers and managers about AP in retail food. The information was obtained through bibliographic and questionnaires. The data were regrouped in tables allowing the use of relations and

other statistic procedures. The collected data were analyzed with the help of the statistic Software SPSS.

Development of the scale

We tried to evaluate the perspective of retailers and managers about diverse questions through an adaptation of the Likert scale, varying from 1 to 10, equivalent to the level of importance that the interviewee attributed to the subject in question: 1= totally disagree (TD); 5= neither agree nor disagree (ND); 10= agree; 10= totally agree (TA). The initial questionnaire had 27 questions that evaluated the relation among assortment, client fidelity, level of service and profits of the retailer, as shown in Tables 2 and 3.

The information obtained by the application of the questionnaire allowed interference on the limitation of space on the gondolas, storage investment, the system of information for assortment planning and effective assortment management. The questionnaire was applied to 135 commercial retail establishments, including hypermarkets, supermarkets, grocery stores, bakery, and convenience store in the main cities of States of Parana and Santa Catarina (Brazil) between March and May of 2013. From these establishments, only 27 did not accept to participate in the research due to lack of time to answer the questionnaire or the confidentiality of the information. The total answers were 108 at sales points.

After the questionnaire was applied, factorial exploratory analysis was made on the questions except question 12. Since there were no initial interferences on the possible dimensions of this questionnaire, it was used the method of the main components and the rotation of Varimax. The initial KMO, with all the variables presented on the initial questionnaire was 0.627, and 7 dimensions were found for this scale. Question 9 with communality of 0.580 was spread among the dimensions. Therefore, we chose to withdraw and rotate the data again.

On the second round, the new KMO was 0.621, with 7 dimensions. The seventh dimension, containing the variable of question 4, was with just one indicator. This way, we decided to withdraw the question and rotate the data again.

The third round had KMO of 0.636 and 6 dimensions. Since question 17 was spread in many dimensions, it was withdrawn. The exploratory factorial analysis was rotated one more time, and this new round had KMO of 0.653 with 5 dimensions. On this round, the variable of question 15 was spread and it was withdrawn. The fifth round was made and had KMO of 0.649 with 5 dimensions. None of the questions was spread among the dimensions and all of the communities are superior with 0.5. The first dimension was counted on the variables 1,2,5,6, and 20; the second with questions 3, 7, 8, and 19; the third, 13, and 16; the fourth, 10, and 14; the fifth, 11 and 18. After the analysis of the content of the questions, we chose to keep all the variables. Now the Cronbach's Alpha was calculated

Table 3. Initial questionnaire.

1	Do you consider yourself an updated professional about the matters related to the assortment planning in the retail?
2	Does the company evaluate if the client found the brand/product he was seeking?
3	Are the products of low turnover substituted on the gondola?
4	Who defines the assortment of products, is it the supplier?
5	Does the company receive investment/support of the supplier to expose the assortment?
6	Does the volume of sales increase if there is a greater assortment?
7	Does the space reduce if there is a greater assortment?
8	Do the costs reduce if there is a greater assortment?
9	Does the probability of the consumer feeling confused and abandoned increase if there is a greater assortment?
10	Does the satisfaction of the client increase if there is a greater assortment?
11	If there is a reduction of assortment, will there be modification in the volume of sells?
12	If the consumer doesn't find the brand/product of choice, he () substitutes for the same brand () substitutes for another brand () delay the purchase () abandons the store
13	Does the time of search reduce and the visibility of the production crease if there is a greater assortment?
14	Is there more space on the gondola for the allocation of high sale/cycle if there is lower assortment?
15	For the implementation of a computerized management system for the analysis of assortment is it necessary high investment?
16	Is the implementation of a computerized management system for analysis of assortment going to contribute significantly to the financial development of the company?
17	Do my decisions impact directly in the assortment offered by the company?
18	Do my decisions about assortment more difficult for food products that offer more variability for the client?
19	Do the products assortment offered to the client impact on the level of service and on the profits of the company?
20	Does the company have a system of information to manage the purchase of the supplier?

Source: The authors.

to obtain the dimensions. The Alpha for the first dimension was 0.802; the value does not increase in case of a withdrawn question. This way, we keep all the questions. On the second dimension, the Alpha calculated was 0.768; just like the first dimension, it also does not increase if there is a withdrawn question. The third, fourth, and fifth dimensions have only two questions, and because of that, we adopted a pattern to keep them, in case of high Alpha. On the third dimension, the Alpha was 0.989 (dimension kept with the two questions); on the fourth, 0.604 and on the fifth, 0.496. The fourth dimension, despite its low Alpha, was kept due to the content, but the fifth, due to the low Alpha, was excluded. Based on this, the final questionnaire is expressed in Table 4. Table 4 shows that the variables of the first and second order, questions 1, 2, 5, 6, and 20 refer to the assortment variable. Questions 3, 7, 8, and 19 refer to the number of items and physical space available for the assortment planning based on the fidelity of the client. Questions 13 to 16 refer to the level of service. Finally, questions 10 and 14 refer to the perception of the visibility and the exposition of the assortment planning based on the profits of the retailer. The next section presents the results and discussion of this research.

DISCUSSION AND ANALYSIS OF RESULTS

This work analyzed the relation among assortment, fidelity of the client, level of service, and profitability of the owners and managers of retail food. The general goal of this research was to contribute to the decision-making process of the limitation of spaces on the gondolas, storage investment, the quantity of launchings, as well as the progressive increase in the number of categories.

Questionnaire was directed to the owners and managers of the main retail establishments in Southern Brazil. The answers allowed an analysis of the profile of the interviewees and a better comprehension of the perception of the professionals in areas related to AP as well as the knowledge of the actions related to the decision-making process.

Profile of the retail professionals

For the profile analysis of the participants, we tried to identify the professionals directly connected to the products market in the category of consumer goods, with experience in their areas. Table 5 shows the result of the research based on the profile of the ones involved in the research field. About the level of education, more than 60% graduated from college; about the function more than 40% are direct managers around 36 and 40 years old (38%); the majority are males (81.5%). For the retail establishment analyzed, the research explored mainly the supermarket in the category with the maximum of 10 checkouts (39.8).

Perception related to assortment planning

Tables 4 and 6 show statistically the answers of the

Table 4. Final questionnaire.

First order variable	Second order variable	Question No	Question
Analysis of the perception of the owners and professionals of the retail related to the assortment planning of food products	Assortment	1	Do you consider a well-informed professional due to the subjects related to the assortment planning on the retail?
		2	Does the company evaluate if the client found the brand/product he was looking for?
		5	Does the company receive investment/support from the supplier for the exhibition of the assortment?
		6	Does the volume of sales increase with a greater assortment?
		20	Does the company have an information system to manage the purchase from the supplier?
	Fidelity	3	Are the products with low cycle substituted on the gondola?
		7	Does the space for each product get bigger with a greater assortment?
		8	Are the costs of products in storage higher with a higher assortment?
		19	Does the product assortment offered to the client impact on the level of service and income of the company?
	Level of service	13	Is the visibility of the product higher with a lower assortment?
		16	Is the implementation of a computerized system of management for the analysis of assortment going to contribute significantly for the financial development of the company?
	Profits	10	Is the probability of a consumer confused and ready to give up about the purchase if there is a greater assortment?
		14	If there is a lower assortment and better visibility of the product with a lower assortment?

Source: The Authors.

Table 5. Result of the research: profile and characteristic of the interviewees and retailers.

Variable	%	Characteristic	Variable	%	Characteristic
Level of Education	60.2	Superior	Function	32.2	Head of the sector
	4.6	Post-Graduated		41.7	Managers
	35.2	High School		21.3	Owners
Gender	81.5	Male	4.8	Other functions	
	18.5	Female	Retail	30.6	Hypermarket
4.0	21 to 25	39.8		Supermarkets	
Age	17.2	31 a 35		5.6	Convenience Store
	9.3	26 to 30		7.4	Grocery Stores
	38.0	36 to 40		16.6	Bakery
Means of Information	31.5	Older than 41	25.9	100 to 499	
	48.0	Internet	38.0	20 to 99	
	36.2	News paper and magazines	10.2	0 to 19	
	12.0	Electronic Media	25.9	Above 500	
	3.8	Other means			

Source: Result of the research.

interviewees about the theme of the research. Related to question 1 (Who do you consider a well-informed professional in terms of the subjects related to assortment

planning on the retail?), the average answer was 6.57, which shows that not all the interviewees considered themselves experts on the theme. Answers that showed

Table 6. Average answers to the questions in Table 4.

Analysis	Assortment						Fidelity			Level of Service		Profitability	
Question	1	2	5	6	20	3	7	8	19	13	16	10	14
Average	6.57	6.42	5.05	6.76	6.93	8.01	8.16	8.23	8.2	9.01	8.18	7.27	7.92

Source: Result of the Research.

less knowledge about the AP were found at the grocery store, bakery and convenience stores. For question 2 (Does the company evaluate if the client found the brand/product he is looking for?), the average of the answers was 6.42.

This result has greater impact for the hypermarkets and supermarkets adding up, together, 70.4% of the sample of the retail. For the other stores, this criterion was rarely evaluated due to the lack of analytic tools necessary. On question 5 (Does the company receive investment/support from the supplier for the exhibition of the assortment?) the average answer was 5.05, which is highly affected by the answers of the hypermarkets and supermarkets that traditionally require more participation of the suppliers in the costs of the store through slotting fees. The average answer for question 6 (Does the volume of sales increase with a greater assortment?) was 6.76. The results show a perception that the assortments cannot be too broad, but necessarily need adequate profile of the client at the point of sales. Question 20 (Does the company have a system of information to manage the purchase from the supplier) had an average of 6.93. This result, one more time, was highly affected by the answers of the hypermarkets and the supermarkets that have specific programs for the management of purchases and sales. In minor proportions, the answers of the grocery stores and the bakeries also contributed to the average, since these points of sale have been focusing on the management by variety for a better control of storage and sales.

For the variable of fidelity, all the questions had average above 8. For this variable, based on the research, it was found that the items of low cycle are substituted during the time. The bigger the space for the assortment, the smallest the space destined for the exhibition of each SKU. Similar answers among the retail stores were also obtained for the relation of assortment and costs of storage, as well as for the assortment, the level of service, and the income of the companies.

For the variable level of services, question 13 had average answer of 9.01. We can suggest that the lower assortment exposed in bigger spaces reduces the time of search since it increases the visibility of the product. A good management of market must involve simultaneously the knowledge that the retailers have of their stores and about the public behavior; and at the same time, the knowledge of the producer, with updated information about the products, demand, share, distribution, and

preferences of the consumers. Question 16, also for the variable of the level of service, obtained average answer of 8.18. The answers showed a perception that the implementation of computerized management system for the analysis of the assortment would contribute for the financial development of the company to satisfy the client. This development will have as a base a better control of MC, by gaining of margin for the group of products. For the profits variable, the average answers were 7.27 and 7.92. The answers showed a perception that the greater the assortment, the greater is the client's satisfaction, as well as the lower the assortment, the bigger the space for the exhibition of each SKU. The perception of the interviewees helps the study of Broniarczyk and Hoyer (2006) on which big volumes of SKUs bring profitability and benefits for the retailer. Greater assortments increase the probability of the consumer to find the ideal SKU, as well as offer flexibility for the consumers wanting variety.

Finally, it is important to highlight the perception of the retailer regarding question 12 (If the consumer does not find the brand/product of choice he substitutes for the same brand, does he substitute for another brand, delay the purchase, or abandon the store?) shows that 63% of the clients substituted the brand, 31.5% would abandon the purchase, and 5.5% would delay the purchase, in case of not finding the wanted product. This result is in line with the research of Zinn and Liu (2001), Gruen et al. (2002) and Sloat et al. (2005). The result of this question shows that the costs of great assortments do not compensate the high level of service, since the majority of the clients substitute the brand, not at the sales point. This result directs AP as a bigger management worry for the retail producer. In practice, the results can help inventory management in companies that operate in this sector.

Final considerations and suggestion for future reaserches

This research evaluated the perception of the owners and managers of retail establishments regarding assortment planning of food products in the Market of South Brazil. The goal of the study was to investigate the level of knowledge and application of the theme to the daily work of the retailers, evaluate the relation among assortment, fidelity of the client, level of service and profitability of the

retailers.

The results of this research allow making inferences on the wrong knowledge of the interviewees about the theme, mainly for smaller stores. Generally, it was found that the professionals and managers evaluated the assortment planning as an important strategic tool and consider important the presence of a system of information. Despite recognizing the strategic importance of AP on the control of the unproductive variety, the retail of consumer goods, mainly the small retail, use for intuitive judgment the use of the analytic methodology.

Summarizing, the results show the need of a management model more strategic, focused on the consumer and seeking sustainable results in a long term. Despite this, the retailers recognize the importance of substituting the low cycle products and how much the assortments influence shelf space, the costs of storage, the level of service offered to the client, and the income of sales point. The interviewees recognize the need to achieve a balance among satisfied clients, ideal availability of products and brands, as well as a better relation among assortment, fidelity, level of service, and profitability. The owners and managers of retail establishments consider the consumers' intent to change the brand, but not when they do not find the wanted product, as demonstrated in the perception of the interviewees. AP is a strategic tool more important for the suppliers than the retailers. Finally, it is important to highlight the limitations of this field of study. This methodology allowed adequate reflection of the theme, but with a limited sample and the data are exclusively from the point of view of the interviewees. Although it presents limitations, this methodology has easy application and allows the collection of data easily. We suggest for future research, the investigation of the same subject but from the consumers point of view, as well as other segments of market and with the use of new analytic tools. Also, one can apply the questionnaire proposed here to other countries. This will enable comparisons of results and cross-culture studies, which aid in the advancement of knowledge on the subject, and can also help companies that operate in several countries in this sector.

Conflict of Interests

The authors have not declared any conflict of interests.

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Full Length Research Paper

Regulation and gender equality and non-discrimination of women in top management positions in Ghana

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The engagement of more women at top level management positions in both public and private institutions has increasingly been attracting interest amongst the general public, academia and policy-makers; especially given the seemingly increasing participation of females in the labour market. In spite of the many campaigns for the inclusion of women at top level management, it appears the proportion of women to men in senior management positions has not been encouraging. The aim of the study was to gain insight into the impact of international conventions and local laws on gender equality, inclusion and non-discrimination of women at top level management in Ghana. A structured questionnaire was used to collect data from 160 workers. The results of the study revealed that despite the number of conferences, conventions, policies and legislations enacted to ensure the non-discrimination, inclusion and equal representation of women at all levels in both public and private institutions, most institutions do not adhere to these enshrined principles. Again, the study showed that the appointment and selection of persons to such top level management positions is often influenced by factors unassociated with qualification, experience or knowledge in Ghana. It is recommended that institutions should be required by law to comply with the provisions of the various conventions and policies through concrete and deliberate actions in order to provide an enabling environment for women to occupy top management positions in Ghana. The study further suggested that affirmative actions be embarked upon with other considerations such as qualification, experience and knowledge.

Key words: Regulations, gender equality, non-discrimination, women in managerial position, Ghana.

INTRODUCTION

In the past, cultural factors determined gender roles in Africa. There were three basic roles – reproductive, productive and community management roles (Tuyizere, 2007). Men were perceived as playing the productive and community management (leadership) roles while women played the reproductive role and cared for the general welfare of the family. With an increase in girl-child education, globalisation, adulteration of cultures, govern-

mental laws and policies, and current economic conditions, the role of women seems to have changed. A lot of women have found their way into private and public sector occupations with some of them in managerial positions. In the first place, working outside the home for an income was solely the preserve of men. Now women are working in this sector and are rising through the ranks to also assume leadership or managerial roles that were

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again solely culturally meant for African men. A vast majority of these women are engaged in micro and informal enterprises. Anecdotal evidence suggests that only a few have found their way to managerial positions.

There have been several campaigns, laws, conventions, conferences to help give women equality at the workplace with the famous among them being the Beijing Conference. In spite of these campaigns for inclusion of women in top level management, anecdotal evidence further suggests the proportion of women in senior management positions is low as compared to men. Studies have shown men are two to three times more likely to be appointed to senior management positions than women. This has been attributed either to women's educational choices, their unwillingness to take challenging positions mainly because it would conflict with their socio-culturally assigned roles (performance of their reproductive and caring roles) or other reasons, which this study hoped to find out. Literature suggests in performing this productive roles, women face several challenges. For instance, most women are limited to occupations that are perceived as women's work – trading, food vending, sewing, hairdressing among others as compared to men. More of these women are also found in the informal sector than men (United Nations, 2005), although only a few end up rising to managerial or top level management positions. Gender equality, despite being a well-established principle in international law and public policy, remains an indefinable ambition. According to the United Nations Development Programme's (UNDP) Human Development Report (1997), no society treats its women well as compared to its men. Gender inequality is one of the most pervasive inequalities which exists in all societies and cuts across social cleavages such as race, class and ethnicity. It also persists in the public and private spheres. Over thirty years after the United Nation's First World Conference on Women which outlined a plan of action to respond to the UN's goals of gender equality and the elimination of discrimination against women, concrete actions to achieve broad-based gender equality have been inadequate. Equal opportunity involves equal treatment of men and women at the workplace, with respect to equal remuneration as well as benefits for work of equal value and ensuring that employment policies and practices are free from all forms of gender-based discrimination. This also suggests that, gender sensitive employment procedures in addition to retention and positive recruitment of women to top managerial and executive positions as well as directorships of corporate bodies, must be embraced and implemented.

LITERATURE REVIEW

Conventions and legislations on elimination of discrimination

The doctrines on the elimination of all forms of

discrimination against women are enshrined in one of the most comprehensive instruments adopted by the United Nations on the rights of women, that is, the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW). CEDAW was adopted in 1979, by the UN as a means of using international efforts to protect and promote the rights of women in all nations. Even though the CEDAW came into force in September, 1981, it was ratified by Ghana in December 1986. In view of its ratification since December 1986, Ghana has been obliged under international human rights instrument such as the UN Chapter of the 1945 and Universal Declaration on Human Rights of 1948, Article 2 and the International Convention on Elimination of All Forms of Discrimination against Women (CEDAW) of 1997 to ensure that women are equally treated as their male counterparts in all aspects of life.

Article 1 of the CEDAW defines discrimination against women as "any distinction, exclusion or restriction made on the basis of sex which has the effect or purpose of impairing or nullifying the recognition, enjoyment or exercise by women, irrespective of their marital status, on a basis of equality of men and women, of human rights and fundamental freedoms in the political, economic, social, cultural, civil or any other field". Moreover, it is worth noting that, the definition of discrimination against women has no limitation and includes both intentional and unintentional discrimination, it also extends to all spheres of social, cultural, economic and political life. Also, the definition makes no distinction between public and private life of women, any differential treatment therefore, in any sphere of life that may give an advantageous right or privilege to a man over a woman may constitute discrimination as per article 1 of CEDAW. Upon ratification of the CEDAW by Ghana in December, 1986, some attempts have been made by the government to incorporate some of these principles in local legislations such as the Labour Act, 2003 (Act 651) as well as the 1992 Constitution.

In light of this, Article 12 of the 1992 Republican Constitution of Ghana guarantees every person the fundamental rights and freedoms, whereas Article 17 makes provision for the protection against discrimination and enjoins the State to take steps to end all forms of discrimination on the basis of gender, race, colour, ethnicity and creed as well as social and economic status. This notwithstanding, Article 35(5) (6) also enjoins the State to end all forms of discrimination through law reforms and affirmative actions.

Furthermore, there are both national and international laws which address the issue affecting particular segments of the population such as discrimination against women in all spheres of life.

Moreover, seeing education and training as a key element to the development of nations, it is prudent that corporate organisations and governments invest in the employment policies and programs that encourage the

advancement of women at all levels and in all business sectors. This principle requires equal opportunities for formal and informal mentoring and networking as well as equal access to corporate supported education and training to men and women with the implementation of a business strategy for empowering women. That is, the principle will only be effective if policies and practices facilitating gender sensitive on women are encouraged by this principle. These policies to facilitate gender sensitive on women cannot permeate freely in certain parts of the continent due to cultural barriers, particularly in most Islamic states where elements of Sharia and family laws are believed to be incompatible with CEDAW.

According to the UN Global Compact on gender equality and empowerment of women, equality means business and the implementation of the principles of empowerment by governments and the corporate world at all levels of economic activities. Again, Articles 10 and 11, particularly, Article 11, reiterates the UN's commitment in ensuring equal opportunity for women in business and employment and seeks to affirm non-discrimination in education and employment and provides that States Parties shall take all appropriate measures to eliminate discrimination against women in the field of employment in order to ensure, on a basis of equality of men and women. The Article underlined certain specific rights which are indisputable to all human beings, these rights include:

- (a) The right to work as an inalienable right of all human beings
- (b) The right to the same employment opportunities, including the application of the same criteria for selection in matters of employment
- (c) The right to free choice of profession and employment, which comprises the right to promotion, job security and all benefits and conditions of service and the right to receive vocational training and retraining, including apprenticeships, advanced vocational training and recurrent training
- (d) The right to equal remuneration, including benefits, and to equal treatment in respect of work of equal value, as well as equality of treatment in the evaluation of the quality of work.

United Nations Environment Program (2006)

However, since its establishment in 1919, the ILO has also been dedicated to promoting the rights of all women and men at work and achieving equality between them. The ILO Policy on Gender Equality and Mainstreaming, which is made operational through the ILO Gender Equality Action Plan 2010-15, supports a two-pronged approach of gender mainstreaming and systematically analysing and addressing in all initiatives, the specific needs of both women and men, and targeted interventions to enable women and men to participate in, and

benefit equally from development efforts.

The issue of gender equality has become a major concern in most international conferences and has eventually brought to light the fight against discrimination of women in all aspects of human endeavour. Notable among these conferences are the UN conferences on women, the 1985 Nairobi Forward Looking Strategies (NFLS), the 1995 Beijing Platform for Action and the 2000 review on Beijing commitments known as the Beijing +5 as well as other UN conferences and the Millennium Development Goal (MDGs) have clear provisions for improving the status of women and promoting gender equality.

Women's inequality, globalisation and global governance

While some women have benefited from increased participation in the formal workforce as a result of trade liberalisation, there is evidence that gender inequality is worsening (UN Research Institute for Social Development (UNRISD) report, 2005). Striving for Justice in an Unequal World, presents evidence that the prevailing neoliberal agenda, which underlies the current process of globalisation, has done little to promote gender equality, 15, and has often had an adverse impact on women.

Gender discrimination and perception

Even though the fight for gender equality has been one of the major discussions on most international conferences for some decades now, a recent research conducted in some top industries in Germany revealed an insignificant women representation at top level positions. For instance, some statistics showed that calls for a quota for women and the widely publicized appointment of four women to the executive boards of DAX 30 companies in 2011 still does not undermine the fact that women continue to play a marginal role in the most important economic and decision-making processes in Germany's largest companies (Holst and Schimeta, 2012).

The percentage of women in the prominent DAX 30 companies was 3.7 percent in 2011, which represents an increase of 1.5 percentage points from the previous year. In companies with government-owned shares some of which are considerably smaller such as 8.2 percent of executive board members and 17.7 percent of supervisory board members are women. This goes to prove that women are also far from achieving gender equality in the boardroom. In comparison with 2010, the percentage of exclusively male supervisory boards even significantly increased by 8.8 percentage points to 23.6 percent in 2011.

The growing realization among policy-makers, business, and civil society that greater gender diversification in the

boardroom is needed has yet to lead to the breakthrough hoped for, in the appointment of women to executive and supervisory boards. Again, further studies in 2011 showed that, almost all seats on the executive boards of Germany's top 200 companies were held by men and out of a total of 942 positions on executive boards, only 28 positions were held by women. This is equivalent to three percent and shows that women on executive boards are still very much the exception. Among the companies ranked between 101 and 200 in order of turnover, only one executive board is chaired by a woman that is, almost 90 percent of the boards analyzed were exclusively male (Holst and Schimeta, 2012).

Gender roles and characteristics are cultured within multifaceted family relationships and become strengthened through the socialization process, where socially ascribed behaviour and responsibilities conform to the norms of each society (Chakravarti, 1995; Ball and Wilson, 2000; Karreman and Alvesson, 2001; Dick and Cassell, 2002). These socially created beliefs and expectations that people embrace about the roles of men and women in society are rarely neutral. They are rather essentially an outcome of power relations that characterize a society, where some are privileged while others may be suppressed or even marginalized. Again, these socially created beliefs further facilitate in creating occupational identities that are led by members of either gender. As a result, gender stereotypes permeate male-female relationships influencing the ways in which members of each sex are expected to behave and the ways in which their behaviour is interpreted (Millward et al., 2000; Cohen and Huffman, 2003; Knights and Richards, 2003). In view of this, Acker (1990, 2006) argues that, gender at workplace lays emphasis on the processes that sustain the present circumstances on gender. Also he recounted that, at the organisational level, the processes are embodied within the construction of divisions, symbols and interactions between groups that result in gendered social structures and practices.

McDowell (1997) also argues that, to a large extent, women face work associated problems especially in cultures that promote masculine values and traits. This prevents them from being noticed, as well as perceiving themselves as fitting in the system (Knights and Richards, 2003; Katila and Merilainen, 2002; van Vianen and Fischer, 2002). In various studies conducted by Powell and Butterfield (1994) and Larwood et al. (1988), the results sustained that people may be involved in discriminatory behaviours and give justification for it, if the same is demonstrated by their superiors or those who have powers over their careers. However, Reskin (2000) cautions that gendering is an unconscious process and it is not necessarily based on overt opposition or hostility. Notwithstanding the fact that equality within the workplace has been reinforced through various types of regulations, discrimination against women continues to exist on several scopes that include occupation and

economic gains (Fagenson, 1993). The prevalence of gender differences in the workplace influences recruitment, salary and career growth opportunities for women. Again, senior positions in organisations continue to be dominated by men despite a significant increase of women in managerial positions (Solomon, 1998; Burke and Nelson, 2002; Welting, 2003). On this note, Catalyst (2002) reiterated that, women would therefore continue to encounter barriers as a result of the culture and traditions of the organisation. Furthermore, Fagenson (1993) argues that the factors that are attributed to these differences include differences in education level and training gender-role socialization.

It has been noticed that, gender-based work behaviour differences are supposed to be much greater in male dominated professions such as the police and the armed forces as compared to other vocations like teaching, nursing which is believed also to be female dominated. Would it then be appropriate to believe that with larger numbers of women entering the police service where there is movement for equal opportunities, discrimination against women would decline? Gender discrimination according to Taylor and Ilgen (1981) and Scott (1994) is possible when women are often evaluated as less acceptable candidates for certain challenging jobs. Thus, they are unable to handle important or sensitive tasks effectively and are believed not to possess the necessary powers to achieve success in high status positions (Baden and Millward, 2000; Heilman, 1983).

Report of earlier studies by Marshal (1973) and Bell (1982) showed that policemen perceived women to be emotional, irrational, illogical and lacking in objectivity to handle the day-to-day unpleasantness of street policing. This was contended by Martin and Jurik (1996) and argued that male police officers associate women with social service, moral values, emotions and domestic roles and equate police with masculinity and build on the image of a 'masculine cop', to prevent the presence of women in the service. This to them was an opportunity to discriminate against women in the police service.

Gender equality thus refers to equality between men and women, and entails the concept that all human beings, both men and women, are free to develop their personal abilities and make choices without the limitations set by stereotypes, rigid gender roles and prejudices. Gender equality means that the different behaviour, aspirations and needs of women and men are considered, valued and favoured equally. It does not mean that women and men have to become the same, but that their rights, responsibilities and opportunities will not depend on whether they are born male or female. Gender equity also talks about fairness of treatment for women and men, according to their respective needs. This may include equal treatment or treatment that is different but which is considered equivalent in terms of rights, benefits, obligations and opportunities. According to Morris et al. (2005), there have been many high profile

accusations of discrimination levelled against organisations within the last several years. For instance, it is argued that Morgan Stanley's investment banking business recently paid out \$54 million to over 300 female employees who claim to have been deprived of pay and promotions equal to those received by their male colleagues. Furthermore, according to statistics from the Equal Opportunities Commission [EOC] (2005), there has been no systematic decline over the last 12 years in the number of discrimination lawsuits filed, or the amount of monetary damages awarded to the plaintiffs of these suits.

Again, Ensher *et al.* (2001) argued that the implication of discrimination can extend beyond women's lack of access to formal and informal resources by influencing their experiences in, and perceptions of, their work environments. Many women who believe they have experienced discrimination, or have seen colleagues affected by it, illustrate less commitment in their work. Moreover, in a study conducted by Ensher *et al.* on employees across jobs and industries and among colleagues established that women and minority employees distinguished between three sources of discrimination, thus, supervisors, co-workers, and organisations. The more strongly employees believed that their supervisors discriminated against them because of their gender or that they had experienced organisational level discrimination, thus, the belief that organisational policies and practices were discriminatory, the less satisfied they were with their jobs and the less committed they were to the organisation. Also, in a study by Shaffer *et al.* (2000) the results showed that perceived gender-bias in organisational decision making has negative effects across cultures.

The more those female employees in the United States, Beijing, and Hong Kong believed they had experienced gender discrimination, the less satisfied they reported being with their jobs, and the less affectively committed they were to their organisations, and had stronger intentions to leave their jobs. In spite of all these conventions and laws ensuring gender equality at the workplace, it appears women are still discriminated against when it comes to appointments and promotions to top management positions and are often excluded during high level decision making process. This study, therefore, examined the impact of international conventions and local laws on gender equality, inclusion and non-discrimination of women at top management level in selected organisations in Ghana. It also examined the knowledge of top level management staff about international conventions and local laws on gender equality, inclusion and non-discrimination as well as barriers to managerial inclusion of women.

Objectives of the study

1. To examine knowledge of top level management about

international conventions and local laws on gender equality, inclusions and non-discrimination.

2. To assess the impact of international conventions and local laws on gender equality, inclusion and non-discrimination of women in top level management positions.

3. To examine barriers to gender equality, inclusion and non-discrimination of women in top management level.

Relevance of the study

This study provides in depth information on issues of discrimination affecting women in top management positions in Ghana. It creates an awareness of the impact of the various regulations and conventions on gender discriminations and suggests other measures which could help facilitate equality amongst all sexes. The study identified factors, including culture, which contribute to the exclusion of women in top management positions. It also suggested the adoption of other means, other than regulation, which could reduce or eliminate certain barriers to the inclusion of women in top management positions.

This paper thus sets the stage for an open discourse on social, economic, political and academic platforms on issues concerning the exclusion of women in top management positions and its implications for the future of Ghana as a nation.

Policy makers would thus be equipped with relevant information which would guide them in the formulation of policies which may have implications for gender exclusion.

METHOD

Research design

A descriptive cross-sectional design was adopted for this study. According to Hair *et al.* (2003) and Neuman (2007), it is the most frequently used design in business research. Besides, Fraenkel and Wallen (2003) argued that the appropriateness of this design is based on the ability to lead the researcher to obtain in-depth information on the subject under study as well as drawing meaningful conclusions from the obtained data. Finally, descriptive cross-sectional survey also identifies standards or norms with which to compare present conditions in order to plan for the next step and to determine how to take action after having determined where you are and where you want to be.

Participants, sample and procedure

Participants included 160 respondents in top level management positions in organisations in the Greater Accra Region. The paper employed the Snowball sampling procedure to select 60 females and 100 males in top management positions from public and private institutions. This technique was deemed appropriate due to the difficulty of identifying a sampling frame for the study. Also, self-developed questionnaire was used for the data collection exercise. The instrument was made up of three sections. Options were

Table 1. Demographic Characteristics of the Study Sample (N=160).

Variable	Description	Frequency	Percent
Gender	Male	99	61.9
	Female	61	38.1
Age	> 49 years	19	11.9
	49 years	64	40.0
	< 49 years	77	48.1
Marital Status	Single	19	11.9
	Married	125	78.1
	Divorced	13	8.1
	Separated	3	1.9
Tenure	1-4 years	45	28.1
	5-10 years	53	33.1
	> 10 years	62	38.8

Table 2. Independent t-test on awareness of existing conventions and laws.

Sex	N	Mean	Std. Dev	t	sig
male	36	3.06	.814	2.406	0.018
female	38	3.47	.742		

Source: Field Data, 2014.

provided to examine the demographic characteristics (ranging from gender to tenure) of the respondents. In the first part of the questionnaire, respondents were given a range of options (from institutional to educational) to select which option they perceive bars their inclusion to top management positions. In the second part, respondents' awareness of the existence of Conventions and Laws by gender was assessed by providing them two options (Aware, Not Aware). Finally, respondents were asked on what they perceive influences appointments and promotions in their respective organisations. The questionnaire was used because all the participants could read and write.

Data analysis

Data were analysed using descriptive statistics. Also, the independent t-test was used to determine the difference in the awareness of gender regulations and laws between males and females. The Predictive analytical software (PASW) formerly known as the statistical package for the social sciences was used to analyse the data collected. Other trends and relationships were determined according to the responses to some of the items in the questionnaire.

RESULTS AND DISCUSSION

The participants' demographic characteristics are presented in frequency tables. The rationale for including

demographic information is to indicate the composition of participants in order to have a better understanding of their responses and the result for this study. From Table 1, a majority of the respondents (61.9%) were males with only 38.1% representing females. Besides, the majority of the respondents (40.0%) were 49 years and above, followed by 40.0% being 46 years of age whereas only 11.9% were less than 49 years old. For marital status, the majority of the participants (78.1%) were married with only 1.9% separated or about to divorce. Finally, the length of service within the organisation was also assessed. From the responses gathered, a majority of the participants have worked for more than 10 years followed by 33.1% who have worked between the periods of 5 to 10 years. However, only 28.1% of them have worked within the period of 1 to 4 years.

Knowledge of top level management about conventions and laws on gender equality, inclusions and non-discrimination

The first objective of the study was on awareness of existence of conventions and laws on gender equality, inclusions and non-discrimination. The results in Table 2 show that the number of females (38) who are aware of the existence of conventions and laws on gender equality and non-discrimination is higher than the male's (36). Thus, the independent t-test analysis indicates that the difference in gender with respect to awareness of conventions and laws on gender equality is statistically significant ($t = 2.406, p < 0.05$). To buttress this finding, the United Nations Environment Program [UNEP] (2006) on Gender Plan of Action stated that to secure high-level commitment towards gender equality requires top-level

commitment from the leadership and management within organisations. Further, UNEP's Gender Plan of Action ensures that equality, equity and rights are well respected across gender, and especially across the top levels of management to promote equality of opportunity and treatment between women and men.

Besides, respondents were asked to indicate their awareness of some conventions and laws on gender equality and non-discrimination. The participants indicated their awareness of the following conventions and laws: (a) Convention on the Elimination of all forms of Discrimination Against Women (CEDAW); (b) International Labour Standards; (c) Beijing Conference Proceedings; (d) The 1992 Constitution of Ghana and (e) The Labour Act, 2003 (Act 651).

Impact of international conventions and local laws on gender equality, inclusion and non-discrimination of women in top level management positions

The second research objective looked at the impact of international conventions and local laws on issues of gender equality and non-discrimination of women in top level managerial positions. The findings of the study suggest non-consideration of conventions and laws during appointment and promotions. Thus, even though some respondents claimed to be aware of the existence of international conventions and local legislations on gender equality and non-discrimination, it appears recruitment and appointment to top management positions do not take into consideration these regulations and as such do not often allow fair representation of men and women. Notwithstanding the fact that equality within the workplace has been reinforced through various types of regulations, Fagenson (1993) argued that discrimination against women continues to exist on several scopes that include occupation and economic gains. Fagenson further suggested that the existence of gender differences in the workplace influences recruitment, salary structure and career growth opportunities for women. In the Ghanaian situation for instance, non-representation of women in top management positions is seen in almost all sectors, particularly in the political arena as well as in certain public institutions. Currently, the Ghanaian Parliament has only 29 women parliamentarians out of a total of 275. The Judicial Council of Ghana currently also has only 5 members out of a total of 18. Even though there appears to be low women representation in top management positions in Ghana, there seems to be some strides made within certain public institutions, such as the judicial service where the Chief Justice is currently a woman. The parliamentary service of Ghana also had a woman speaker from 7th January 2009 to 6th January 2013. Thus, in as much as more needs to be done in ensuring a lot more women representation in top management

positions, there appears to be some progress, particularly, within the public sector (Akpah, 2013; Judicial Service of Ghana, 2014; Parliamentary Service of Ghana, 2014).

However, data gathered indicate that even where considerations are given during appointments and promotions, the focus has always been on qualification, years of service in an organisation and position in the organisation for the public sector institutions whereas the private sector focuses mainly on loyalty and family relations, and political affiliations. Hence, gender balance, experience and/or competence are often relegated to the background. Participant responses on the factors that influence appointment and promotion of top level management are illustrated in Figure 1.

Barriers to inclusion of women in top management level

The third research objective sought to establish the barriers to inclusion of women in top level management positions. As shown in Table 3, institutional and cultural barriers respectively, recorded the highest response rate from the participants. Thus, Catalyst (2002) opined that, women would continue to encounter barriers as a result of the culture and traditions of the organisation in which they find themselves. According to Fagenson (1993), these barriers are caused by differences in educational level and training, and gender-role socialization. However, intimidation from male counterparts was the least barrier to women's inclusion in top management positions. In agreement with this finding is the assertion that senior positions in organisations continue to be dominated by men despite a significant increase of women in managerial positions (Solomon, 1998; Burke and Nelson, 2002; Welting, 2003).

CONCLUSION AND RECOMMENDATIONS

Understanding the significance of international conventions and local laws on gender issues in Ghana is imperative. Consistent with this proposition, the study provides insight into the impact of international conventions and local laws on gender equality, inclusion and non-discrimination at top level management in Ghana. Nevertheless, the study revealed that most people in top level management are unaware of international conventions and local laws on gender equality, inclusion and non-discrimination. Finally, it was found that institutional, intimidation from male colleagues, social, cultural and educational issues were among the barriers to gender equality, inclusion and non-discrimination of women in top management level.

A key recommendation is that if these barriers are addressed, it would not only ensure full participation of women in the growth and development of the private

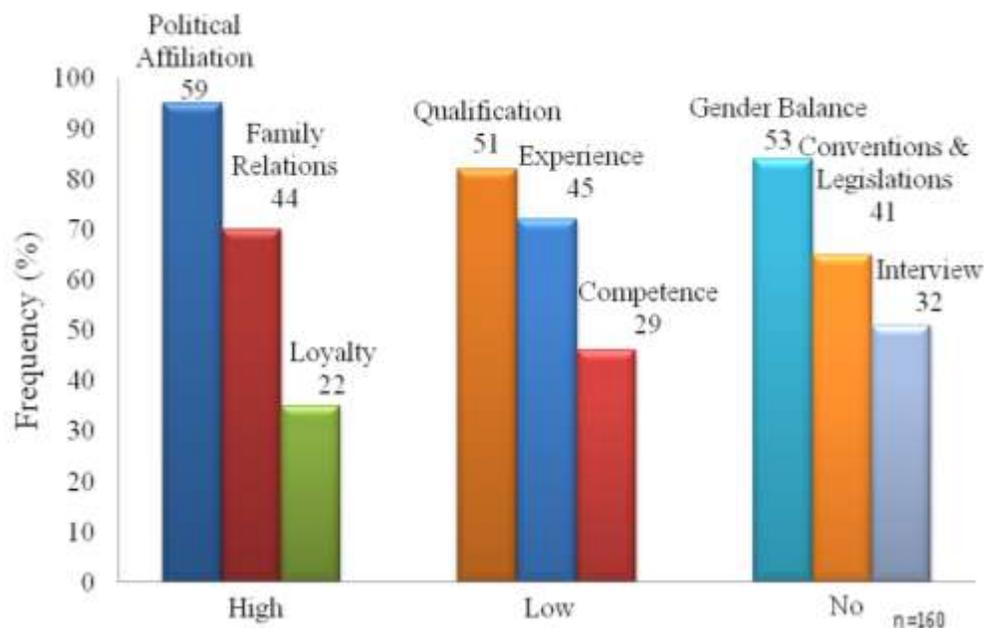


Figure 1: Factors influencing appointments and promotions.

Table 3. Barriers to Women's Inclusion in Top Management

Barriers	Female		Male		Total	
	Freq.	%	Freq.	%	Freq.	%
Institutional	60	100	80	80	140	88
Intimidation from male	20	33	61	61	81	51
Social	37	62	22	22	40	25
Cultural	54	90	30	30	84	53
Educational	34	62	15	15	52	33

Note. Total response exceeds 100% because of multiple response items.

sector but also the public sector economy. To ensure the fruition of this economic growth and development agenda, rigorous policy and programme interventions like in-service training, seminars and workshops to make the conventions and laws more effective than they are currently should be employed to fully utilize the potential of women. The Ministry of Gender and Social Protection, Civil societies, and religious bodies are implored to take up these recommendations to aid address this unfortunate situation.

Conflict of Interests

The authors have not declared any conflict of interests.

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Full Length Research Paper

The nurse as an integration agent in handoff: A social networks analysis perspective

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The growing interest in social networks, in health services, follows international pressure by improving quality and reducing costs in this sector. Identifying the most important actors in a social network is one of the applications of graph theory in social network analysis (SNA). Socialization among health professionals (actors) and their structural positions, in social networks, are important factors to be considered in developing strategies, which include information dissemination and influence. This research applied SNA to identify the actors with the greatest influence during handoff in a hospital. Data were collected in the second half of 2012, in the city of São Paulo. Semi-structured interviews have been conducted with actors in six handoffs. A seventh handoff has been created, as ideal hypothetical model, to compare the distinguishing features among the handoffs. The nurse in the unit of origin emerges as the actor with greater popularity (degree, eigenvector), greater influence or control (betweenness) and better access to information on the handoff (closeness, actor information centrality). A nurse is, possibly, an important categorical role to facilitate actions of integration during a handoff.

Key words: Handoffs, information dissemination, social networking analysis, healthcare.

INTRODUCTION

The growing interest for social networks in health services arises from international pressures to quality improvement and costs reduction in this sector. The identification of strategies, through the analysis of social networks, to disseminate information, as well as to understand the process of influence among health professionals (actors), can contribute to improvements in health sector (West et al., 1999).

Identifying the most important actors within a social network is one of the applications of graph theory in

social network analysis. Several measures of centrality and visibility have been created to identify the most important and more prominent actors within a social network. These measures are based on the connections between the actors. However, since the description of the centrality measures by Freeman (1979), few studies have been conducted to evaluate the quality of such measures (Zemiljic and Hlebec, 2005).

West et al. (1999) suggest that socialization among health sector professionals and the structural position of

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these actors are important factors of social networking and should be considered when developing strategies that include information and influence of actors in the health sector. The structural dimension provides information on the social network patterns of links between individuals. For example, the number of connections among actors in the network (degree) and the control over the information flow in the network (betweenness).

The diversity of measures to assess the centrality in social networks reflects the different approaches to understand how an actor behaves. Stephenson and Zelen (1989) argue that there is no reason to believe that the communication between two actors occurs only through shorter connections between them. An actor can travel a greater distance to access other actors, if there is an impediment to access a closer actor faster. The actor information centrality is a measure of symmetric social network, i.e., the exchange of information is two-fold (A exchanges information with B; B exchanges information with A). This measure indicates how is the flow of information between different access routes, weighted by the strength of ties and by the distance between the actors. The availability of the actor information centrality of an actor tells the degree of this actor's control over the flow of information within the social network. Thus, the greater the degree of actor information centrality of an actor, the higher the position of this actor as information gatekeeper (Veltri, 2013).

The transfer of patients among sectors of a hospital can be interpreted as an act organized by a team of professionals in the health sector, which are connected to each other, to promote a flow of information about patients. The analysis of social networks can verify the implications of the restrictions of actors involved in the information flow during this process. There is international pressure for the development of policies for patients' transfers, due to the growing recognition of the damage associated to the transfer of medical or surgical care among the various sectors of a hospital (Wachter, 2012)

Is there a predominant categorical role among health professionals, establishing an optimal number of connections needed or feasible, to ensure secure flow of information about patients, among sectors of a hospital?

This research analyzes five measures of centrality and visibility of the actors involved in seven handoffs. The main goal is to identify the categorical role with better structural positioning for the development of strategies that include reliable information on handoffs. The intermediate goal of the research is to compare the similarities, differences or relationships among centrality measures used to describe the handoffs.

The research is structured in a literature review of the concept, types, applications and limitations of centrality measures. Then, the applied methodology is described;

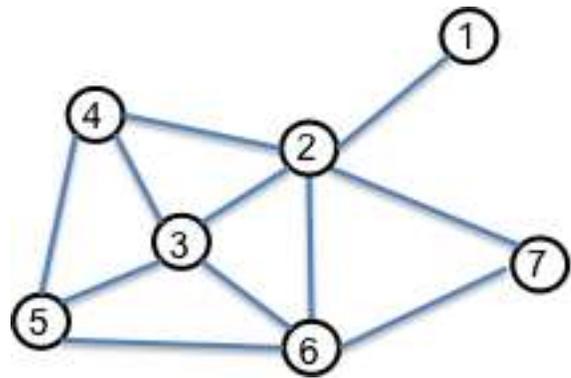


Figure 1. Example of social network.

description and discussion of the results, and the final remarks conclude the presentation.

Centrality measures in social networking analysis

The SNA is based on graph theory, a branch of mathematics that studies the relationships between the objects of a given set. Consider Figure 1, for example, where we have a $G(V, E)$ graph, where V are the vertices (actors) and E are the edges (relationships between the actors). Actor 2 has the highest measure of degree, five connections (actors: 1, 3, 4, 6, 7), while actor 1 has the lowest degree as: one connection (only relates to the actor 2). The measures of degree are, respectively, for these actors, 5 and 1. Therefore, actor 2 has greater power to influence this network than actor 1. Note that the information can spread rapidly through the network through actors 2, 3 or 6 (closeness). The other actors are, at best, two steps of each of these actors to receive information. However, the greatest measure of betweenness is from actor number 2, which functions as real gate-keeper. This actor, for political reasons, for example, can hinder or facilitate the transmission of information through the social network. Actors 3 and 6 both have 4 direct connections, so that the exclusion of any of the two does not drastically affect the flow of information in the network. On the other hand, the network presents some degree of dependence on actor number 2. Its exclusion would affect the flow of information in the network, leaving isolated actor 1, and the information could go long way to reach actor 7.

Frank (2002) discusses the centrality of an actor as a latent property, which allows him to create a private social network structure. The centrality measures are conceived as descriptive statistics of actors or social networks specific structural properties. From this perspective, a response pattern of an individual, such as the information exchange with other persons associated

with him, may establish a functional relationship with his power degree (latent property) in the context he is inserted.

The centrality measure of intermediation (*betweenness*) determines the proportion of indirect contacts among others actors through a central actor. Such measure, for example, expresses an exploratory variable on the central actor attributions that give him influence or control over the social network. The *degree* determines the number of direct contacts of an actor with other actors of the network. This centrality measure has been explored in studies on the popularity and activity of the actors in the social network. The centrality measures of proximity (*closeness*) and information (*actor information centrality*) analyze the distances and routes between the actors. Thus, these properties provide evidence of the structural properties of the network related to the availability, security and guarantees in the vicinity of the actors. The central conception of the centrality measures proposes to capture structural properties to explain other attributes of the actors or performance properties of the social network (Borgatti and Everett, 2006; Freeman, 1979; Wasserman and Faust, 1994)

Borgatti (2005) points out evidences that a conceptual comparison is possible between centrality measures considering the characteristics of flows through the social network. The *group power* proposed by Ramon et al. (2012) does not show to be comparable to the measures of closeness or betweenness, but becomes more consistent with the measurements of eigenvector, while the measures of centrality, such as the degree and closeness are defined by number of ties between actors.

Bonacich (2007) argues that the *eigenvector* centrality measure can be seen as a weighted sum of both direct and indirect connections, which considers the whole pattern of the network. The β centrality measure (derived from eigenvector measure) allows the assessment of negotiation power in social networks even with negative connections - type of network in which the power of an actor is reduced by the connection with other actors with many alternative trade patterns. It also allows assessing social networking with both positive and negative ties, so that a hostile network connection with another network of higher status can reduce its status and vice versa.

The route by which a flow (e.g., information flow, resource flow) is processed is crucial to the operation of most social networks. Many centrality measures quantify the importance of sharing these routes within the social network. The measure of betweenness orders the actors in terms of their individual importance in the social network, but does not make clear in advance, how they exert their influence on the social network. Studies on how this influence occurs are important to understand how actors form social groups or coalitions. Works on interactions in the social network structure, on the information flow and on the selection and training types of

influence subsets of actors have sparked recent interest in social network researchers (Kolaczyk and Barthélemy, 2009).

The centrality measures assume the previous pre-supposition that the relationships directions between a pair of actors are always symmetrical. However, there are real situations of asymmetry between relationships. In this way, it becomes important to define the centrality measures (or improve existing measures) to situations of asymmetry between relationships. The introduction of an asymmetric element in relationships implies different possibilities of power negotiations for both actors (Pozo et al., 2011).

Kim et al. (2012) presented a new concept of state power for consideration, based on social network analysis: the index of structural power of the social network (*structural network power index-SNP_I*), defined as the power of a state to emerge from its location within the social network of international relations in which it is embedded. A state acquires power as a result of its interactions with other states within the system and its structural position in the social network. A well-positioned state occupying central positions in the social network acquires more power. Many social network analysts believe that there is a positive relationship between the centrality of an actor and his power in the social network. The central actors acquire more power due to the increased accessibility and greater control of social network resources.

Understanding the social structure of a project development can contribute to direct the goals to ensure best performance in the execution. The success of the project development requires a high degree of connectivity to its reference network to be side by side with opportunities that permeate its structure. For example, in the context of movie's industry, better access to information from the social network may allow producers to find promising ideas that ensure copyright before their competitors take ownership of opportunities or may recognize values in projects whose potential has not yet been exploited (Ferriani et al., 2009).

Connectivity joins several agents for a common action. Marcus and Henderson (2006) consider the connectivity, for example, as a juxtaposed network of people, organizations, information and resources that can capture, contain and recover from a terrorist incident or other disasters. This concept is useful to describe the integration and coordination of activities in public health, among other areas. Even if a system has adequate resources in terms of technology, training and funding, such components do not ensure alone a properly functioning system, without certain threshold of connectivity (Kerby et al., 2005).

Research on organizational connectivity and readiness in public health suggest that organizational connectivity perception may be a good indicator of organizational

readiness (Dorn et al., 2007). In fact, in an emergency, it is important for an organization to know in a timely manner the availability of the necessary resources to the action. Actions to improve formal links between actors may allow greater collaboration, open communication, teamwork, and enhance the ability of the system global response to emergencies with flexibility and resilience (Hall et al., 2010)

The formation of a team for a project is a choice among a set of possibilities, so that administrators should reduce the risks for an improper configuration of a team. In the composition of a team, the project leader should take into consideration the potential of each member to bring innovative contributions. A balanced configuration among new actors and senior ones seems to be most appropriate to ensure a better setting and better team performance. The centrality of the network surrounding the development of a project has a positive impact on its performance (Ferriani et al., 2009).

Ferriani et al. (2009) found evidence that the project leaders with greater centrality in the social network are more likely to succeed in their business ventures. This suggests that the connections are an expression of how social capital provides access to opportunities for projects. However, the author's research suggests that there is a potential disadvantage in the excessive exposure within the network. New research on social networks has demonstrated negative implications of excessive centralization, both at the individual and at the organizational level. As you increase the connectivity of an actor in the network the benefits of high degrees of centrality decreases (Sampson, 2005; Owner-Smith and Powell, 2003; McFadyen and Canella, 2004).

Researchers have questioned the responsibility of an actor who is deeply embedded in social relationships as this gives him many possibilities for restriction of choices (Uzzy, 1997). Researches on the risks of *hyper-connectivity* are also emerging. Is there an optimal number of connections needed or feasible to maintain the sustainability of performance within the network? The hyperconnectivity refers to the restrictions an individual or company may face in the quantity of relationships (and by implication the amount of information) that they can sustain. Another phenomenon, known as *over embeddedness* results in increased resistance of the actor to accept communication with unknown actors (whose tendency for cooperation becomes uncertain) (Uzzi and Spiro, 2005).

The disparity in the actors' centrality also helps to increase the inefficiency of information flow in closed systems. Instead, in open systems, the flow of information within its borders becomes important. The disparity between the centralities of the actors in a system increases the inefficiency of internal communication, but reduces inefficiency in communication between the system and the environment. To the extent that a system

becomes more open, the disparity of the actors' centralities makes the information flow more efficient across their borders (Yamaguchi, 1994)

Hossain and Wu (2009) investigated the differences in coordination activities between actors with different degrees of centrality in social networks. Research shows statistical evidence that the betweenness measure seems like the best predictor of the coordination ability in indirect graphs, whereas the out-centrality measures are more robust to predict this ability in direct graphs.

In specific social networks, social capital reflects a unique set of resources available for embedded people. It emerges from the relationships between people and it is not an inherent property of an individual. In terms of tangibility, it exists in social relationships between people and figure as the value of the relationship or communication links. The existence of social relationships is not a single component of social capital. The macrostructure of a social network is made up of unbalanced relationships, i.e., the strong and weak ties between actors. In general, the greater the relationships network in which a person is embedded, the greater its social capital (Coleman, 1988).

Bodin and Crona (2008) explored aspects of social capital in a rural fishing community to explain why collective action towards sustainability management were not put into practice, despite the incontrovertible evidence of the decline of the fish markets, the coastal degradation and the increasing awareness of these problems by the local community. Social capital contributes with beneficial effects on people's ability to organize effectively, and in conjunction with leadership, to leverage changes in the social group (Coleman, 1990). From the perspective of social network analysis (Borgatti et al., 1988), Bodin and Crona (2008) used structural measures of social network to identify influential actors in the community. The analysis of the structural characteristics of the rural community social network has identified an actor with high centrality, who represented the only link between the heads of the community. The rural community became vulnerable by relying on a single actor for formal connections with governmental organs and, sometimes, personal interests of the most central actor surpass the collective interests.

Coleman (1990) identified four common elements in a collective action: group of people doing the same actions simultaneously; dynamic system whose equilibrium can be achieved eventually, synchronization actions, and some degree of unpredictability, with possible explosive results. When meeting with these assumptions, Ramón et al. (2012) created a group power indicator with the same concept: *the power to initiate an action*. The power to initiate an action quantifies the group ability for a society to adopt its behavior and how quickly people learn this new behavior. From this information, an administrator, for example, can allocate the people most able to help

prevent or encourage an action in a given context. The group power has a broader scope than the group centrality measure, and is not limited to graph theory.

Competence for actor collaboration, within a weighted network, must be related to the amount of employees (degree), with the collaboration frequency and with the importance of employees (strength of the actors in the neighborhood). Conventional measures of centrality (degree, betweenness, closeness, eigenvector) are not able to accurately describe the power of collaboration between nodes in a social network (Yan et al., 2013).

Yamaguchi (1994) found that social networking systems with two or more subgroups connected by bridges become less inefficient because the actors that act as bridges become more central in their own subgroups. This may explain why open systems tend to be more organized so that the communication to the center of the system is easier than with its peripheries.

The structural characteristics of social networks can explain the variation in the degree of inefficiency of the information flow within social networks. Both segmentation (number of bridges) and location in social networks increase the inefficiency of information flow in social networks. An increase in network density only contributes for the efficiency of information flow within subgroups, but increases the inefficiency of the information flow between the subgroups (Yamaguchi, 1994).

Relations between centrality and power can be more contextual than it has been believed. Even in social networks with multiple possibilities of interactions, when social influence is contrasted against a decision making, for example, high centrality degrees does not guarantee success for an actor. A semiperipheral actor that monopolizes communication flows with peripheral actors, and is skilled at surrounding central actors may emerge with more power than the actor with the highest centrality degree. The centrality measures are important to understand the power of an actor, but have different degrees of importance. The way the centrality of an actor affects his power is deeply related to the social network structure in which he is embedded. A third significant aspect of the structure of the social network, involves the number of existing subgroups, as well as how a central actor is able to perform to resolve deadlocks between competing groups (Mizruchi and Potts, 1998).

There are qualitative differences between theoretical and real models of social networks. Amaral et al. (2000) identified at least three structurally different classes of social networks. These can be differentiated by the degrees' distribution of the actors (vertex degrees). Such structures form social networks of single scale, without scale or with broad scale. Social networks occur in various fields, such as genetic or metabolic regulatory networks, food chain, epidemics, transport, economic interactions and internet. The degree is a typical measure used to analyze social networks. This measure is intrinsic

to characterize the site of a graph so a meaningful interpretation becomes possible only with graphs that form a statistical set known (Wuchty and Stadler, 2003).

Stable social networks are defined as those in which no one of both actors get gains with the development of a bond between each other or when just one actor fails to win by providing services to other actors who are connected (Jackson and Wolinsky, 1996). Nevertheless, the concepts of stable social networks are not adjustable for online communication networks. Farrell and Fudge (2013) found evidence that an actor benefits from the social capital and choose communication ties to maintain or improve its social capital. Despite the continuous flow of communication links in these social networks, the social network structure remains relatively constant over the months, making these structures almost stable.

The centrality and prominence measures present variations of reliability. The simplest centrality measures (degree, betweenness, closeness) showed to be more stable to variations while the measure of flow betweenness showed to be less stable compared to the others. In general, global indexes are less stable in comparison to the local index. The convergence measures (in-degree, in-closeness) showed to be more stable than measures of divergence (out-degree, out-closeness) (ZEMILJIC; HLEBEC, 2005). Unlike measures of flow-betweenness, variations of betweenness measures do not alter the basic model (Brandes, 2008).

Reliability is one of the criteria used to verify the quality of a measurement. For reliability matters the extent to which a measure is repeated or how the random error is distributed in the measurement process. That is, the reliability assessment aims stability and internal awareness (equivalence) of the measures. In social networks analysis, for example, some research on the reliability have been made on the entire network measurements, on the actors' choices and on the popularity of an actor (Wasserman and Faust, 1994; Ferligoj and Hlebec, 1999).

This literature review points to a nonconformity of researchers with the classic measures of centrality to describe the latent properties of social network actors: how reliable these measures are to describe the popularity (degree, eigenvector), the influence or the control (betweenness) and the access to information on a social network (closeness, actor information centrality), as for example, a handoff? Another current challenge is the ability of an actor, who holds high degrees of centrality, in mobilizing collective action in the network. In the next section, follows the description of the methodology applied.

DATA COLLECTION AND PREPARATION

This research was exploratory in nature, whose main purpose was to clarify concepts and ideas on the SNA applied to the handoffs in

Table 1. Example of data tabulating matrix for data analysis in UCINET.

	phs_WRD	phs_UTI	nrs_WRD	nrs_ICU	pht_ICU
phs_WRD	0	1	1	0	0
phs_ICU	1	0	0	1	1
nrs_WRD	1	0	0	1	0
nrs_ICU	1	1	1	1	1
pht_ICU	0	1	0	0	0

a Private Network of Hospitals of the City of São Paulo, with the intention to formulate more specific issues for further study. This way, it aimed to provide a general view, something approximate, about handoffs, whose literature is scarce under SNA perspective. The objective of the questionnaire in an SNA is to gather information about the relationships of each person who is part of a social network (Parker et al., 2001). Specifically, in this research, the aim of the questionnaire was to identify the actors who shared information about the patient during the handoff, whose standard question for each actor was "who have you exchanged information with about the patient during the handoff?" From the responses of the actors, it was assembled a matrix of square order, whose marginal rows and columns contain the actors of the handoff. The elements a_{ij} of the matrix represent the values 1 or 0, whether the actors have exchanged information or not, respectively, among themselves during the handoff (Table 1). The data in this format were analyzed using UCINET 6 software for Windows (Borgatti and Foster, 2003).

In general, sampling procedures and quantitative data collection techniques are not common in exploratory research. The authors applied the method of snowball sampling, used, in general, when you do not have the list of members of a population of interest.

The snowball sampling assumes that there is a link between the members of a population given the object of interest (Faugier and Sargeant, 1977). For example, people who were involved in the transfer of a patient from the ICU to the ward, in the same hospital, probably exchanged information with each other, to some degree at some point.

In snowball sampling, the initial respondents have been chosen for convenience. Those respondents have been used to identify other respondents who participated in the transfer of patients among hospitals sectors. The process continued until reaching the saturation point. The snowball sample was introduced by Goodman (1961) and is a technique that successively amplifies the social network vertices, as it connects adjacent actors. Respondents reveal other respondents who they have had contact. Indicated respondents have the social and demographic characteristics of the people who indicated them. This increases the chance to quickly locate the desired actors in the social network, with relatively low cost. If the identity of all involved persons is observed, then the social network is completed around the social phenomenon under study (Frank and Snijders, 1994; Frank, 2002).

Epidemiologists and public health practitioners use snowball and contact tracing techniques to control epidemics, to recruit people for programs to promote health and for vaccine tests (Valente, 2010).

Data were collected in the second half of 2012, in a hospital in the city of São Paulo. Semi-structured interviews were conducted with actors involved in six Handoffs, among hospitals' sectors. A seventh handoff was created as a hypothetical model based on the identification of the categorical roles involved in the six handoffs studied.

In the hypothetical model, handoff 7, it has been inserted a categorical role called clinical integration agent (cia_U). In a

systematic review of the literature, Rennke et al. (2013) found evidence that an intervention of integration organized by a professional, fully dedicated to exchange information interfaces, in care transitions, has reduced visits to emergency departments and in readmission rates. The clinical integration agent would be part of an integration strategy aimed at the prevention of adverse clinical outcomes, the involvement of patients and their families, the use of a professional with a focus on exchanging patient information and facilitating communication with other actors.

The implementation of the strategy to use a person as intermediary in the transition of patient care has been described in 30 studies (of which 21 were randomized and controlled trials). The involvement of the patient has been among the interventions applied by the intermediary in 20 of these works (Rennke et al., 2013).

Based on this strategy, we have inserted the hypothetical model, plus two other categorical roles: the patient (ptn_U) and the patient's family member (pmf_U). The assumption has been adopted that all connections between two actors were symmetrical. The hypothetical model assumes the premise of a maximum degree of satisfaction among all actors involved in the handoff, so that the flow of information meets all stakeholders.

The interviewees have been asked to what extent, within an ordinal scale from 1 to 5 (1 = I do not exchange information... 5 = I exchange information very often), they exchanged information with the other actors involved in the handoff and what were they degree of satisfaction or dissatisfaction with the handoff, in an ordinal scale from 1 to 5 (1 = very dissatisfied, 5 = very satisfied). The data have been processed using algorithm by the software UCINET for Windows (Borgatti et al, 2002) and have not been dichotomized (ordinal scale transformed on a binary scale).

The dimensions of social support and measurement scales combinations represent the most important predictor variables to explain the variability of reliability in global indexes. The type of question, in turn, is the most important predictor variable to explain changes in the extent of the reliability of the in-degree (number of information received). The network density affects the reliability of the measurements of the out-degree (number of information sent). The reliability of centrality and prominence measures becomes greater when ordinal scales are used. The greatest consistencies in predictors of reliability on measures of centrality and prominence are in the domain of social support, in the combination of measures scales and in the range in which the measurements are made (Zemiljic and Hlebec, 2005).

The interviewees have been classified into categorical roles by operating units. Table 2 presents a description of the units and categorical roles applied in this research. For example, phs_ICU means physician from the intensive care unit; nrs_wrd means the ward nurse and so have been appointed the other categorical roles. In handoff 07, the origin unit has been called A, while the destination unit has been called B. The sectors of support services have generically been called ADM in Handoffs 1- 6 and U in handoff 7. The patient and family member have been located in

Table 2. List of sectors and categorical roles in handoffs.

Unity	Description
ADM	administration
WRD	ward
OSP	outpatient specialty
PHR	pharmacy
ERM	emergency room
NDS	nutrition and dietetics services
ICU	intensive care unit
Categorical role	Description
aas	administrative assistant
hag	hospitality agent
cia	clinical integration agent
swr	social worker
nrs	nurse
phr	pharmaceutical
pht	physiotherapist
phs	physician
pfm	patient's family member
ntr	nutritionist
ptn	patient
rcp	receptionist
ntc	nursing technician
amn	administrative manager

ADM (handoffs 1- 6) and in C in handoff 7. The designations were arbitrary.

The centrality measures have been correlated with the average level of satisfaction with the handoff and verified to what extent the centrality measures correlate with each other. Valente et al. (2008) found an average correlation of 0.54 (0.14) between centrality measures (degree, betweenness, closeness and eigenvector).

The participation of respondents has been voluntary and free of coercion, force or requirements. The right to privacy has been assured by anonymity and confidentiality by restricting access to the identification of the respondent to the researchers. There has been no conflict of interest in this research. The results of these interviews are described in the next section.

RESULTS

The nurse of handoffs of the origin unit has the most direct contact with the other actors, which gives her/him the greatest popularity and prestige in the network (Table 3). There are wide asymmetries in the degree of connections among nurses of the origin units and destination units of the patient in handoffs 01, 02, 04, 05. There is a correlation of 0.7 (however, $p = 0.09$) between the degree of these actors and the average level of satisfaction with the handoff.

The nurse of the origin unit, except in handoff 01, has the highest proportion of indirect contacts between other

actors (Table 4). Such measure, for example, expresses an exploratory variable on the nurse assignments, which gives him/her influence or control over the social network. The route by which the flow of information is processed is crucial to the operation of most social networks. There has been no correlations between betweenness measures and the average level of satisfaction with the handoffs ($p = 0.505$).

The nurse of the origin unit has the highest centrality of proximity between the actors, except in handoff 02 where he/she ranks second (Table 5). The closeness highlights the structural properties of the network related to information and resources access in the vicinity of the actors. There has been a correlation of 0.7 (however, $p = 0.07$) among nurses of greater closeness measures and the average level of satisfaction with the handoff.

The nurse of origin unit, except in handoff 06, has the highest centrality eigenvector measures, as it examines both direct and indirect connections, which considers the whole pattern of the network (Table 6). The correlation between the eigenvector measures of the main actors and the level of satisfaction with the handoff has not been significant in this sample ($p = 0.71$).

The nurse of origin unit, except in handoff 02, has the highest actor information centrality measures whose meaning resembles the closeness measure (Table 7). The correlation between actor information centrality measures of the main actors and the level of satisfaction with the handoff has not been significant in this sample ($p = .97$).

The actor information centrality measure shows very strong correlations with degree, closeness and eigenvector ($p = 0.00$) and strong correlation with betweenness measure (Table 8). The average correlation between these measures was 0.89 (0.10). The degree measure showed the lowest coefficient of variation between the handoff (3.5%), while betweenness measure showed the highest coefficient of variation (15.24%).

Inspecting the sociogram in Figure 2, it shows the structural position of actors involved in handoff 4. The nrs_ICU stands on structural position, followed by nrs_WRD. Asymmetric relationships predominate between the actors. There has been no information exchange with the patient or the patient's family member.

Inspecting the sociogram in Figure 3, it shows the structural position of actors involved in handoff 7. The cia_U stands on structural position, followed by nrs_WRD, ptn_U and pmf_U. Symmetry relations predominates between the actors. The cia_U exchanges information with all network actors.

An interpretation of these results for practical applications in transitions of care follows in the next session.

DISCUSSION

Works on the care transition of inpatient in hospitals to

Table 3. Actors' degree centrality measures in the seven handoffs.

Actors' betweenness centrality													
Actor	Handoff 01	Actor	Handoff 02	Actor	Handoff 03	Actor	Handoff 04	Actor	Handoff 05	Actor	Handoff 06	Actor	Handoff 07
rs_ICU	71,43	nrs_ICU	60,00	nrs_WRD	44,44	nrs_ICU	69,23	nrs_ERM	77,78	nrs_ERM	55,56	cia_U	100,00
ntc_ICU	64,29	aas_ADM	30,00	nrs_ERM	44,44	nrs_WRD	38,46	ntc_ERM	44,44	nrs_ICU	55,56	nrs_A	69,23
phs_ICU	57,14	phs_ICU	20,00	phs_ERM	33,33	aas_ADM	23,08	phs_ERM	33,33	phs_ERM	44,44	ptn_C	69,23
ntr_SND	42,86	ntr_SND	20,00	ntc_ERM	22,22	ntc_ICU	23,08	ntr_SND	33,33	rcp_ADM	44,44	pfm_C	69,23
rcp_ADM	42,86	nrs_WRD	10,00	ntr_SND	22,22	phs_ICU	23,08	nrs_WRD	33,33	ntc_ERM	33,33	nrs_B	53,85
aas_ADM	35,71	ntc_ICU	10,00	ptn_ADM	22,22	nrs_ERM	23,08	rcp_ADM	22,22	phs_ICU	22,22	phs_A	53,85
nrs_WRD	35,71	phr_PHR	10,00	pfm_ADM	22,22	phs_ERM	23,08	pfm_ADM	22,22	nrs_WRD	22,22	aas_U	46,15
phr_PHR	28,57	rcp_ADM	10,00	phs_WRD	11,11	rcp_ADM	23,08	others	22,22	phs_OSP	11,11	ntr_U	38,46
pfm_ADM	21,43	amn_ADM	10,00	ntc_WRD	11,11	phr_PHR	7,69	ntc_WRD	11,11	ntc_ICU	11,11	phs_B	38,46
others	21,43	phs_OSP	10,00	others	11,11	ntr_SND	7,69	phr_PHR	11,11	hag_ADM	11,11	ntc_A	38,46
pht_ICU	21,43	others	10,00			others	7,69					ntc_B	38,46
ntc_WRD	7,14					phs_OSP	7,69					rcp_U	38,46
phs_WRD	7,14					ntc_WRD	7,69					pht_U	30,77
swr_ADM	7,14					hag_ADM	7,69					hag_U	23,08
pht_WRD	7,14												
Handoff flow direction													
From ICU to WRD		From ICU to WRD		From ERM to ICU		From A to B							
Actors' satisfaction with the handoff (mean) (scale de 0 a 5)													
3,9		4,2		3,0		2,3		4,1		2,7		5,0	

Table 4. Actors' betweenness centrality measures in the seven handoffs.

Actors' betweenness centrality													
Actor	Handoff 01	Actor	Handoff 02	Actor	Handoff 03	Actor	Handoff 04	Actor	Handoff 05	Actor	Handoff 06	Actor	Handoff 07
phs_ICU	29,78	nrs_ICU	88,89	nrs_WRD	77,78	nrs_ICU	69,87	nrs_ERM	65,28	nrs_ERM	40,28	cia_U	24,99
ntc_ICU	28,33	aas_ADM	88,89	nrs_ERM	51,39	nrs_WRD	32,48	ntc_ERM	23,61	nrs_ICU	33,80	ptn_C	6,69
nrs_ICU	24,10	phs_ICU	20,00	ntc_ERM	22,22	rcp_ADM	15,39	nrs_WRD	22,22	rcp_ADM	24,07	pfm_C	6,69
pht_ICU	14,29	ntr_NDS	20,00	ntr_NDS	22,22	phs_ICU	4,27	phs_ERM	2,78	phs_ERM	12,50	nrs_A	6,32
ntr_NDS	3,55	nrs_WRD	0,00	phs_ERM	1,39	phs_ERM	3,85	ntr_NDS	2,78	ntc_ERM	6,02	aas_U	3,63
rcp_ADM	3,19	ntc_ICU	0,00	ptn_ADM	0,00	nrs_ERM	2,99	rcp_ADM	0,00	phs_ICU	0,00	nrs_B	2,90
aas_ADM	1,87	phr_PHR	0,00	pfm_ADM	0,00	aas_ADM	1,92	pfm_ADM	0,00	nrs_WRD	0,00	phs_A	2,64

Table 4. Contd.

nrs_WRD	0,77	rcp_ADM	0,00	phs_WRD	0,00	ntc_ICU	1,28	others	0,00	phs_OSP	0,00	rcp_U	2,07
phr_PHR	0,71	amn_ADM	0,00	ntc_WRD	0,00	phr_PHR	0,00	ntc_WRD	0,00	ntc_ICU	0,00	phr_U	0,43
pfm_ADM	0,00	phs_OSP	0,00	others	0,00	ntr_NDS	0,00	phr_PHR	0,00	hag_ADM	0,00	phs_B	0,40
others	0,00	others	0,00			others	0,00					ntc_A	0,40
ntc_WRD	0,00					phs_OSP	0,00					ntc_B	0,40
phs_WRD	0,00					ntc_WRD	0,00					ntr_U	0,14
swr_ADM	0,00					hag_ADM	0,00					hag_U	0,00
pht_WRD	0,00												
Handoff flow direction													
From ICU to WRD		From ICU to WRD		From ERM to ICU		From A to B							
Actors' satisfaction with the handoff (mean) (scale de 0 a 5)													
3,9		4,2		3,0		2,3		4,1		2,7		5,0	

Table 5. Actors' closeness centrality measures in the seven handoffs.

Actors' closeness centrality													
Actor	Handoff 01	Actor	Handoff 02	Actor	Handoff 03	Actor	Handoff 04	Actor	Handoff 05	Actor	Handoff 06	Actor	Handoff 07
wrd_ICU	77,78	wrd_ICU	71,43	wrd_WRD	64,29	wrd_ICU	76,47	wrd_ERM	81,82	wrd_ERM	69,23	cia_U	100,00
ntc_ICU	73,17	aas_ADM	52,63	wrd_ERM	56,25	wrd_WRD	59,09	ntc_ERM	60,00	wrd_ICU	69,23	wrd_A	76,47
phs_ICU	66,67	phs_ICU	47,62	ntr_NDS	45,00	ntc_ICU	54,17	phs_ERM	56,25	rcp_ADM	64,29	ptn_C	76,47
ntr_NDS	60,87	ntr_NDS	47,62	ntc_ERM	45,00	aas_ADM	52,00	ntr_NDS	56,25	phs_ERM	60,00	pfm_C	76,47
rcp_ADM	60,87	wrd_WRD	43,48	phs_WRD	40,91	wrd_ERM	50,00	wrd_WRD	56,25	ntc_ERM	52,94	wrd_B	68,42
aas_ADM	56,00	ntc_ICU	43,48	phs_ERM	40,91	phs_ICU	50,00	rcp_ADM	52,94	phs_ICU	47,37	phs_A	68,42
wrd_WRD	53,85	phr_PHR	43,48	pfm_ADM	39,13	rcp_ADM	50,00	pfm_ADM	50,00	wrd_WRD	47,37	aas_U	65,00
phr_PHR	51,85	rcp_ADM	35,71	ptn_ADM	39,13	phr_PHR	44,83	others	50,00	phs_OSP	42,86	ntr_U	61,91
pfm_ADM	51,85	amn_ADM	35,71	ntc_WRD	32,14	phs_ERM	44,83	ntc_WRD	39,13	ntc_ICU	42,86	phs_B	61,91
others	50,00	phs_OSP	33,33	others	32,14	ntr_NDS	44,83	phr_PHR	37,50	aht_ADM	40,91	ntc_A	61,91
pht_ICU	51,85	others	33,33			others	44,83					ntc_B	61,91
ntc_WRD	43,75					phs_OSP	38,24					rcp_U	61,91
phs_WRD	41,18					ntc_WRD	38,24					wrd_U	59,09
swr_ADM	41,18					aht_ADM	34,21					aht_U	56,52
pht_WRD	35,00												
Handoff flow direction													
From ICU to WRD		From ICU to WRD		From ERM to ICU		From A to B							
Actors' satisfaction with the handoff (mean) (scale de 0 a 5)													
3,9		4,2		3,0		2,3		4,1		2,7		5,0	

Table 6. Actors' eigenvector centrality measures in the seven handoffs.

Actors' betweenness centrality													
Actor	Handoff 01	Actor	Handoff 02	Actor	Handoff 03	Actor	Handoff 04	Actor	Handoff 05	Actor	Handoff 06	Actor	Handoff 07
nrs_ICU	63,56	nrs_ICU	93,32	nrs_PSC	79,54	nrs_ICU	81,44	nrs_PSC	83,30	nrs_ICU	66,70	cia_U	60,63
ntc_ICU	55,53	aas_ADM	50,93	phs_PSC	66,34	nrs_WRD	48,10	ntc_PSC	52,02	nrs_PSC	61,65	nrs_A	47,95
phs_ICU	48,56	phs_ICU	42,10	ptn_ADM	52,46	ntc_ICU	44,52	phs_PSC	48,58	phs_PSC	58,27	ptn_C	46,68
ntr_NDS	45,71	ntr_NDS	42,10	pfm_ADM	52,46	nrs_PSC	41,59	ntr_NDS	44,65	rcp_ADM	58,19	pfm_C	46,68
rcp_ADM	45,51	nrs_WRD	35,88	nrs_WRD	49,88	aas_ADM	40,61	nrs_WRD	39,15	ntc_PSC	42,90	nrs_B	40,05
nrs_WRD	40,48	ntc_ICU	35,88	ntc_PSC	20,60	phs_ICU	40,57	rcp_ADM	38,12	phs_ICU	35,77	phs_A	39,63
aas_ADM	39,32	nrs_PHR	35,88	ntr_NDS	20,60	rcp_ADM	34,06	pfm_ADM	37,15	nrs_WRD	29,93	ntr_U	32,91
phr_PHR	33,08	rcp_ADM	19,58	phs_WRD	17,94	phs_PSC	33,89	Others	36,04	ntc_ICU	19,09	phs_B	31,84
Others	27,41	amn_ADM	19,58	ntc_WRD	7,41	phr_PHR	21,19	ntc_WRD	14,65	phs_OSP	17,65	ntc_A	31,70
pfm_ADM	26,22	phs_OSP	16,18	Others	7,41	ntr_NDS	21,19	phr_PHR	11,03	hag_ADM	16,66	ntc_B	30,76
pht_ICU	20,37	Others	16,18			Others	21,19					aas_U	29,42
ntc_WRD	9,24					phs_OSP	12,52					rcp_U	27,17
phs_WRD	8,08					ntc_WRD	12,52					phr_U	24,20
asc_ADM	8,08					hag_ADM	8,86					hag_U	15,97
pht_WRD	3,39												
Handoff flow direction													
From ICU to WRD		From ICU to WRD		From ERM to ICU		From A to B							
Actors' satisfaction with the handoff (mean) (scale de 0 a 5)													
3,9		4,2		3,0		2,3		4,1		2,7		5,0	

outpatient clinics indicate benefits for patients with actors in the intermediation role of this transition. There has been a statistically significant reduction in the rate of hospital readmission in four studies whose intermediation role in care transitions of inpatient to outpatient care has been performed by a single categorical role exclusively. In the systematic literature review there has not been found data on the costs of the intervention, contextual factors and a long-term plan for the deployment of an intermediation agent (Rennke et al., 2013).

The nurse stood out as the main categorical role involved in processes of information exchange intermediation in the handoffs, in five of the centrality measures applied in this survey. This observation is consistent to the systematic literature review as in Rennke et al. (2013). Other categorical role has also been identified in literature as integration agent, such as the pharmacist.

Connectivity unites several agents into a common action (Marcus and Henderson, 2006). Connectivity, for example, as a network of

juxtaposed people, can facilitate a more secure handoff. Inspection of Figure 2 reveals the fragility of the connections between the actors and contrasts with the high levels of connectivity among the actors in the model of Figure 3. The handoff 4 has had the lowest mean score of satisfaction. It meets the assumption of Kerby et al. (2005): a system with adequate resources does not ensure, by itself, a properly functioning system, without certain threshold of connectivity. Note that, in Figure 2, most of the relationships among the actors are asymmetric; the actors are

Table 7. Actors' actor information centrality measures in the seven handoffs.

Actors' betweenness centrality													
Actor	Handoff 01	Actor	Handoff 02	Actor	Handoff 03	Actor	Handoff 04	Actor	Handoff 05	Actor	Handoff 06	Actor	Handoff 07
nrs_ICU	1,77	nrs_ICU	0,79	wrd_WRD	0,78	wrd_ICU	1,34	wrd_ERM	1,42	wrd_ERM	1,44	cia_U	4,30
ntc_ICU	1,74	aad_ADM	0,58	wrd_ERM	0,68	aad_ADM	1,12	ntc_ERM	1,13	wrd_ICU	1,37	wrd_A	3,72
phs_ICU	1,69	phs_ICU	0,52	phs_ERM	0,56	ntc_ICU	1,09	phs_ERM	1,06	phs_ERM	1,37	ptn_C	3,72
ntr_NDS	1,57	ntr_NDS	0,52	ntc_ERM	0,53	wrd_WRD	1,08	ntr_NDS	1,05	ntc_ERM	1,36	pfm_C	3,72
rcp_ADM	1,57	nrs_WRD	0,48	ntr_NDS	0,53	phs_ICU	0,99	wrd_WRD	1,00	rcp_ADM	1,29	wrd_B	3,34
aad_ADM	1,49	ntc_ICU	0,48	ptn_ADM	0,53	wrd_ERM	0,98	rcp_ADM	0,93	phs_ICU	0,97	phs_A	3,31
nrs_WRD	1,48	phr_PHR	0,48	pfm_ADM	0,53	phs_ERM	0,97	pfm_ADM	0,91	wrd_WRD	0,95	aad_U	3,04
phr_PHR	1,38	rcp_ADM	0,39	phs_WRD	0,48	rcp_ADM	0,90	others	0,91	phs_OSP	0,67	ntr_U	2,81
pfm_ADM	1,25	amn_ADM	0,39	ntc_WRD	0,37	phr_PHR	0,62	ntc_WRD	0,59	ntc_ICU	0,65	phs_B	2,81
others	1,25	phs_OSP	0,37	others	0,37	ntr_NDS	0,62	phr_PHR	0,55	hag_ADM	0,63	ntc_A	2,80
pht_ICU	1,13	others	0,37			others	0,62					ntc_B	2,79
ntc_WRD	0,69					phs_OSP	0,56					rcp_U	2,79
phs_WRD	0,68					ntc_WRD	0,56					hag_U	2,47
swr_ADM	0,68					hag_ADM	0,51						2,00
pht_WRD	0,57												
Handoff flow direction													
From ICU to WRD	From ICU to WRD	From ERM to WRD	From ERM to WRD	From ERM to WRD	From ERM to WRD	From ERM to WRD	From ERM to WRD	From ERM to WRD	From ERM to WRD	From ERM to WRD	From ERM to WRD	From ERM to WRD	From A to B
Actors' satisfaction with the handoff (mean) (scale de 0 a 5)													
3,9	4,2	3,0	2,3	4,1	2,7	5,0							

Table 8. Handoffs correlations among actor information centrality and other centrality measures.

Correlations among actor information centrality (AIC) and others centrality measures (p = 0,000)							
Centrality measure	AIC/Handoff 1	AIC/Handoff 2	AIC/Handoff 3	AIC/Handoff 4	AIC/Handoff 5	AIC/Handoff 6	AIC/Handoff 7
Degree	0,93	0,94	0,94	0,87	0,93	0,95	0,98
Closeness	0,93	1,00	0,97	0,88	0,98	0,91	0,93
Betweenness	0,60*	0,94	0,87	0,65**	0,76**	0,77**	0,76**
Eigenvector	0,98	1,00	0,70*	0,95	0,99	0,91	0,99

* p = 0,02

** p = 0,01

Understanding the social structure of handoffs may contribute to drive objectives that ensure better performance in the care transition.

The analysis of structural features in handoffs has identified a categorical role, the nurse's origin unit, with high centrality and represented the only link among the others actors. The handoffs become vulnerable by relying on a single actor to the formal connections between subgroups of actors and, sometimes, personal interests of the most central actor can surpass the interests of the subgroups. In Figure 3, despite the *cia_U* has had the highest centrality of network, alternative routes by which the information flow processes can be observed. In particular, routes that involve the patient, or their relatives, are favorable to the observations that the involvement of these actors is important for reducing errors during transitions of care (Rennke et al., 2013).

The existence of gaps in care transitions can contribute to the success or failure in the transition strategy. Among the failures, for example, improper selection of information (not relevant), heterogeneity in categorical roles and type of patient involved (Rennke et al., 2013). In six handoffs analyzed, the improper selection of information emerged as the main failure, followed by the absence of electronic system to disseminate information.

The formation of a team to implement a handoff should reduce the risk for an improper care transition of a patient. A balanced configuration between the actors of the subgroups may be more appropriate to ensure a better setting and better team performance. Connections are an expression of how social capital provides access to information (Ferriani et al., 2009). These characteristics seem more likely to occur in a network configuration model handoff 7 than in the configuration of handoff 4.

The leadership of handoff by the actor with the highest centrality may be more likely to succeed in the transition of care. However, there may be a potential disadvantage in exposure excess within the network. As you increase the connectivity of an actor in the network, the benefits of higher degrees of centrality decreases (Sampson, 2005; Owner-Smith and Powell, 2003; McFadyen and Canella, 2004).

The disparity in the actors' centrality also helps to increase the inefficiency of information flow in closed systems (Yamaguchi, 1994). In Table 3, for example, the gap can be seen among the similar categorical roles in the units (*nrs_ICU*, *nrs_WRD*, *nrs_ERM*; *phs_ICU*, *phs_ERM*, *phs_OSP*; *ntc_ICU*, *ntc_WRD*). The same phenomenon occurs when analyzing the data in tables 2, 3, 4 and 5.

Table 6 illustrates that the actor information centrality measure can discriminate numerically the various actors. This measure, whose interpretation resembles the concept of closeness, showed strong correlations with degree, closeness and eigenvector measures. These three measures, however, showed less ability to

discriminate actors among themselves (Tables 2, 4 and 5). Regarding the betweenness measure, the correlation with the actor information centrality measure is strong and shows less efficient to discriminate actors among themselves. However, the betweenness has provided the largest discrepancies among the intermediation potentiality of the actors, so it makes the actors with greater intermediation power visible. The eigenvector measure has had the highest correlation of measures with the actor information centrality measure. Both measures are different perspectives of simpler measures (degree and closeness, respectively). The strong correlation among these five measures of centrality suggests redundancy, and also agrees with literature (Valente, 2008).

Recent research seeking new centrality measures to better characterize the actors of the social networks, given the limitation of classical centrality measures (degree, betweenness and closeness) to identify the actors capable of initiating collective action on the social network in which they are inserted (Kim et al., 2012; Ramon et al., 2012; Yan et al., 2013). The hypothetical model suggests mediation by an integration agent to establish an optimal number of connections needed or feasible, to ensure secure flow of information about patients, among sectors of a hospital environment.

The initial assumption of the model that all relationships are symmetric contrasts the relationships between patterns of handoffs 4 and 7 (Figures 2 and 3). Assuming the model of handoff 7 is correct, i.e., in accordance with the laws of nature and not of arbitration, nor without insufficient assumptions; also assuming it's the most complete model compared to other existing models, its utility will not depend on the model itself, but especially of those who use it and for what purpose. Therefore, any model, regardless of being an innovation, will not ensure effectiveness (Merton, 2013). Applying this assumption to handoffs brings speculation about what variables affect on the handoff effectiveness.

Conclusion

In the context of this research, it could be considered that, among health professionals, the nurse provides the largest number of connections necessary or feasible, to facilitate a safe information flow about patients, among sectors of a hospital environment.

The nurse of the origin unit of handoff emerges as the categorical role with the greatest popularity (degree, eigenvector), greatest influence or control (betweenness) and the best access to information on the handoff (closeness, actor information centrality). A categorical role, important for an integration action in care transitions, shows up. The patient or his family even appears as central actor in the handoff, which contradicts the concept of patient-centered medicine.

The correlations among the five-centrality measures have been very strong, but the actor information centrality measure has been more effective to differentiate the level of centrality among actors. There has not been significant correlation (with $p = 0.05$) among these measures and the average level of satisfaction with the handoff.

In literature, there is a lack of studies to assess the level of evidence of the strategies effectiveness for the prevention of adverse events, in the information exchange of patients, through a clinical integration agent. Therefore, it is adequate the development of research to obtain information on contextual factors, on the implementation and costs of strategies interventions related to care transitions, such as the insertion of the clinical integration agent.

Specific interventions on the quality of information exchange in the handoffs, such as patient monitoring, recommendations, patient and family education, medical reconciliation and follow-up have not been studied. This represents a limitation of this study, despite having been asked to the respondents their level of satisfaction with the handoff. Another limitation lies with the fact that the sample does not have significant power to detect important differences among the analyzed handoffs and the hypothetical model.

Conflict of Interests

The authors have not declared any conflict of interests.

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