The performance implications of leveraging internal innovation through social media networks: An empirical verification of the smart fashion industry

The Performance Implications of Leveraging Internal Innovation through Social Media Networks: An Empirical Verification of the Smart Fashion Industry.

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Abstract

Despite rigorous empirical research exploring the changes in innovation dynamics triggered by Social Media Networks (SMNs), the benefits coming from the use of these digital platforms for knowledge search in innovative activities for small to medium enterprises (SMEs) are still unexplored. Customers become the new trailblazers. Thus, by adopting a customer led innovation perspective, this paper seeks to measure the effect on return on investment (ROI) of the use of SMNs as external drivers for supporting internal innovation search processes. On the basis of the extant literature on information system and social network analysis, the research describes and evaluates the multidimensional activities interwoven into the open innovation process, driven by integrating the five constructs of structural dimension, relational behaviour, cognitive dimension, knowledge transfer, and legitimisation into our hypothesised conceptual model.

Empirical research was conducted via the Classification Regression Tree (CART) on a sample of 2,548 SMEs belonging to the fashion industry and based in Italy and in the United Kingdom. This study is of importance to academics and practitioners due to the increasing significance taken on by the adoption of social media networks in the fashion industry to improve innovation search. Recommendations are made to fashion managers and social media experts to support the planning and development of new products and services. New contributions are offered to the innovation and knowledge management literature. In addition, theoretical implications and avenues for future research are also considered.

Keywords*: SMEs, fashion industry, social media networks, return on investment, knowledge search, innovation.*

1.0 Introduction

Since the 1990s, the process of knowledge search in company innovation activities has increasingly accessed external networks (Chesbrough, 2007). Initially, the locus of such external networks was represented by suppliers; however, over the last decade, users have been identified as a relevant source of innovation (Cillo & Verona, 2008; Currie & White, 2012; Grigorian & Rothaermel, 2014; Smith et al., 2005; Toh & Polidoro, 2013). Companies started to seek new knowledge externally by relying on an outflow of knowledge which called for an open innovation approach (Chesbrough, 2005). Lately, with the internet and social media networks, the knowledge search process has sped up and the cost of innovation has gone down (Billington & Davidson 2013).

The knowledge search in innovation activities involves a much broader network, one that goes beyond company boundaries and also advocates combining with company knowledge stock (Savino et al.,

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2015; Enkel & Gassman, 2010). Therefore, through such extension of the borders of this activity, millions of users work with a company in order to create a new product and\or service (Billington & Davidson 2013). Companies have jumped on the bandwagon of using social media networks (SMNs) to improve their innovativeness, as has been showed by several case studies involving companies such as Barilla (Martini et al., 2013), Starbucks (Gallaugher & Ransbotham, 2010), and Dell Computers (Gangi et al., 2010) among others.

In the innovation process, the involvement of consumers thus fosters and facilitates the acquisition of knowledge. Management scholars have tested the positive influence of involving customers in product development (Rothwell et al., 1974; Maidique & Zirger, 1984; Dwyer & Mellor, 1991; Cooper & Kleinschmidt, 1995; Zahn et al., 1995; Souder et al., 1997; Gruner & Homburg, 1999; Reichart, 2002), pointing out the essential role they play in R&D activities (Hippel, 1976, 1998; Cooper & Kleinschmidt, 1986; Kreuz & Förster, 2003). Some companies (e.g., LEGO, Procter & Gamble, and Orange) have already involved consumers in their idea creation processes. For instance, LEGO introduced a new co-creation project entitled "LEGO Ideas" to seek new innovative ideas via its dedicated online platform. This new way of innovating calls for an open approach (Chesbrough, 2003, 2011) that relies on the external environment and also on the outflow of knowledge. In turn, innovation processes tend to become cheaper, more efficient, and faster due to the use of digital platforms (Persaud, 2005).

In a nutshell, companies seek new knowledge by interacting with users through SMNs. They exchange knowledge interwoven with the users' backgrounds in terms of experiences and skills. Then, having acquired external knowledge, companies combine it with their internal one, virtually interweaving inflowing and outflowing knowledge (Chesbrough 2011; Hvass & Munar 2012; Tussyadiah & Zach 2013; Scuotto 2014; Kietzmann et al., 2011; Palacios-Marques, Merigo & Soto-Acosta 2015).

As stated in previous research (Muller et al, 2005; Weinberg & Pehlivan, 2011; Romero, 2011), the entire process of seeking knowledge in innovation activities by using SMNs is kick-started by setting up SMNs as a space in which to seek and share knowledge, and ends with a knowledge legitimization step. Specifically, the whole process involves five dimensions, as follows:

1. the structural dimension of SMNs, pertaining to the time and money invested in innovation search through them;
2. the relational behaviour between customers and SMEs, which refers to the time and money spent interacting with users to foster and facilitate both innovation search and ROI;
3. the cognitive dimension of customers, which is the diverse set of user skills and experiences employed during the knowledge search activity;
4. the knowledge transfer between customers and SMEs, which refers to the combination of inflowing and outflowing knowledge;
5. the legitimization of new ideas, which pertains to the reliability of the external knowledge shared between customers and companies (see Figure 1).

Insert Figure 1 here

Despite the process described above seemingly being improved by the use of digital platforms, the creation of a new product and/or service is still fraught with a high degree of uncertainty in terms of the expected return on investment (ROI). Managers are particularly obsessed by achieving ROI in the short term. It is likely that the use of SMNs has not only changed the ways in which innovation is sought, but it has also increased company revenues and, in turn, it has sped up the accomplishment of ROI (Kaske et al., 2012). Billington & Davidson (2013) pointed out that the increasing number of people involved in the process of innovation search proportionally enhances the degree to which the time necessary for such accomplishment is reduced (see Figure 2).

Insert Figure 2 here

Kaske et al., (2012) declared that SMNs enhance product development through the close collaboration with customers and, consequently, drives ROI in innovation. As reported by McKinsey (2013), SMNs are bringing relevant benefits to companies, such as a 20% increase in of successful new products or services, a 15% increase in revenue, and a 30% improvement in knowledge search and sharing.

Despite the aforementioned studies, the influence exerted by SMNs on the process of knowledge search in innovation activities to facilitate the achievement of ROI has been rarely argued. Very few scholars have analysed this aspect by taking a qualitative approach (Billington & Davidson, 2013; Martini et al., 2013; Gallaugher & Ransbotham, 2010; Gangi et al., 2010). In fact, ROI is considered to be "stubbornly difficult to identify and quantify" (Kane et al., 2010:iii), which gives rise to the widely accepted understanding of not being able to measure ROI through SMNs, which, in turn, was one of the main barriers to the use of digital tools (Fisher, 2009).

However, in spite of this, this study seeks to evaluate whether the aforementioned five dimensions have a positive direct effect on the achievement of ROI in the process of knowledge search in innovation activities through SMNs. Empirically, by means of a classification and regression tree (CART), this research analysed a sample of 2,548 SMEs belonging to the fashion industry and based in Italy and in the United Kingdom.

The remainder of this study is structured as follows. Section 2.0 is based on the study of the hypotheses regarding the value of using SMNs to support the knowledge search process in innovation activities and

how this process is related to the achievement of ROI. Especially, five hypotheses are developed, relying on five key dimensions (1. structural; 2. relational behaviour; 3.cognitive; 4.knowledge transfer; and 5. legitimization) involved in the process of knowledge search through SMNs. Section 3.0 reports the empirical test of the hypotheses on a sample of 2,548 SMEs from the fashion industry and based in Italy and in the United Kingdom by applying a classification and regression tree (CART). In section 4.0, the findings show that ROI is positively affected mainly by the structural, relational behaviour, knowledge transfer, and legitimization dimensions; whereas the cognitive dimension emerged as having a negative effect on ROI. In section 5.0, the findings are discussed, highlighting their managerial and academic implications. Section 6.0 then concludes by presenting the research limitations and future directions.

2.0 Study of the Hypotheses

The open innovation approach has facilitated the way in which knowledge can be sought in the external environment. Initially, suppliers were involved in the search for innovation but, lately, users have become an essential source of innovation thanks to the increasing prevalence of SMNs (Billington & Davidson, 2013). SMNs have given a powerful twist to the search for innovation, enhancing the circulation of knowledge—both inflowing and outflowing—and speeding up the ROI (Kaske et al., 2012). SMNs have been identified as being online open source platforms based on dyadic ties (from individuals to collectives) (Kane et al., 2014; 2011; Bonsón 2011; Howcroft & Durkin, 2000; Dibb & Meadows, 2001; Boyd & Ellison, 2007; Ellison & Boyd, 2013). Using SMNs, users and companies interact directly with each other, which creates an articulate path composed of various nodes, in which each node depends on another with reference to its position along the path (Kane et al., 2014; Sharif, 2012). Indeed, SMNs facilitate and foster the search for and transfer process of knowledge, involving users from a diverse set of geographic and organizational boundaries (Pavitt, 2003; Soto-Acosta & Meroño-Cerdan, 2006; Lopez-Nicolas & Soto-Acosta, 2010; Del Giudice et al., 2013; Scuotto et al., 2016). Alongside this, the relevance of external knowledge has been confirmed by several scholars who emphasized the role played by new technologies in supporting the acquisition/creation, dissemination, and utilization of knowledge (Darroch, 2003; Tiwana, 2003; Lucio-Nieto et al, 2012; Jayasingam et al, 2013; Scuotto & Morellato, 2013; Del Giudice et al., 2014). Consequently, growing numbers of companies are making greater use of external knowledge in their activities (Wang & Scuotto, 2012; Dahlander & Gann, 2010; Chesbrough & Bogers, 2014; Scuotto & Sunila, 2015). They tend to develop their R&D activities with the involvement of external resources (Gassmann & Enkel, 2004). As it has emerged, the idea creation process relies on the collective ability to share and combine knowledge in a virtuous flow (Doll & Deng, 2001; Lopes-Nicolas & Soto-Acosta, 2010; Dias & Bresciani, 2006; Del Giudice et al., 2013; West & Bogers, 2014). Piller & Walcher (2006) analysed the toolkit for idea competitions (TIC) used to engage users in the innovation process. For instance, Huston & Sakkab (2006) studied P&G's Connect and Develop program so as to evaluate its online method to collect customer and supplier ideas.

In a nutshell, SMNs offer users opportunities to voice out their ideas. Customers are more active, creative, and keen to develop social collaborations (Roser et al., 2009; Piller et al., 2012). They like "the idea that one day someone in the supermarket could say: do you see this biodegradable package? It was an idea of mine" (Martini et al., 2013). It represents a shift in the innovation approach from a manufacturing-active method to a customer-active one (Von Hippel, 2001, 2005); one that is taking place through SMNs. This phenomenon has been driven by the friendly use of technological tools that encourages users to share knowledge with companies even in designing new products (Von Hippel, 2005). Essentially, the impact of SMNs on the innovation process has been increasingly associated to the co-creation model, in which customers lead the creation of new products or services (Prahalad & Ramaswamy, 2004).

As stated by Schumpeter (1942) and Scherer & Harhoff (2000), innovations are essential for economic growth and company value creation. These current creative ideas are generated more by the recombination of existing elements in different ways (Arts & Veugelers, 201; Cohen & Levinthal, 1990; Hargadon, 2003) than by experimentation and discovery. Hence, customers have been assuming a dominant role in promoting innovative ideas.

The virtual environment is the setting for a wide range of activities (Wang and Scuotto, 2012) that develop the search for knowledge. Specifically, selecting suitable SMNs as an innovation search space (structural dimension) in which companies seek new knowledge by interacting with users (relational behaviour) who use their brain and reveal multiple sets of knowledge (cognitive dimension). In turn, a combination between outflowing and inflowing knowledge is involved in the search for innovation (knowledge transfer) which enables the verification of external knowledge reliability (legitimization) (Muller et al, 2005; Weinberg & Pehlivan, 2011; Romero, 2011).

However, the search for innovation also calls for uncertainty in the achievement of ROI. In fact, despite the growing degree of innovation, companies are still struggling to reach the return on investment (ROI) in the first three years (Ferraris et al, 2012). Usually, ROI has been considered as a metric suited to estimate company performance (Calantone et al., 2002; Romero, 2011).

Although, according to Kaske et al (2012), ROI is "the net proceeds from an investment over its costs (3900) … it is not a direct measure of a firm's profitability, it is more sensible to define the hurdle rate that a certain project has to clear" (3901). Fisher (2011) associated this rate with the process of idea creation. So, considering the fact that ROI has already been studied as a metric to evaluate both the profitability of social media (Kaske et al., 2012) and the return on market investment (Rust, 2004), this research investigates this metric to explore whether the above five SMN dimensions involved in the search for knowledge in innovation activities would positively influence company ROI.

Therefore, we believe that

H1. The structural dimension has a positive impact on company ROI.

As the social media network focus is to be considered, a connection within online communities has to be created (Ardichvili et al., 2006). Social media networks transform reality in a new vibrant social dimension;

one in which consumers interact, recommending products and\or services, and are involved in company innovation processes. The sharing of knowledge takes place in a virtual reality in which online customer services are offered (e.g., chat or live agents, Internet-based telephony applications). According to Sharratt & Usoro (2003), trust between information sources and respondents within online knowledge-sharing communities is of the utmost importance. Thus, in order to make sharing knowledge easier, it is essential to encourage trusting relationships (Usoro et al., 2007; Hsu et al., 2007; Li et al., 2013). Furthermore, trust is the basis of feeling safe in promoting and developing new ideas. These observations—referring to the ways in which relationship-based communication is affected by trust—may be applied to several other relational, structural, and cognitive means of interaction that generate capital (Phillips, 2014; Yoon et al., 2015). The general scheme of the linkages connecting enterprises or business units is integrated by the structural dimension (Nahapiet & Ghoshal, 1998), thus showing the nodes between the actors, which reveal the entire network of connections. Social interaction is essentially based on this system of relations, which makes it easier to acquire and exploit the relevant knowledge when needed. Sharing information is fundamental for the purpose and success of innovation activities, in particular in an SMN setting (Muller et al, 2005; Weinberg & Pehlivan, 2011; Romero, 2011). Therefore, the relational dimension is made up of a pattern of virtual interactions in which ideas and know-how are exchanged (Frohlich, 2002; Lopez-Acosta & Merono-Cerdan, 2008). Frohlich & Westbrook (2002) suggested that engaging users through SMNs helps companies to anticipate market needs.

Therefore, we propose that:

H2. The relational dimension has a positive impact on the achievement ROI;

Consequently, the cognitive dimension becomes part of this journey because a diverse set of external and internal competencies is employed (Nahapiet & Ghoshal 1998; Valkokari et al, 2012). Indeed, such diversity, in terms of ability and competencies, has been shown to be a valuable resource for innovation (Dasgupta et al., 2002; Cai, 2005; Chong et al., 2009). In a nutshell, the cognitive dimension is associated with the abilities of different actors to interpret and understand meanings. The level of the languages and codes they share is the means by which products are created (Nahapiet & Ghoshal 1998; Alavi & Leidner 2001; Del Giudice et al., 2014).

Hence, we state that:

H3. The cognitive dimension has a positive impact on company ROI.

The literature has provided substantial evidence of how respondent behaviours are influenced by trust and by the reliability of a source of information (Van Wijk et al., 2008; Levin & Cross, 2004). "An understanding of the benefits social media end-users need and want is an approach to enhance social interaction and also build trust" (Bowen & Ozuem, 2015:74). The more reliable a source appears to be, the greater the probability of parties sharing its information, and the higher the actual quantity of information exchanged (Szulanski et al., 2004). Online retailers are smarter than traditional ones as they can exploit external knowledge—coming

from consumers and\or other businesses—to implement new marketing strategies; co-create new products\services, and satisfy consumer needs (Pantano & Timmermans, 2014; Adetola et al., 2013; Verhoef et al., 2009). Sharrat & Usoro (2003) stated that the main precondition for the exchange of knowledge within online knowledge-sharing communities is trust towards the source of information (Scuotto & Morellato, 2013; Del Giudice et al., 2014). Thus, the innovation search process also involves the quantity and intensity of the knowledge transferred, generating a flow of internal and external knowledge (Simonin, 1999; Lane et al., 2001; Yli-Renko et al., 2001, Ardito et al., 2016, Capaldo et al., in press).

In turn, the transfer of knowledge empowers companies on their journey towards realizing a new product or service. They integrate external knowledge within their organizational setting and combine it with their own knowledge stock (Meroño-Cerdan et al., 2008; Chong et al., 2009; Savino et al., 2014). As a result, SMNs come to be considered as workable platforms for companies to search and share ideas and end up introducing innovations into the market (Dasgupta et al., 2002; Cai, 2005; Chong et al., 2009).

Therefore, we believe that:

H4. The transfer of knowledge has a positive impact on company ROI.

However, formal and informal knowledge practices affect company uncertainty in reference to technical skills, production resources, and market needs (Thomke, 2003; Nielsen & Nielsen, 2009). A transparent management of the information sources (Häubl & Murray, 2006) may reduce such uncertainty. As argued by Wang (2002), the attitude towards a prospective product depends on the credibility of the information source; moreover, if the latter is trustworthy, customer willingness to purchase a product increases (Smith, Menon et al., 2005). Consequently, as knowledge is directly influenced by the issue of legitimation and trust, users are more eager to co-create new products with companies (Ogawa, 1998; Von Hippel, 1998; Diener & Piller, 2010). Changing managerial attitudes and improving online transparency have been prioritized in corporate culture (Tapscott & Williams, 2008; Constanzo, 2009; Kupp & Anderson, 2007). However, the challenge for companies is still to convert customer ideas in an innovation. The legitimization of customer ideas relies on employee expertise (Alvesson, 1993; Lowendahl, 2000), which also involves the codification of the external knowledge within an organization (Scott, 1998; Sveiby, 1997). As result, knowledge is legitimized through an ongoing interaction between customers and companies (Morris, 2001). SMNs can benefit the innovation journey by bringing together external and internal resources with different sources of expertise and experience (Dasgupta et al., 2002; Cai, 2005; Chong et al., 2009).

Therefore, we declare that,

H5. Legitimisation positively influences the innovation search process and, in turn, ROI in innovation.

As all of these activities involve company investments in time and money, but nobody has hitherto examined their effect on ROI, we believe that the rationale of the innovation search process is related to SMNs

facilitating the interaction with the external environment in which the innovation search starts. SMEs interact with customers through SMNs to exchange knowledge that will contribute to generating innovation in the short term and reducing the financial resources required. Based on this, SME ROI may be improved, reducing the tension between creativity and financial profit (Godard, 2012).

3.0 Methodology

To summarise, the literature review identified five constructs involved in the knowledge search process in innovation activities by using SMNs—structural dimension, relational behaviour, cognitive dimension, knowledge transfer and legitimisation—which were examined in relation to SME ROI. Figure 1 portrays these constructs, stating the relationship of each determinant with SME ROI.

The hypotheses where tested by means of the Classification and Regression Tree (CART). The authors applied this method because it has been recognised as being valuable and suitable for empirical research (Breiman et al, 1984). It employs the use of both qualitative and quantitative dependent variables, which can be considered as predictors, and reduces large size trees to achieve optimal dimensions. Breiman et al. (1984) described this statistical procedure, which is based on the classification of a variable into two or more populations, as an appropriate method to examine either categorical or continuous data. Specifically, CART involves three stages: first of all, by means of a portioning technique, variables are selected and split up in different dimensions, creating a large tree. In the second stage, the number of nodes will be reduced using a pruning technique. The scope is "a nested subset of trees starting from the largest tree grown and continuing the process until only one node of the tree remains" (Lee et al., 2006:1117). Finally, the optimal tree will be obtained based on "a tree yielding the lowest cross-validated or testing set error rate" (Lee et al., 2006:1117). The advantages of applying the CART method to an empirical analysis can be summarize as follows: 1. the model enables the identification of the relevant independent variables through the built tree; 2. it works properly on a wide dataset; 3. it facilitates data interpretation; 4. it classifies the criterion by which to select the relevant variables; 5. it supports practitioners in making managerial decisions. Despite this, CART provides an approximated linear function and the researcher has to continually check the effect of data perturbation on results (Prasad et al., 2006).
However, we deem CART to be more suited to our research than, for example, classic regression modelling because it enables us to draw nonlinear interactions among variables (Moore et al., 1991), and to map out the effect of the independent variables on the dependent one. Moreover, CART is a flexible method that enables the adjustment of the results in time to current market changes (Timofeev, 2004).

In summary, CART facilitates:

- classifying the factors of the dependent variable; in line with this, the explanatory variables (X) were identified to categorize the dependent variable (Y);

- rejecting redundant data; this step enables the rejection, mainly, of those variables that have a limited connection with Y;
- exploring the interactions between projective variables; which refers to the effects that one or more variables can have on the dependent one;
- creating classification rules; this aspect concerns the forecasting of the value of the dependent variable relying on the explanatory ones;
- discovering non-linear and non-monotonic relations.

Having recognised its appropriateness, CART was applied to the empirical research. The above hypotheses were tested on 2,548 SMEs located in Italy and the United Kingdom and operating in the fashion industry. The scope was to assess whether the five elements of SMNs involved in knowledge search in innovation activities—structural dimension, relational behaviour, cognitive dimension, knowledge transfer, and legitimization—have a positive effect on company ROI.

3.1 Research Setting

Given the chance to disseminate information through social media networks, SMEs are gaining a competitive advantage quickly and with less investment (Palacios-Marques, Merigo & Soto-Acosta, 2015a, 2015b). SMEs are keen to learn more about SMNs (Amy & Poston 2013). Stelzner (2013) claimed that SMEs tend to use these virtual realities to create new products based on customer needs and, in turn, to reduce product development costs. Initially, the manufacturing industry was the first to adopt these digital tools, followed by tourism, and high-tech (Soto-Acosta et al., 2015; Damirchi & Rahimi, 2011). Currently, SMEs from the fashion industry also seem to be increasingly affected by these virtual realities, with consumers assuming an active role in commenting, tagging, and recommending products and\services (Mohr, 2013; Kim & Ko, 2010, 2012; Phan et al., 2011; Postman, 2009). In fact, consumers are easily recognised as company ambassadors, bringing about managerial and organisational changes (Kane et al., 2010), and also as resources for the innovation process (Prahalad & Krishnan, 2008; Martini et al., 2013). Customers tend to be more and more involved because fashion is recognised as a form of customer expression (Godart, 2012). The fashion sector is a creative industry that "pushes out" and "pulls in" social changes (Messarovitch & Arnault, 2000), and comes up with innovative ideas that tend to integrate or to replace existing ones (Godard, 2012; Popper, 1959). In this creative sector, the embeddedness of social life strengthens the role played by consumers in the innovation process. Besides this, consumer relevance is also highlighted by the tension that exists in this field between innovation and fashion profit (Fuller & Matzler, 2007; Bughin et al., 2011; Fabrizio, 2009; Kohler et al, 2012; Sofka & Grimpe, 2009, 2010; Hoffman, 2007). The fashion industry is becoming a juggernaut of innovation in the virtual market due to the growing use of vibrant and technological tools. In fact, embeddedness in social media networks is one great change that many companies have started to accept in a big way (Phillips, 2011). The fashion industry is constantly pervaded by change (Christopher et al., 2004; Agins, 2010; Burns & Bryant, 2002; Vecchiato & Roveda,

2010; Jernigan & Easterling, 1990; Ko et al., 2007). In the highly globally competitive and digital era, fashion organisations are going to great lengths to advertise and promote their products and to discover a new sense of fashion style and design (Bohdanowicz & Clamp, 1994; Hines & Bruce, 2007; Easey, 2009; Godard, 2012).

3.2 Data analysis

A database provided by Cerved (2013) was used to identify the sample. This dataset, composed of 2,548 SMEs, was elaborated by an online survey in which the process of open innovation was evaluated. In particular, the data were related to the relationships between the companies and their ecosystems, of which customers were a part. The online survey, which was conducted over roughly one year, provided an overview of the process involved in setting up a co-creation model between the companies and their ecosystems through the use of SMNs.

However, we selected only the data related to relationships with customers, as these were in line with the research. These data come from a closed-response questionnaire circulated via the CATI (computer-assisted telephone interviewing) system.

Moreover since the CART model works without pre-assumptions in regard to the correlation among variables (Moore et al., 1991), we selected the predictors by taking into consideration the above literature on digital innovation. Substantially, five key determinants were individuated based on the use of SMNs during the knowledge search process:

- Structural dimension: an explanatory variable that supports the general scheme of the linkages connecting actors. This dimension includes information and communication technologies—such as digital platforms, technological tools, and the internet, among others—which enable companies to build up new virtual and international spaces to seek and share knowledge.
- Relational/behavioural dimension: an explanatory variable that supports the sense of creating social ties on digital platforms. This definition reflects four significant elements, such as the creation of their own profiles by users, the access to information in cyber space through search engines (e.g., Google), the interaction with one's own network or with connections made by others, and also the time and money invested. This dichotomous variable was set at 1 if the SMEs performed all the aforementioned actions, and at 0 otherwise;
- Cognitive dimension: an explanatory variable that supports the combination of diverse sets of knowledge. It involves the interaction of multiple knowledge sources coming from users. This dichotomous variable was set at 1 if the SMEs performed all the aforementioned actions, and at 0 otherwise;
- Knowledge transfer: an explanatory variable that supports SME knowledge management. It is based on the virtual interweaving of outflowing and inflowing knowledge. This dichotomous variable was set at 1 if the SMEs performed all the aforementioned actions, and at 0 otherwise;

- Legitimation: an explanatory variable that stands for the code and\or language used to convert user ideas into innovations. It refers to the number of innovations based on user ideas. This dichotomous variable was set at 1 if the SMEs performed all the aforementioned actions, and at 0 otherwise.

The variables were scored using the following databases: Eikon (Thomson-Reuthers), Datastream (Thomson-Reuters), and Annual reports.

A first screening was performed on 5,978 companies—either SMEs or large companies—located either in Italy or the United Kingdom using two features: (1) their number of employees and (2) their annual revenues, both of which have been determined to be observable variables suited to classify companies as SMEs—i.e., companies with less than 250 employees and turnovers of less than EUR 50 million (European Commission, 2006). This screening produced a sample of 2,548 SMEs suited to implement the analysis.

Then, the classification rule for the research sample relied on the distinction between "High ROI" and "Low ROI" fashion SMEs. This classification rule corresponds to the Y variable of the classification tree, which refers to the SMEs' profitability in the fashion industry. This dichotomous variable was organized by a range score of 1 if a SME had a high ROI, and 0 otherwise. A high company ROI is one that is higher than the mean sector ROI.

Following this stage, a recursive separation was used to delineate the X variables which rely on the classification of SME ROI.

Consequently, the sample was broken down into ever smaller groups with the aim of defining internal homogeneity in terms of the dependent variable (Y). Substantially, all possible segmentations were created for each explanatory variable and the variable with the most homogenous subset was selected. During this stage, CART was applied using the dependent variable (ROI) and the explanatory ones (X1, X2, X3, X4, and X5). Therefore, the database was segmented into ever more Y-homogenous subsets. A final node defined as pure reflects that the same value of the dependent variable is occurring in 100% of the cases in the node.

Following this step, each subset was further segmented into a child node and a parent one, with the first one being less impure. These two segmentations formed the basic structure of the tree, in which the final nodes where optimized referring to the minimum number of cases in both the parent node—i.e., 100—and the child one—i.e., 50.

Furthermore, impurity was evaluated by using the Gini heterogeneity index, which establishes the minimum change rate as 0.0001. Finally, to measure the reliability of the tree, the segment was confirmed by means of a training sample including 60% of the companies in the aggregate sample. The remaining 40% was used to validate the model (test sample). However, before applying CART to generate the tree, the following pre-steps were completed:

- *step 1:* constructing the fully expanded tree crown—i.e., the exploration tree with a very low percentage of statistical units in each terminal node;

- *step 2:* identifying a sequence of sub-trees and pruning the weakest link, starting from the expanded tree crown and ending with the root node;
- *step 3:* selecting the decision tree from among the sub-trees generated by the tree crown pruning process, and identifying the sub-tree associated with the lowest classification and prediction error rates (as estimated based on a test sample).

4.0 Findings

In table 1 the model specifications as well as the analysis results are described. The 'Specifications' section provides the dimensions employed in the tree model, including the explanatory variables. In the 'Results' section, the scores stated refer to aggregate node number, number of terminal nodes, and tree depth. Then, figure 1 describes the tree diagram of the training sample that emerged from the minimizing process. The best sub-tree is represented in figure 1.

Insert Table 1 here

The examination of the CART classification sub-tree of the training sample (Fig. 1) yielded the following results:

- The 'structural dimension' variable divides the data into node 1 and node 2. The data in node 1 show that 62.5% of those SMEs that used SMNs in their innovation search processes and had set up digital platforms in their organizational settings had high ROIs; however, node 2 displays that 68.7% of SMEs had low ROIs despite having embedded SMNs in their processes;
- The subsequent optimal classification variable for those SMEs that scored positively for 'structural dimension' (node 1) is 'relational behaviour' (node 3). In node 3, 71.2 % of those SMEs that had created their own profiles based on user input, accessed information in cyber space through search engines (e.g., Google), made and shared relational connections, and also interacted with their virtual network had high ROIs. This means that those SMEs for which 'relational behaviour' could be identified as a key determinant in driving SMEs' innovation process were focussed on customer engagement;
- The subsequent best classification variable for those SMEs that scored positively in terms of 'relational behaviour' (node 3) is 'knowledge transfer' (node 8). In node 8, 79.7% of those SMEs that implemented actions to enhance their knowledge sharing, frequency of communication, and trust had high ROIs;

– Node 2 shows those SMEs for which SMNs did not positively affect ROIs, thus showing a negative performance of the cognitive dimension. Indeed, in node 5, 75.5% of SMEs were negatively affected by this variable. The issue emerged from managerial decisions which were unable to coordinate the diverse sets of knowledge and integrate an online organizational culture within their settings. The consequent better classification for those SMEs that had low ROIs is node 6. Therefore, these SMEs had low ROIs.

Insert Figure 3 here

Insert Figure 4 here

Matching results emerged from both the training sample (Fig. 2) and the test sample (Fig. 3), the appropriateness of the model was confirmed. In fact, as reported in the Risk and Classification Tables (Tabs 2 and 3), the correct classification rate obtained for the training sample is 63% and the classification error risk rate of the model (see Tab. 3) stands at 0.27 with a 0.01 standard error value.

Insert Table 2 here

Insert Table 3 here

Consequently, Table 4 shows node gain by reporting the number of nodes, the number of cases, the average profit and ROI (Return on investment) . From the empirical research, it emerged that node 8 reported the highest ROIs, while the node 6 showed the lowest. However, as shown in table 6, there is a prevalence of SMEs with high ROIs.

Insert Table 4 here

Insert Table 5 here

Insert Table 6 here

Table 5 pertains to the 'High ROI' target variable, showing the gain as a percentage, the response rate and the percentage index (lift) for each node, and confirming the reliability of the model.

In summary, structural dimension, relational behaviour, knowledge transfer, and legitimization were shown to mainly positively affect the ROIs of the sample SMEs. Thus, the active role played by SMNs in innovation search was estimated. Initially these platforms were used as free or low cost windows; however, to be more effective, SMEs currently have to acquire new sophisticated and engaging systems. In any case, companies are still struggling to manage multiple knowledge sets. As it emerged, the cognitive dimension negatively affects ROI (LOW ROI: 57.2). Although the introduction of digital infrastructures was beneficial to part of our sample, the cognitive dimension needs to be worked out and enhance SME performance. Therefore, $H_{1,}$ $H_{2,}$ $H_{4,}$ H_5 are confirmed, while H_3 is not supported.

5.0 Discussion

The paper responds to the digital, social and technological transformations affecting the field of fashion. It fuses fashion with the ever expanding online world of digital and social commerce, in which modern *prosumers* engage, review, and co-create fashion brands within and between their online communities. Fashion, fashion brands, designs, and trends are increasingly impacted upon and transformed by digital and creative technologies and prosumers who have visual, vibrant, and viral lifestyle identities. In line with this, our research model has been designed to bridge the existing gap in the literature and respond to the growth and transformational impact of digital and social phenomena in the search for innovation.

According to our empirical research, the relevance of SMNs as a valuable space in which to seek and share knowledge was confirmed by their high impact on ROI. The predominant and active role played by users in the search for innovation was confirmed by the positive results stemming from the structural dimension (HIGH ROI: 62,5), relational behaviour (HIGH ROI: 71,2), knowledge transfer (HIGH ROI: 79,7), and legitimization (HIGH ROI: 50). Our results show that ROI is improved through customer involvement and interaction in the innovation process in terms of ideating, producing, or testing innovation (i.e., in testing prototypes, supporting design, suggesting references or additional services, etc.) (Chesbrough, 2003, 2011; Prahalad & Ramaswamy, 2004). The virtual interaction between SMEs and their consumers relies on changes in organizational behaviours from traditional approaches to collaborative ones (Shih et al., 2010). SMEs seek to collaborate with consumers in creating new products and\or services (Postman, 2009) and in getting more information on their needs. SMEs gain advantages from SMNs; for example, blogs enable companies to collect feedback and new ideas from different stakeholders, such as consumers, suppliers, and

employees, among others (Chikandiwa et al., 2013; Bonson & Flores, 2011). From this prospective, consumers are identified as the first ambassadors of a company (Kane et al., 2010); this highlights the significance of understanding consumer needs and perspectives by setting up social media strategies (Bernoff, 2007) that drive innovation and strengthen SME competitive advantage. While companies rely on co-creation approaches through SMNs to deal with their innovativeness, they develop iterative customer relationships through the sharing of new ideas and the combination of these with company knowledge stock (Savino et al., 2014). As empirically demonstrated, the virtual environment is facilitating the search for innovation. In turn, companies are able to convert customer ideas in products or services, thus improving their ROIs.

This research highlighted the growing numbers of active users who are keen to contribute to the development of new ideas and consequently satisfy their needs. Companies seek to enhance their "digital recognition" by showing off their ideas to a wide pool of customer-creators. In line with this, the adoption of a customer-led innovation view is embedded in organizational culture. Indeed, from a managerial point of a view, we believe that SMEs should take on a more active role, reanimating their organizational settings via digital, social, and transformational technologies online. Through the distinctive style provided by SMNs, companies may inspire and improve the creativity of the fashion industry and bring about the establishment of a 21st century entrepreneurial generation of fashionistas. The idea is to take the localised and material fashion industry and its people and transport them into a digital global brand, destination and, again, centre for fashion.

6.0 Conclusion

With local and global communities being transformed by the techno-culture of digital and social technologies, the increasing digitalisation of customer services has become a key driver for business. Customers reflect their identity and emotions through what they wear, eat, and listen. Indeed, fashion is more than just clothes and accessories; it embraces the aspirational identities, lifestyles, and experiences shared by social media such as Facebook, Twitter, and Pinterest, among others. In other words, fashion is all about self-expression. Fashion brands are immersing themselves in this virtual world to visually stimulate its potential customers and provide them with a rich and varied experience. The Facebook pages of global retailers are stated to be influential by 23% of consumers, while 92% of consumers around the world trust the "word of mouth" of social media. Fashion is a £1.2 trillion global industry, with more than £26bn billion spent annually in the fashion industry (UK Oxford Economics, 2014). Therefore, based on this growing virtual phenomenon, SMEs in this field are adopting SMNs in their search for innovation, this enables them to come up with new products or services while, at the same time, reducing ROI uncertainty. ROI is a metric suited to measure cost savings and increases in revenue (Romero, 2011). Challenging the common perception regarding the inability of estimating ROI through SMNs, this paper demonstrates a valuable measurability by using the five drivers of the SME structural dimension, relational behaviours between

consumers and SMEs, customer cognitive dimension, and knowledge transfer and legitimization, employed in the innovation search process (Muller et al., 2005; Weinberg & Pehlivan, 2011; Romero, 2011). The use of SMNs requires minimal investment, with an increase in ROI. However, the efficient management of these digital tools is widely required in order to generate cyclical and continuous innovation, one that pushes out changes in social life or pulls them in from customers (Bhardwaj & Fairhurst, 2010; Phillips & Tuladhar, 2000; Diaz-Rainey et al., 2015). Indeed, based on the latter, SMNs have become one of the most effective ways to attract customers to businesses and to generate a buzz around fashion brands (Kim & Ko, 2012). The fashion industry is, in fact, driven by a convergence of social trends and industrial creations, and measures its ongoing growth by its ROI, reducing the sense of uncertainty (Godard, 2012). Furthermore, our research design model related to the search for innovation through SMNs defines the journey to innovation and manages an unstable, chaotic, and frightening world.

Despite this, our research model may be extended to either other sectors and/or countries. By conducting empirical research, it would be interesting to look into the entire process of innovation that also involves internal company R&D activities. What is the time and money involved in this process? Is it manageable? These and other questions may provide stimulus for further research and improve this one. For instance this research did not specify the type of knowledge acquired (e.g., tacit vs. codified; general vs. specialized; established vs. novel, among others); this could stimulate further research.

Consequently, this research could be theoretically analysed on the users' side, where a qualitative methodology could be associated to a quantitative one to gather more detailed information. This could provide an overview of any overlooked psychological traits, individual characteristics, and environmental features. Moreover, an in-depth analysis of the cognitive dimension could also be of value. From our research, this variable yielded negative results due to managerial issues. Therefore, a better understanding of such issues could empower companies to enhance their social and technological performances.

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Tables and Figures

Figure 1. Research Design for the Search for Innovation through SMNs

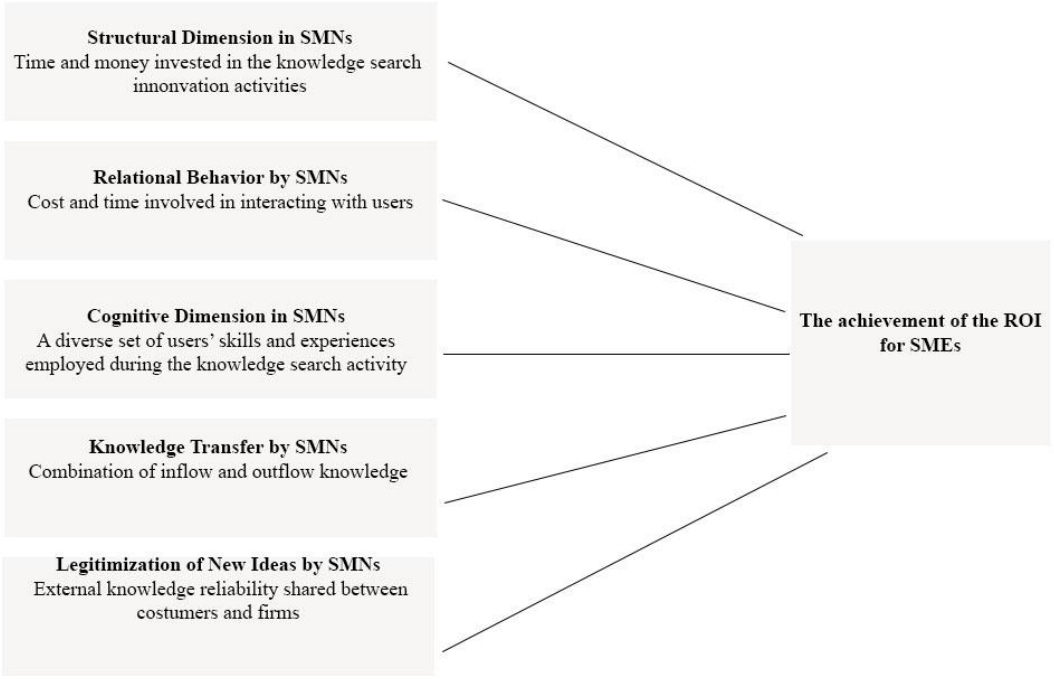
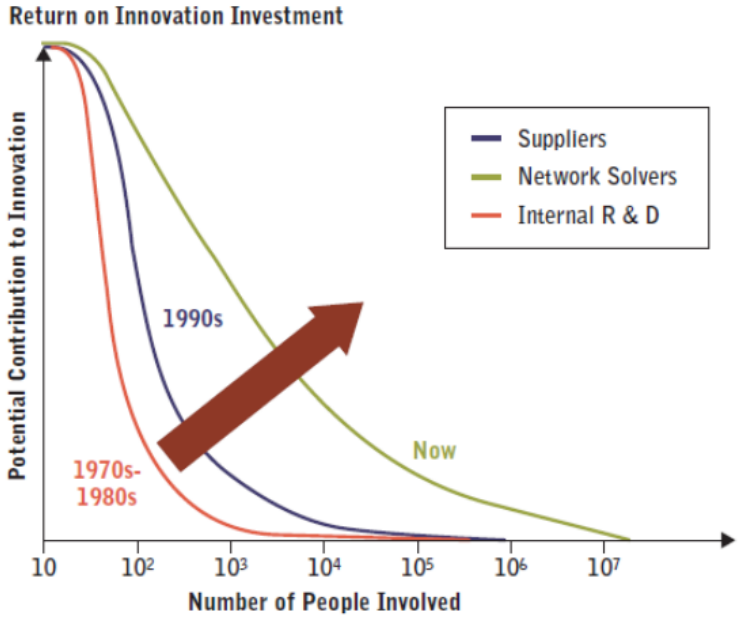


Figure 2. Return on innovation Investment



Source Billington and Davidson, 2013

Figure 3. Hypotheses

H_1 (+)	Structural Dimensions→ ROI
H_2 (+)	Relational Behaviour → ROI
H_3 (+)	Cognitive Dimensions → ROI
H_4 (+)	Knowledge Transfer → ROI
H_5 (+)	Legitimization → ROI

Table 1. Model summary

Specifications	Growing Method	CRT
	Dependent Variable	ROI
	Independent Variables	
	Validation	Split Sample
	Maximum Tree Depth	5
	Minimum Cases in Parent Node	100
	Minimum Cases in Child Node	50
Results	Independent Variables Included	
	Number of Nodes	10
	Number of Terminal Nodes	4
	Depth	4

Table 2. Risk

Sample	Estimate	Std. Error
Training	0.274	0.001
Test	0.324	0.015

Growing Method: CRT
Dependent Variable: ROI

Table 3. Classification

Sample	Observed	Predicted		
		Low ROE	High ROE	Percent Correct
Training	Low ROI	574	171	79.0%
	High ROI	224	654	51.4%
	Overall Percentage	67%	41%	63.1%
Test	Low ROE	403	108	84.3%
	High ROE	208	206	52.0%
	Overall Percentage	55.0%	47.0%	71.0%

Growing Method: CRT
Dependent Variable: ROI

Table 4. Gain Summary for Nodes

Sample	Node	N	Percent	Profit	ROI
Training	8	323	21.3%	3.010	4.5%
	14	56	3.5%	2.156	3.2%
	10	103	7.9%	1.769	2.7%
	11	110	6.1%	1.632	2.5%
	9	156	8.5%	1.256	1.9%
	12	214	8.8%	1.110	1.7%
	13	54	3.5%	.753	1.3%
	6	607	33.0%	-.754	-2.0%
Test	8	205	21.8%	3.578	4.3%
	14	40	2.9%	1.300	2.3%
	10	118	7.8%	1.326	2.2%
	11	71	7.0%	1.152	2.0%
	9	71	7.0%	1.055	1.9%
	12	127	8.2%	1.250	2.2%
	13	43	3.1%	1.895	3.5%
	6	250	27.0%	-.573	-2.0%

Growing Method: CRT
Dependent Variable: ROI

Table 5. Target category: High ROI – Gain for Nodes

Sample	Node	Node		Gain		Response	Index
		N	Percent	N	Percent		
Training	8	323	21.3%	242	42.5%	84.9%	174.3%
	14	56	3.5%	32	4.3%	54.1%	120.4%
	10	103	7.9%	76	8.8%	51.5%	108.9%
	11	110	6.1%	57	7.6%	52.3%	109.2%
	9	156	8.5%	67	8.2%	46.1%	98.3%
	12	214	8.8%	95	9.2%	47.3%	92.7%
	13	54	3.5%	25	3.3%	37.9%	83.1%
	6	607	33.0%	143	25.8%	20.2%	42.2%
Test	8	205	21.8%	305	42.8%	84.3%	179.0%
	14	40	2.9%	28	3.9%	49.0%	104.5%
	10	118	7.8%	61	8.6%	45.7%	100.5%
	11	71	7.0%	55	7.7%	45.5%	96.1%
	9	71	7.0%	53	7.4%	41.8%	94.5%
	12	127	8.2%	65	9.1%	48.1%	102.7%
	13	43	3.1%	37	5.2%	52.9%	119.5%
	6	250	27.0%	108	15.2%	20.3%	43.3%

Growing Method: CRT
Dependent Variable: ROI

Table 6. Case Processing Summary

ROI	Valid N (listwise)
Positive	1.039
Negative	581

Notes: Larger values of the test result variable(s) indicate stronger evidence for a positive actual state; (a.) The positive actual state is High ROI.

Figure 4. Training sample

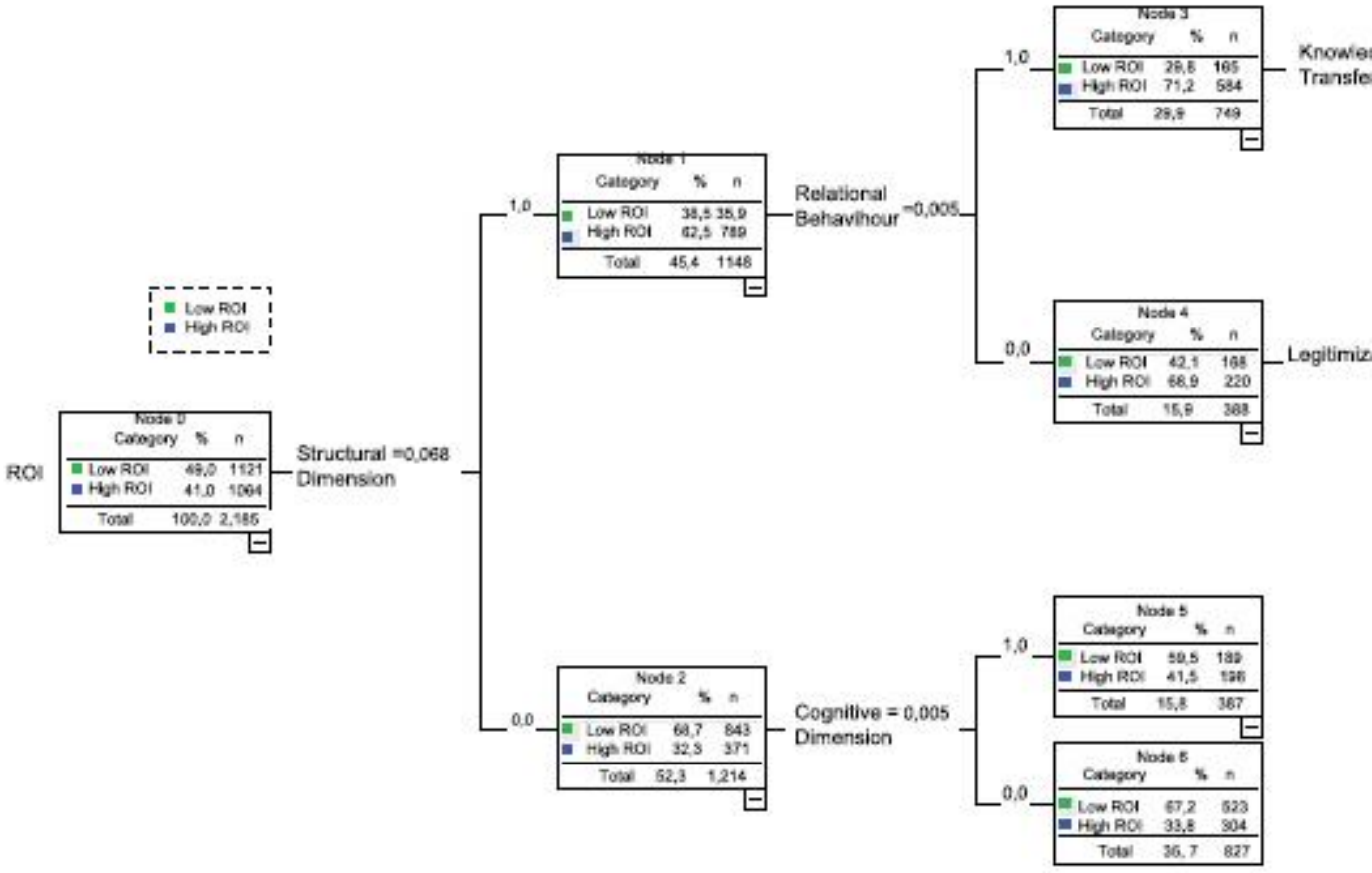
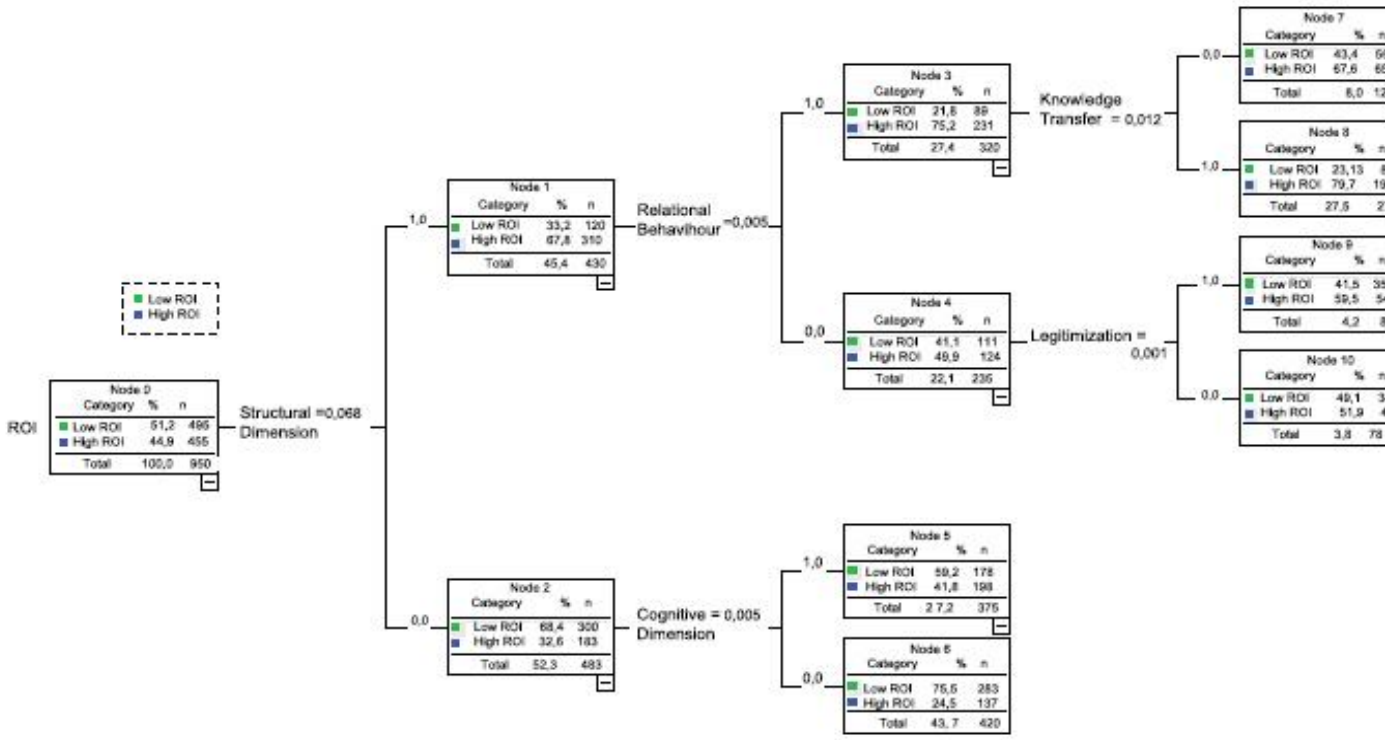


Figure 5. Test sample


Low ROI
High ROI
ROI
Node 0
Category % n
Low ROI 51,2 485
High ROI 44,9 455
Total 100,0 950
Structural =0,068
Dimension
1,0
0,0
Node 1
Category % n
Low ROI 33,2 120
High ROI 67,8 310
Total 45,4 430
Relational
Behavihour =0,005
Node 2
Category % n
Low ROI 68,4 320
High ROI 32,6 163
Total 52,3 483
Cognitive = 0,005
Dimension
Node 3
Category % n
Low ROI 21,6 69
High ROI 75,2 231
Total 27,4 320
Knowledge
Transfer = 0,012
Node 4
Category % n
Low ROI 41,1 111
High ROI 48,9 124
Total 22,1 235
Legitimization =
0,001
Node 5
Category % n
Low ROI 59,2 178
High ROI 41,8 198
Total 27,2 375
Node 6
Category % n
Low ROI 75,5 283
High ROI 24,5 137
Total 43,7 420
Node 7
Category % n
Low ROI 43,4
High ROI 67,6
Total 8,0
Node 8
Category % n
Low ROI 23,13
High ROI 79,7
Total 27,5
Node 9
Category % n
Low ROI 41,5
High ROI 58,5
Total 4,2
Node 10
Category % n
Low ROI 48,1
High ROI 51,9
Total 3,8