Journal of Knowledge Management

IT and relationship learning in networks as drivers of green innovation and customer capital: evidence from the automobile sector

Antonio Leal-Millán Jose Luis Roldán Antonio L. Leal-Rodríguez Jaime Ortega-Gutiérrez

IT and relationship learning in networks as drivers of green innovation and customer capital: evidence from the automobile sector

Antonio Leal-Millán, Jose Luis Roldán, Antonio L. Leal-Rodríguez and Jaime Ortega-Gutiérrez




Antonio Leal-Millán is Full Professor at the Department of Business Administration and Marketing, Universidad de Sevilla, Seville, Spain. Jose Luis Roldan is Associate Professor at the Department of Business Administration and Marketing, Universidad de Sevilla, Seville, Spain. Antonio L. Leal-Rodríguez is Research Assistant and Lecturer at the Universidad Loyola Andalucía, Sevilla, Spain. Jaime Ortega-Gutiérrez is based at Universidad de Sevilla, Sevilla, Spain.

Received 28 May 2015
Revised 28 October 2015
Accepted 24 November 2015

Abstract

Purpose – *Despite the positive effects of customer capital (CC), questions remain over how managers enable CC growth by applying their skills and capabilities through managerial actions and strategies, such as developing information technology (IT) capability, fostering relationship learning (RL) activities and developing green innovation performance (GIP) with clients. These questions are especially pertinent in small and medium-sized enterprises and automotive industry companies that operate through supply chains, where knowledge about customers is likely to result from personal contact between customers and organisational members. The purpose of this paper is to analyse the extent to which these managerial actions were more likely to lead to the successful creation of CC.*

Design/methodology/approach – *Using the partial least squares technique, this paper studies how these three managerial actions impact on CC. To do so, data from 140 companies in the Spanish automotive components manufacturing sector have been used.*

Findings – *The findings support the influence of RL on both GIP and CC. RL is a key managerial action in exploiting customer information and knowledge advantages, enabling firms to structure and reconfigure resources to produce new ways to compete and to satisfy stakeholders. In addition, results show that GIP is a determinant of CC because of its contribution to achieving sustainable competitive advantage, with GIP performing a mediating role in the relationship between RL and CC. A second contribution shows that IT is not in itself able to yield a competitive advantage, thereby validating the existence of complementary or co-focused strategic assets such as RL and GIP, which enhance IT's influence on CC.*

Research limitations/implications – *The authors were unable to explore the subtleties of the processes over time. Future research should include a longitudinal study.*

Practical implications – *This study considers RL an essential factor in achieving both GIP and CC. Consequently, managers should seek to build strong RL cultures. In addition, this study shows that IT is not in itself able to yield a competitive advantage, thereby validating the existence of complementary or co-focused strategic assets such as RL and GIP.*

Originality/value – *No study has ever examined these three antecedent variables (IT, RL and GIP) together, with the aim to examine their effects on CC.*

Keywords *IT capability, Automotive industry, Partial least squares, Customer capital, Green innovation, Relationship learning*

Paper type *Research paper*

1. Introduction

Intellectual capital (IC) embodies an organisation's stock of knowledge at a particular moment. IC is a snapshot of what an organisation has learned. Underlying this view is the assumption that IC comprises three components: structural, human and relational capital

"When firms share information and knowledge with customers and suppliers, they enhance their knowledge base, capabilities and competitiveness through relationship-level learning."

(Edvinsson and Sullivan, 1996). Some authors have extended the concept of relational capital, conceptualising it as customer capital (CC) (Choo and Bontis, 2002).

Nahapiet and Ghoshal (1998) argue that new IC is created through the combination and exchange of existing intellectual resources, which may be in the form of explicit and tacit knowledge and knowing capability. Nahapiet and Ghoshal (1998) have provided strong evidence that the combination and exchange of knowledge are complex social processes and that much valuable knowledge is socially embedded in relationships. Accordingly, Nahapiet and Ghoshal (1998) believe that CC theory offers a worthwhile perspective for understanding and explaining the IC creation.

Customers provide companies with steady revenues by purchasing products or services. Similarly, acquiring knowledge about the customer, developing long-term relationships and sharing activities create value because these actions build trust, reputation and a greater capability to react to present and future customer needs. In this study, we defined CC as the value, in terms of contributions to existing and forthcoming revenues, derived from an organisation's relationship with its customers (Wensley *et al.*, 2011). Despite the positive effects of CC, however, questions remain over how managers enable CC growth by applying their skills and capabilities through managerial actions and strategies (Ashworth, 2006). These questions are especially pertinent in small and medium-sized enterprises, where knowledge about customers is likely to result from personal contact between customers and organisational members. This also happens in companies that operate through supply chains (e.g. companies belonging to the automotive components and equipment manufacturing sector), where developing strong client–supplier relationships is essential for effective and efficient management.

In this study, we considered which managerial actions (or antecedents) were more likely to lead to the successful creation of CC. We also explored how the creation of CC might occur. To do so, we examined the effect of managers' improvement regarding three managerial actions (or antecedent variables) associated with customer relationships and enhancing CC: developing information technology (IT) capability, fostering relationship learning (RL) activities and developing green innovation performance (GIP) with clients. No study has ever examined these three antecedent variables together. We also explored the links among these antecedent variables, as well as the indirect or mediating relationships with CC. The three managerial actions are discussed in detail in the following section.

We empirically analysed how the support or hindrance of these three managerial actions affects CC. To do so, we conducted an empirical study of data from 140 companies in the Spanish automotive components manufacturing sector (ACMS). This key sector in the Spanish economy represents 10 per cent of Spain's gross domestic product and employs 9 per cent of the working population. It is an innovation- and knowledge-intensive industry that channels its operations through project teams, intensively seeking and using external knowledge and maintaining strong interdependence relationships in supply chains. Within the automotive sector, it is especially important to develop green technologies, innovate in components or production processes, establish strong relationships with clients and suppliers and develop IT-based information systems and mechanisms that are efficient in real time. In addition, automotive firms usually form clusters that encourage and develop institutional isomorphism. This homogeneity is likely to limit potential sources of variance in the data and affords us an outstanding opportunity to focus on managerial action.

To achieve our goals, the paper proceeds as follows. The next section presents the theoretical background. Section 3 contains the research model and hypotheses. Section 4 describes the method. Section 5 involves a description of the main results derived from the data analysis. Finally, in Sections 6 and 7, the paper presents the discussion, conclusions, implications and limitations of this study.

2. Theoretical framework

The arrival of the knowledge era has changed the core values and key resources needed to create competitive advantage in business. IC, such as knowledge and technique, plays an important role in creating competitive advantage and improving business value. Hence, IC is the most valuable asset and competitive weapon of any business. In addition to human and structural capital, IC includes CC, which refers to the firm's relationships with its customers (Edvinsson and Malone, 1997; van Buren, 1999). Long-term relationships with customers represent a foundation for success in competitive markets. Thus, CC comprises relationships between customers and businesses, knowledge contained in marketing channels and customer relationships, the value of relationships between the business and its customers (i.e. the contributions to current and future profits), customer depth (penetration), customer width (coverage), customer attachment (loyalty) and company profitability (Edvinsson and Malone, 1997; Duffy, 2000; van Buren, 1999). Although there is no single definition of CC, all definitions cover the relationship between the business and its customers or deal with the value of this relationship.

The expression "customer capital" can be used to refer to what an organisation knows about its customers' business, market and specific difficulties and challenges. CC also refers to the ability to improve and implement a strategy that will meet customers' needs. Thus, CC can be expressed in terms of the value of a firm's relationships with its clients. CC thus includes a strong component of knowledge about customers that is enhanced with very close customer relations.

Nowadays, there is no doubt that the growing consideration towards sustainability is changing the competitive scene, by increasingly driving companies to change the manner in which they think about products, technologies and business processes. This situation is even more critical in environmental-resource-intensive sectors, for example the automobile industry, which usually causes a critical environmental impact. For this aim, any measure designed at improving their green effectiveness and sustainability positively implies a competitive advantage to be borne in mind.

The present research work is based on the ACMS in Spain, characterised by its knowledge intensity, innovativeness and the customer's orientation. These companies deliver components, and highly tailored products and services to large automakers. The ACMS presents special characteristics that other areas of activity (e.g. non-industrial sectors) do not possess. On the one hand, they act as external knowledge bases for their client firms, and on the other hand, they are progressively becoming autonomous innovation creators. Those firms that will be able to combine the IT expert knowledge and aggregate RL desirable to develop green innovations will be better positioned to differentiate their outputs from their rivals or enhance their CC.

> **"Relationship learning is thus a process to improve future behaviour in a relationship."**

> **"Our findings empirically confirm the influence of Relationship Learning on both Green Innovation Performance and Customer Capital."**

Customers change their features such as business processes, behaviour and preferences. As these customer characteristics shift, not only may service providers have to review their knowledge about the customer but they may also have to revise managers' basic beliefs and assumptions and any other implicit or explicit knowledge constituting CC or knowledge that enables value creation using CC (Akgün *et al.*, 2007a). Accordingly, several capabilities and managerial actions can play an important role in customer relations because they are likely to contribute dynamically to a positive atmosphere – positive in the sense that it enables the use of such knowledge and the hiring and coaching of employees who can use this knowledge to meet customer requirements (Barney and Wright, 1998). In this study, we operationalised managerial actions (i.e. antecedents of CC) in terms of IT capability, RL activities and GIP.

2.1 Information technology

IT assets cover IT infrastructure, IT human abilities and the firm's ability to use IT. These three components together form an intangible resource called IT capability (Bharadwaj, 2000). This view of IT assets has received ample support in the IT literature. Chen and Tsou (2012) describe IT capability as the ability to manage these three IT assets. Indeed, a mixture of these assets is a strong resource that drives the firm's competitive advantage. The resource-based view (RBV) of IT holds that firms can distinguish themselves through their IT resources (Chen and Tsou, 2012). Learning to combine existing IT assets effectively lets firms achieve competitive advantage.

Researchers broadly agree that quality customer service is the key to achieving customer satisfaction. Furthermore, quality customer service is the main condition for assessing customer value added and firm competitiveness. Therefore, greater emphasis on customer service has influenced the information systems priorities, and the business perception about the key role that IT plays in this process. Despite the importance of IT in customer service, empirical research examining the link between IT and CC is scarce. We designed this study to provide empirical evidence of the linkages between IT and CC in Spanish automotive firms and thereby fill the gap in the literature.

2.2 Relationship learning

When firms share information and knowledge with customers and suppliers, they enhance their knowledge base, capabilities and competitiveness through relationship-level learning. In our framework, we adopt broadly the meaning from Cheung *et al.* (2011) and the original definition from Selnes and Sallis (2003, p. 86) of the RL activities "as an ongoing joint activity between the customer and the supplier organisations directed at sharing information, making sense of information, and integrating acquired information into a shared relationship-domain–specific memory to improve the range or likelihood of potential relationship-domain–specific behaviour. Relationship learning is thus a process to improve future behaviour in a relationship. We further propose that relationships vary in terms of their learning capabilities, and thus some relationships perform better because they have developed appropriate learning mechanisms". Consistent with Selnes and Sallis' (2003) perspective, Cheung *et al.* (2011) contemplate RL to be equivalent to, but theoretically different from, the more general concept of organisational learning, and view RL as a multi-dimensional construct consisting of three components: information sharing, joint sensemaking and knowledge integration into a relationship-specific memory. As per Mesquita *et al.* (2008), they advocate the relational vision to explain how these three dimensions influence the buyer–supplier relationship performance and consequently enhance CC. This previous statement can be supported in the nature of the RL construct, which may be conceptualised as a joint action in which the two parties struggle to generate more value jointly than they would produce separately. Selnes and Sallis (2003) believe that the capability of a relationship to learn is linked with how it is managed and the trust environment in which it is inserted.

Selnes and Sallis (2003) have identified, as a first dimension of RL, that information sharing between the two parties in a customer–supplier relationship is a starting point and a central element of working relationship and affects RL, thereby achieving operational efficiency. Second, the dialogue within the two parties in a customer–supplier relationship constitutes a relationship-specific element of interpretation (sensemaking) of the shared information. Nevertheless, individual and groups vary in the ways they make sense of the same information, or lack the knowledge to make sense of it. For this reason, firms involved in a RL experience must use several mechanisms to joint sensemaking of information. Organisations in a customer–supplier relationship introduce management meetings, face-to-face communications in visit programmes, informal interpersonal networks, task-forces teams and cross-functional teams as instruments to solving operational problems in the relationship, and creating joint learning arenas. Finally, customers and suppliers "develop relationship-specific memories into which acquired relationship-specific knowledge is integrated" (Selnes and Sallis, 2003, p. 83). Relationship memories are shared, and manifest in documents, computer memories, etc. They involve the common history, values of the two parties and joint lessons learned, facilitating the knowledge integration process.

2.3 Green innovation performance

In 1947, Schumpeter reported technology development to innovation that improves people's welfare. Successions of innovations in the automotive industry conform to the Schumpeterian model. Heavy car usage leads to air emissions that cause climate change, pollution, greenhouse gas emissions and human disorders, so car firms in the twenty-first century must offer green solutions that protect the environment.

Innovation is an important way to mitigate or avoid environmental damage. Sherry and Stubberud (2013, p. 47) reported the following on green technologies: "Green technologies can have a double benefit for business – the feel good rewards that come from creating environmentally sustainable products and the practical financial benefits that can contribute to improved competitiveness and overall business success". Buyers around the world want and expect to purchase ever more environmentally friendly products and services. Indeed, green innovation is a strategic need for firms, and it offers a great opportunity for meeting buyers' wishes without harming the environment.

Green innovation has become a central strategy within manufacturing industries so that manufacturers can achieve environmental improvement in response to growing environmental pressure. Historically, investing in eco-friendly behaviours was seen as an excessive investment, but today's strict environmental guidelines and the current prevalence of conservationism have changed competitive strategies, policies and patterns for firms (Porter and van der Linde, 1995). The "green" tag is a stimulus for non-stop innovation, creating new market opportunities for firms to satisfy new consumer demands and thereby create CC.

Green innovation can consist of either green products or green processes. Green innovation comprises innovation in technologies involved in energy saving, pollution prevention, waste recycling, green product designs and corporate environmental management (Chen *et al.*, 2006). Chang (2011, p. 361) stated the following regarding green innovation: "If companies are willing to undertake green innovation enthusiastically, they can obtain the advantage from differentiation and low cost which can even change the existing competitive rules".

3. Research model and hypotheses

3.1 Information technology as a determinant of relationship learning

We adopt the notion of IT infrastructure, defined as shared IT capabilities that support the flow of knowledge within an organisation (Gold *et al.*, 2001). Within the category of IT infrastructure, we include a group of technological resources, both hardware and software applications, which support diverse tools for knowledge and learning activities (Leonard-Barton, 1995). These tools include business intelligence, technologies for cooperating and distributing knowledge, knowledge detection, localisation and use, knowledge creation and storage and support hardware for these technologies.

IT infrastructure provides a platform capable of standardising and integrating data and processes. This level of integration makes it possible to gather and share achievable, appropriate and precise information, and this comprehensive information allows fast, effective decision-making. For example, in some industries, real-time information integration lets firms quickly find and access price and value information to cope with rapid market fluctuations. Firms can thus collect, trawl and circulate information concerning variations in customer needs, competitor tactics and so forth (Lu and Ramamurthy, 2011). Moreover, IT infrastructure provides a basis that improves the customer and firm knowledge and supports the organisation in accessing, combining and exploiting knowledge (Sambamurthy *et al.*, 2003). For example, IT systems enable the handling of knowledge management (KM) artefacts by codification and dissemination tools and practices. One of the benefits of the codification approach is the reuse of knowledge. Codification pursues to transform organisational knowledge, making it accessible to the firm's members who need it. In this vein, "knowledge is codified using a people-to-documents approach: extracted from the person who developed it, made independent of that person, and reused for various purposes" (Hansen *et al.*, 1999, p. 108).

An emerging stream of research on IT and learning investigates the use of technologies that support organisational learning (Robey *et al.*, 2000). IT is involved in numerous KM processes, including knowledge creation (Alavi and Leidner, 2001; Pawlowsky *et al.*, 2001). Many procedures, tools and activities support the knowledge creation process (Nonaka *et al.*, 2001). IT contributes to achieving sustainable competitive advantage through its interaction with other resources. Recent studies have shown that RL plays an important role in enhancing a firm's capabilities and competitive advantage (Cheung *et al.*, 2011) and may benefit from the judicious application of IT. Scholars have also argued that for firms to be successful, they must complement IT with KM both as an antecedent and a consequence of organisational learning (Lu and Ramamurthy, 2011; Tippins and Sohi, 2003). Hence, we propose the following hypothesis:

H1. IT has a positive influence on RL as a KM process.

3.2 Relationship learning as a determinant of green innovation performance

Organisations develop structures whereby organisational members operate in a knowledge-exchange system and learn from worldwide experiences. In addition, firms recognise that innovations may develop at many points in the supply chain but particularly through direct partnerships (Cheung *et al.*, 2011). An important facet of KM is the use of cross-organisational teams, which are implemented to foster learning and knowledge transfer among organisations. Cheung *et al.* (2011, p. 1,067) argue that "the use of joint sensemaking activities assists performance-related outcomes by enhancing new product outputs and new process innovations as well". Both networks and cooperation generate information and knowledge that lead the absorptive capacity enhancement, which in turn improves innovation outcomes and firm performance (Akgun *et al.*, 2007b). Furthermore, Isaak (2002, p. 89) suggested that "stimulation of networking for the sake of sustainability" is an action whereby individuals and organisations wishing to stimulate environmental innovation can contribute to green practices. Thoughts and techniques could be shared and spread, leading to greater absorptive capacity.

The creation of collaborative networks between firms and stakeholders is crucial in innovation development (Bossink, 2002). Through partnerships and collaborations, firms can successfully innovate by sharing complementary resources and competencies (Powell, 1998). Firms can thus generate alliances, joint ventures, inter-firm networks, R&D consortia and partnerships (Doz *et al.*, 2000). This is the basic idea underlying Chesbrough's (2003) open innovation paradigm where firms "can and should use external ideas as well as internal ones, and internal and external paths to market" to fully exploit their technologies (Chesbrough, 2003, p.24). To generate a successful green innovation process, however, cooperation and information exchange with external agents may be even more necessary. In fact, green issues do not represent core competencies for most companies. Additionally, many firms lack knowledge and competencies to cultivate green innovations. For instance, in the ACMS, if a firm wishes to reduce its products' environmental impact – assuming that the firm does so at various points in the supply chain and that the firm itself is not involved in all product manufacturing phases – cooperation with other firms in the product's value chain is fundamental (Petruzzelli *et al.*, 2011). Moreover, the intricacy of ecological matters means that organisations exposed to green innovations build a dense, broad network of ties to their stakeholders (Ngai *et al.*, 2008). These stakeholders will be a source of eco-friendly knowledge and abilities external to the firm's core dominion. The relevance of RL mechanisms and processes – drawing together external environmental knowledge – in developing green innovations is thus essential.

H2. RL as a KM process has a positive influence on GIP.

3.3 Relationship learning as a determinant of customer capital

Greater competition in the markets, coupled with growth in the number of demanding customers aware of their purchasing power, forces companies to strengthen ties with and focus solely on customers. The recently coined term "customer capital" highlights the importance of customer relationship management and the impact on the firm's value.

RL can strengthen customer relationships and thus influences CC. RL activities enable combinations of knowledge such that RL can provide value to the customer and can simplify the process of seizing and disseminating the successful genuine customer knowledge pattern. Furthermore, RL activities generate explorative and exploitative knowledge processes simultaneously. When viewed through this relational lens, both explorative and exploitative processes are crucial in increasing competitive advantage, improving customer contacts and enhancing the value of CC (Chan and Wang, 2012). Wensley *et al.* (2011, p. 135) differentiated between explorative and exploitative processes as follows: "While explorative processes pursue new knowledge and result in the development of new products and services for emerging customer, exploitative knowledge processes built upon current knowledge to more precisely meet the needs of existing customers hence increasing the value add of the firm's products/services for the existing customers". In a sense, RL and CC refer to the firm's customer relationship management.

Managers can support the process of knowledge exploration by embracing some blend of RL activities (e.g. formal and informal meetings) or by building external communities of practice whereby customers and employees cooperate and work together to pursue mutually beneficial goals. Improving relational confidence, a shared language and confidence (Selnes and Sallis, 2003) lets firm members co-create, share and internalise this mutual knowledge.

Assuming that customer knowledge lays the foundations for customer value creation and that customer knowledge exploitation reflects the firm's ability to apply existing knowledge concerning customers to boost its customer relationship management, we posit the following:

H3. RL as a KM process has a positive influence on CC.

3.4 Green innovation performance as a determinant of customer capital

The literature suggests that organisational relational capital is rooted in the bi-directional flow of suppliers' and customers' value chains, and scholars have argued that CC is a sub-category of relational capital to the extent that customers contribute to RL and firms grant considerable weight to customer relationships (Bontis *et al.*, 2002; Teece, 2002; Husain *et al.*, 2013). The latter suggests that organisational knowledge, as well as innovation, is embedded in customers, and the use of this knowledge can generate CC in a circular way. Furthermore, classic works have shown that CC – as a value creation process – can be explored through knowledge creation and innovation (Nonaka, 1994; Teece, 2002).

Firms' and individuals' awareness of environmental matters is growing as pollution, climate change, ozone reduction and so forth become ever more pressing global problems. Consumers and manufacturers understand that by acting together, they can make great strides in safeguarding and protecting our ecosystem. Against this backdrop, effective green innovation helps firms to achieve greater efficiency, create and reinforce their core competences and improve their green image, all of which may ultimately contribute to success (Wong, 2012, p. 469).

Conventional innovation creates value because it results in efficiency, productivity or product market performance improvements. Green innovation, in contrast, creates value by addressing the green interests of the market, firm and target customers of a product or process (Wong, 2012).

In a sense, green innovation is a proactive strategy for the firm. Chen (2008) reported that adopting proactive strategies in environmental management may not just prevent the company from facing environmental protests or sanctions, but also help firms to develop new market opportunities and increase their competitive advantage. Furthermore, a company whose green innovation takes the form of new green products and services will experience first-mover advantages and will develop a better corporate image (Chen, 2008) and customer loyalty. Nevertheless, no empirical research has investigated the positive influence of firms' green innovation on customer relationships and the creation of CC. To fill this research gap, we tested a model positing that GIP will positively influence CC. Hence, we propose the following hypothesis:

H4. GIP has a positive influence on CC.

3.5 Information technology and its influence on green innovation performance

Recently, the link between IT and innovation has received considerable attention in the information systems literature. Researchers have studied IT as a driver of firm innovativeness in terms of both product and process innovation. Furthermore, customers' and firms' environmental awareness has recently increased considerably, leading to analysis of companies' environmental impact. As a result, companies are progressively developing organisational capabilities (e.g. IT capabilities) related to the enhancement of green innovation processes and environmental performance.

Benitez-Amado *et al.* (2010) showed that firms need significant investment in IT resources to cultivate innovation capability. Specifically, IT resources could act as key enablers of the firm innovation process. IT resources can enable a firm to expand its skills and create an innovative atmosphere that supports creativity and the development of new products or processes. Creativity can be encouraged if the company provides employees with resources such as software, databases or email systems, so that they may do their jobs more innovatively. IT can also help employees to access and exchange knowledge and to collaborate with other employees, departments and customers. More intensive knowledge and information interchange and partnerships between people and organisations leads to a greater wealth of new ideas, products and processes. For example, the internet can benefit the firm by offering new ways to deliver products and services to customers or by offering these products using greener delivery processes.

A major feature of IT infrastructure is flexibility: the capacity to support hardware, software and networking tools through a range of systems, along with the capacity to increase functionality and competence. IT flexibility lets a firm innovate quicker than competitors can because the company is able to adjust its schemes and business methods to more successfully accommodate for customer-changing conditions. Dai *et al.* (2007, p. 2) describe a flexible IT infrastructure as follows: "A flexible IT infrastructure supports the basis for organisational innovativeness to rapidly develop or enhance products or services in a competitive market. This potential value can be converted to real business value when management exploits the flexibility of the infrastructure to develop new resources".

Real *et al.* (2006) built an organisational learning model whereby IT, contemplated as a resource, contributes to converting resources into capabilities by allowing employees to share work practices and enabling interaction within groups and between individuals. The model's underlying idea is that IT helps reflection, experimentation and training in routines and work practices. IT also contributes to the process of converting capabilities into distinctive competencies.

Green innovation is, up to a point, a form of technological knowledge that may be described as a distinctive combination of knowledge and abilities that make it possible to generate a series of commercial innovations. Thus, IT plays an active role in the dissemination of the knowledge and know-how required for distinctive competencies throughout the organisation. From a dynamic capability perspective, Zhang and Lado (2001) showed how IT affects the development of distinctive competencies at the operational level and how IT can help the company to obtain a strategic competitive advantage. Given these considerations, we propose the following hypothesis:

H5. IT has a positive influence on GIP.

3.6 Information technology and its influence on customer capital

In a customer-orientation setting, customers are the core drivers of profit. A strategic competitive advantage results from value creation for customers. Firms need information about customers' wishes and the value they perceive. Successfully identifying and knowing customer needs may be enough for an organisation to improve customer satisfaction, gain customer loyalty and, therefore, enhance CC.

Creating a satisfactory customer information system lets businesses offer higher-quality service and improve forecasting of service resources. Information system literature maintains that IT indirectly affects firm performance through the improvement of products and production processes reliant on IT (Chan and Wang, 2012). Investments in IT can yield significant changes in firm's skills, abilities, innovativeness and market orientation (Dewett and Jones, 2001).

IT expertise is crucial if firms wish to store new customer knowledge, achieve continuous green innovativeness and enhance CC, whenever required. IT is especially significant in this era of market restructuring and rapid response to customer demands. Firms must recodify or record important knowledge in databases, operating processes and KM systems (Cepeda-Carrion *et al.*, 2012). Accordingly, IT capabilities positively enhance companies' ability to absorb clients' knowledge, which is a crucial strategic target to improve CC.

Authors adopting different viewpoints have emphasised IT's strategic status as a source of competitive advantage. From an industrial point of view, some authors argue that exploiting IT may provide competitive advantage (Kettinger *et al.*, 1994). Conversely, some empirical studies fail to identify positive relationships (Loveman, 1994). The technology productivity paradox then appears (Lucas, 1999). According to this paradox, IT is not automatically converted into better performance for the firms using it.

Under the RBV, Powell and Dent-Micallef (1997) showed that IT alone is not a strategic resource. It is only through complementary resources that IT becomes a source of competitive advantage. Consequently, IT is not a synonym of competitive advantage. In terms of sustainability, the competitive advantage afforded by IT lies in the organisation's IT management abilities, not the technology itself. Other studies have supported this conclusion (Teo and Ranganathan, 2003; Real *et al.*, 2006), underlining the importance of human and intangible resources. The following hypothesis naturally follows from this argument:

H6. IT by itself does not have a positive impact on CC.

Figure 1 shows our proposed research model.

4. Method

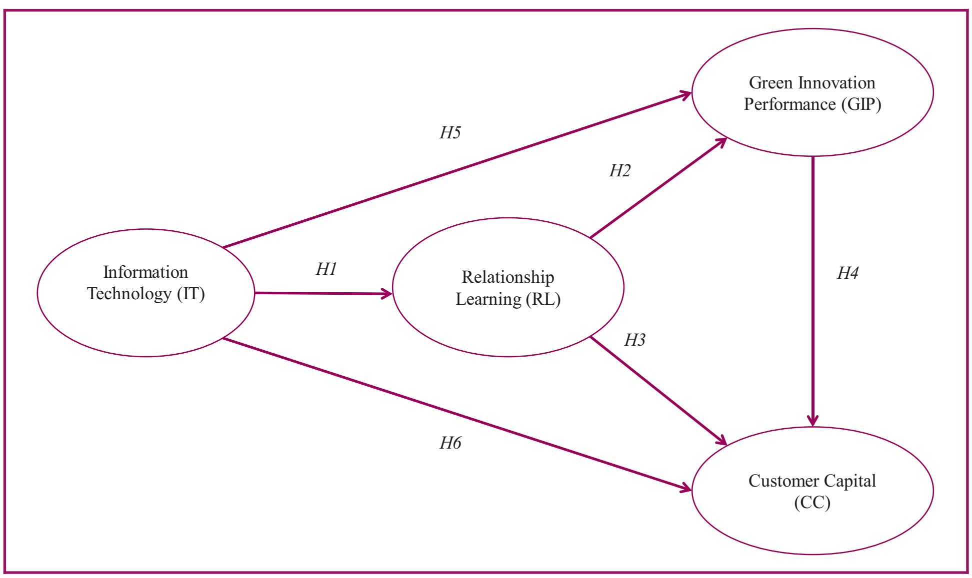
4.1 Sample selection

The study population was the entire population of Spanish firms in the ACMS. The sample was drawn from a list compiled by Sernauto, the Spanish Association of Manufacturers of Equipment and Components for the automotive industry. From this sector's 906 companies, 492 fulfilled the selection criteria (i.e. knowledge-intensive companies that work in supply chains). We sent the questionnaire to all 492. Respondents returned 152 questionnaires, of which 140 were useable. We eliminated 12 questionnaires because they yielded data that were unsuitable for the statistical analysis. The response rate was therefore 28.45 per cent. To ensure the correct sample distribution, we carefully ensured it was proportional to the population of each stratum by sector and size.

4.2 Measures

All variables were measured on seven-point Likert scales (1 = *strongly disagree* to 7 = *strongly agree*). The IT scale had 12 items adapted from the study by Gold *et al.* (2001). All 12 loaded onto a single dimension. We adapted the measure for *RL (information sharing, joint sensemaking, knowledge integration*) from the study by Selnes and Sallis (2003) and drew upon the conceptualisation for the three dimensions of RL from the same source. We

Figure 1



used eight items from the study by Chen *et al.* (2006) to measure GIP. Finally, strength of CC was measured using six items by Wensley *et al.* (2011).

5. Data analyses and results

We analysed the data using structural equations with the partial least squares (PLS) technique. This method, which uses the ordinary least squares (OLS) algorithm, is designed to reflect the theoretical and empirical qualities of social sciences and behaviour, where there are usually situations with insufficiently supported theories and little available information (Wold, 1979). This study used PLS-Graph software version 03.00 Build 1058 (Chin, 2003).

We followed the standard two-step approach for the PLS analysis (Barclay *et al.*, 1995). In the first step, we assessed the measurement model. We were thus able to specify the relationships between observable variables and theoretical concepts. We analysed individual item reliability, construct reliability, average variance extracted (AVE) and discriminant validity of the indicators as measures of latent variables. In the second step, we evaluated the structural model. The objective was to observe to what extent the causal relationships specified by the proposed model were consistent with the data.

To analyse the relationships between the different constructs and their indicators, we adopted the latent model perspective, whereby the latent variable is taken to be the cause of the indicators. We therefore speak of reflective indicators. The IT, GIP and CC constructs were first-order factors in which items formed a single principal factor. In contrast, RL was operationalised using a molecular approximation such that the second-order factors were the cause of their first-order components or factors (Chin and Gopal, 1995). For RL, we used a two-step application – also known as a hierarchical components model – for the approximation (Lohmöller, 1989, pp. 128-133).

Regarding the measurement model, we first assessed individual item reliability (see Appendix). Indicators were greater than the accepted threshold of 0.707 (Carmines and Zeller, 1979) for both the first- and the second-order factors, except for items IT1 and IT2. Nevertheless, several researchers have argued that this rule of thumb should be more flexible (Barclay *et al.*, 1995; Chin, 1998), and we therefore decided not to eliminate these items, whose loadings were greater than 0.65.

As results (see Appendix) show, all constructs were reliable because values for both Cronbach's alpha and composite reliability (ρ_c) were greater than 0.7 (the minimum required in the early stages of research) and the stricter value of 0.8 (basic research) (Nunnally, 1978).

The AVE should be greater than 0.5, in other words, 50 per cent or more of the indicators' variance should be accounted for (Fornell and Larcker, 1981). All constructs met this condition (see Appendix).

For discriminant validity, we compared the square root of the AVE (i.e. the diagonals in Table I) with the correlations among constructs (i.e. the off-diagonal elements in Table I).

Table I Averages, typical deviations and construct correlations

Constructs	*Mean*	*SD*	*IT*	*RL*	*GIP*	*CC*
IT	4.687	0.405	**0.763**			
RL	4.929	0.395	0.689	**0.883**		
GIP	3.596	0.183	0.712	0.656	**0.814**	
CC	5.298	0.351	0.649	0.830	0.689	**0.878**

Notes: [a]Diagonal elements (bold figures) are the square root of the variance shared between the constructs and their measures; off-diagonal elements are the correlations among constructs; for discriminant validity, diagonal elements should be larger than off-diagonal; [b]all of the correlations are significant at the $p < 0.01$ level

On average, each construct related more strongly to its own measures than to others.

Figure 2 summarises the structural model resulting from the PLS analysis. Figure 2 shows the explained variance of endogenous variables (R^2) and the standardised path coefficients (β). As results show, the analysis corroborated all hypotheses.

Because PLS makes no distributional assumptions in its parameter estimation, traditional parameter-based techniques for significance testing and model evaluation are considered inappropriate (Chin, 1998). One consequence of the comparison between modelling with covariance structure analysis approaches and PLS is that no proper overall goodness-of-fit measure exists for PLS models (Hulland, 1999). We evaluated the structural model by examining R^2 values, using the Q^2 test for predictive relevance, and checking the size of the structural path coefficients.

Finally, we analysed the stability of the estimates using the *t*-statistics obtained from a bootstrap test with 500 resamples. Table II illustrates the relationships posited in our research hypotheses, along with observed path coefficients and *t* values. Level of significance from the bootstrap test also appears in Table II. In addition, Table II lists the direct, indirect and total effects; proportion of explained variance; and Q^2 of the three endogenous variables.

Results support the relationship expressed by *H1*, which posits a link between IT and RL considered as a knowledge creation process ($\beta = 0.689$, $p < 0.001$).

In accordance with *H2*, results provide evidence for the influence of RL on GIP ($\beta = 0.315$, $p < 0.001$). The effects of RL on CC are fully verified for the relationships considered in both *H3*, which links RL and CC ($\beta = 0.634$, $p < 0.001$), and *H4*, which links GIP and CC ($\beta =$

Figure 2

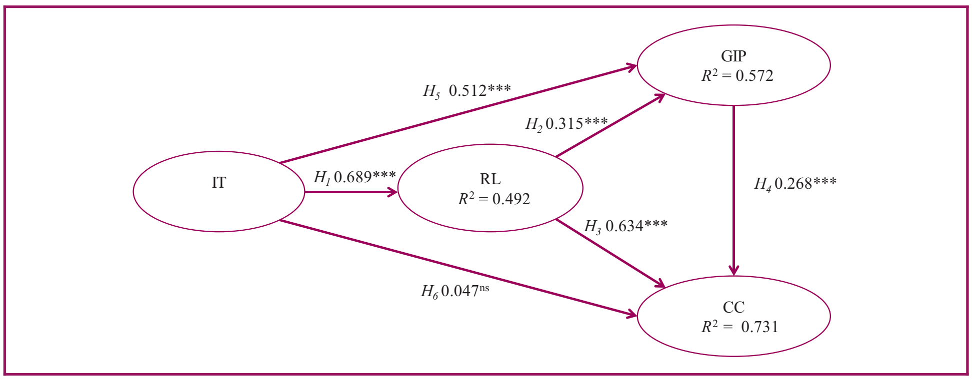


Table II Direct, indirect and total effects, explained variances and Q^2 test for the endogenous variables

Effects on endogenous variables	*Direct effects t value (bootstrap)*	*Indirect effects*	*Total effects*	*Variance explained*	Q^2
Effects on relationship learning				0.492	0.672
H1. Information technology	0.689***(14.609)	–	0.689	0.492	
Effects on green innovation performance				0.573	0.623
H2. Relationship learning	0.315***(3.523)	–	0.315	0.188	
H5. Information technology	0.512***(6.141)	0.211	0.723	0.385	
Effects on customer capital				0.723	0.495
H3. Relationship learning	0.634***(9.381)	0.176	0.810	0.509	
H4. Green innovation performance	0.268***(3.915)	–	0.268	0.183	
H6. Information technology	0.047^{ns} (0.451)	0.619	0.666	0.031	

Notes: ***$p < 0.001$; **$p < 0.01$; *$p < 0.05$; ns = not significant (based on a Student $t_{(499)}$ distribution with one tail); $t(0.05; 499) = 1.64791345$; $t(0.01; 499) = 2.333843952$; $t(0.001; 499) = 3.106644601$

0.268, $p < 0.001$). GIP mediated the relationship between RL and CC, with a value of 0.176 representing the indirect effect. This value is above the 0.15 level set by Falk and Miller (1992).

Results fully confirm the influence of IT on the outcomes of RL. *H5*, which posited the influence of IT on the development of GIP ($\beta = 0.512$, $p < 0.001$), was corroborated. Results confirm that IT did not exert a direct, positive influence on CC ($\beta = 0.047$, ns), thereby corroborating *H6*. Therefore, in accordance with the last hypothesis (*H6*), the effect of IT on CC occurred indirectly (0.619), mediated by RL (0.429), GIP (0.145) and the interaction between both (0.045). The total effect was 0.666, which was greater than the minimum threshold set by Falk and Miller (1992).

With reference to the explained variance (R^2) of the endogenous variables (Table II), the research model had good predictive power. The endogenous variables yielded R^2 values greater than or equal to 0.492, and CC had a maximum explained variance of 72.3 per cent.

In addition to examining the R^2 values, we evaluated the model by studying the Q^2 predictive relevance for the model constructs (Geisser, 1974; Stone, 1974). This test measured how well observed values were reproduced by the model and its parameter estimates (Chin, 1998). A Q^2 value greater than 0 implies that the model has predictive relevance, whereas a Q^2 value less than 0 suggests that the model lacks predictive relevance. The results in Table II confirm that the model measures were adequate, and the structural model had satisfactory predictive relevance for the three outcome constructs of RL, GIP and CC.

6. Discussion

As Table II implies, the model predicted 49.2 per cent of RL's variance. This explanatory power owes to IT's prominent role in the relational KM process. As Vargo and Lusch (2004) argue, the basic flow between organisations is information. It is this information that enables the coproduction of products or services among different partners or stakeholders, thereby helping to build relationships, insight and knowledge. The importance of IT raises an important research question: How can two or more firms generate cooperation spaces whereby these organisations can share the knowledge they create? According to Pawlowsky *et al.* (2001), the question of how knowledge is generated cannot be answered with simple learning tools. Nonetheless, it is plausible for organisations to create organisational environments that foster the adoption and diffusion of shared information systems and hence boost RL. Authors such as Nonaka *et al.* (2001) reached this conclusion, too, identifying the importance of IT in the knowledge conversion processes through the construction of a shared context or "ba". IT can thus act as an important ingredient in the design of RL among organisations by providing an infrastructure for storing, accessing and revising elements of organisational memory (Robey *et al.*, 2000).

Despite the importance of IT in the information sharing–RL framework, some authors, such as Rodriguez and Edwards (2009), have stated that there are three key components in knowledge sharing: IT, people and processes. All these components are included (in several ways) in the IT construct used in this work. We use a broad notion of IT infrastructure, defined as shared IT capabilities that support the flow of knowledge within an organisation, allowing employees and people to collaborate with other persons inside/outside the organisation.

Similarly, we observed that RL affects the development process of GIP because RL explained 18.8 per cent of GIP's variance. This finding is consistent with the findings of Benet-Martinez *et al.* (2002), who reported that certain RL dimensions (i.e. joint sensemaking and knowledge integration) can combine different knowledge structures to help with innovation. Alternatively, companies can stimulate innovation performance through the recombination of existing knowledge to create new ideas that are useful and practical for customers. The formation of RL activities in the innovation process can positively enhance GIP (Chang and Chen, 2013). Organisational members who rely on project teams with clients and suppliers may be motivated by what Chang and Chen (2013) call uniform environmental organisational identity, which enables these members to discover meaningful linkages between new technologies and customer needs and to find creative ways to improve innovation. Chang and Chen (2013) posit that environmental organisational identity positively influences GIP. In fact, though, the variable with the greatest explanatory power for GIP was IT, which predicted 38.5 per cent of GIP's explained variance. Notably, RL significantly mediated IT's effect on GIP. As Adams and Lamont (2003) have suggested, this finding may owe to IT's key contribution to the organisation's skill in identifying, assimilating and applying external information from customers and suppliers to new processes or products (i.e. the organisation's absorptive capacity).

Results indicate that CC had a suitable R^2 value (72.3 per cent). Results also confirm the well-documented influence of RL. RL explained 50.9 per cent of CC's variance, whereas GIP explained 18.3 per cent of CC's variance at a low significance level. These values show the importance of RL in CC. Chan and Wang (2012) and Wensley *et al.* (2011) had already presented this argument, but scholars had yet to provide sufficient empirical verification of the importance of RL in CC. This finding challenges the belief that organisational learning does not always have an immediate effect on company performance (Crossan *et al.*, 1995; Huber, 1991).

The mediating role of GIP in the relationship whereby RL affects CC is evident from the size of the indirect effect (0.176). This result suggests that the relationship between RL and CC cannot be direct and is instead mediated by other variables. Results imply that although GIP is an important direct driver of CC, it is also a necessary mediator of the relationship between RL and CC. This finding is consistent with the work of Chen (2008, p. 272), who concluded the following: "businesses can increase the productivity of resources through green innovation. Moreover, the corporations that pioneer in green innovation will enjoy the 'first mover advantage', which allow them to ask for a higher price for green products and, at the same time, improve their corporate images, develop new markets and gain competitive advantages". GIP are useful for allowing firms to create ever superior products, an outcome likely to increase market share, boost relational capital and improve other performance indicators, particularly when compared to firms with less developed green innovation practices.

The extent to which IT explains CC is negligible (0.031). This result implies that the effect of IT on CC and competitive advantage is mediated by certain complementary elements (Powell and Dent-Micallef, 1997). Consequently, this result may provide evidence of essential complementarity and likely interactions of IT with other intangible resources. In this respect, GIP and RL may operate as complementary organisational resources (Melville *et al.*, 2004; Wade and Hulland, 2004) because IT in itself does not guarantee that the RL–knowledge creation process will occur. The strong indirect effect of IT (0.619) mediated by RL and GIP coincides partially with the results obtained by Tippins and Sohi (2003). The small direct effect (0.047) implies that merely adopting IT does not enable value creation. Therefore, IT, by itself, does not automatically generate an enhancement of the CC. IT will indirectly improve the CC construct insofar as it generates an improvement of the RL and GIP variables. Several studies have already provided evidence of this as equivalent indirect effects due to IT (Teo and Ranganathan, 2003; Real *et al.*, 2006). Finally, even if IT in fact creates value (Santhanam and Hartono, 2003), companies cannot appropriate it because competitors can adopt the same IT resource.

7. Conclusions and implications

Despite considerable attention paid by scholars to the role of information, learning and innovation as key factors to increase IC and, consequently, achieve corporate success, little empirical research has examined the managerial actions that may be associated with creating and sustaining CC. Based on an empirical study of data for 140 automotive components manufacturing companies, this study examined how the nature and existence of three managerial actions (IT, RL and GIP) is linked to the nature and existence of knowledge exploration and exploitation processes by an organisation's workforce. We also explored how the existence of these actions contributes to the creation of CC.

Our study was both theoretically and practically relevant. Using the literature on RL and the knowledge-based view as theoretical frameworks, we have examined the problem of the complexity of RL as a knowledge creation and transfer process. We built a research model that, through the measurement of the RL process, demonstrated the key role of IT as a revitalising element of RL. We used this model to analyse the relationships among RL, green innovation and CC.

RL acts like a path capable of generating competitive advantage, but the relationships between RL and competitive advantage have been insufficiently tested in the literature. Our findings empirically confirm the influence of Relationship Learning on both Green Innovation Performance and Customer Capital. RL is a key managerial action in exploiting customer information and knowledge advantages, enabling firms to structure and reconfigure resources to produce new ways to compete and to satisfy stakeholders. In addition, results show that GIP is a determinant of CC because of its contribution to achieving sustainable competitive advantage, with GIP performing a mediating role in the relationship between RL and CC.

A further contribution of this research is the explanation of IT's role in the model. The study demonstrated that IT is not in itself able to yield a competitive advantage, thereby validating the existence of complementary or co-focused strategic assets such as RL and GIP, which enhance IT's influence on CC. Thus, IT helps firm members build and maintain customer relations, strive to understand customers' priorities and resolve customer-related issues. Therefore, managers should emphasise the human and organisational features of KM systems. We further suggest that all relational efforts should centre on people in the company who are actually performing the work where knowledge sharing and use take place. Because employees deal with customers and strive to satisfy their requirements, it is important for employees to have considerable autonomy, so that they can offer solutions to their customers. Such autonomy would certainly prevent time and energy being wasted when employees address customers' needs.

From an applied approach, this study considers RL an essential factor in achieving both GIP and CC. According to this viewpoint, managers should seek to build strong RL cultures. This type of atmosphere accelerates the search for new customer information and knowledge, creating learning that reinforces new green innovations and hence the value of the relationship between the business and its clients. This RL culture considers inter-organisational knowledge level (external knowledge from stakeholders) as a key source of intelligence and new ideas. Likewise, findings imply that mechanisms enabling knowledge co-creation and sharing among organisations should be implemented through RL activities. Thus, companies should increase their investment in IT not only because of IT's direct effect on CC and performance, but also because of IT's palpable role in organisational knowledge creation, assisting knowledge flow and accessibility for employees. This role would aid our understanding of the sustainability of competitive advantage resulting from synergies between IT and some complementary resources. For example, building an extranet linking two companies via the internet would let these companies share performance data and exchange feedback on joint initiatives between buyer and supplier. The extranet in some sense would provide a shared picture of the state of the relationship so that face-to-face meetings could focus on novel issues rather than merely updating and solving communication problems (Knoppen *et al.*, 2011). Finally, managers should recognise that GIP, as a result of a continuous activity, includes a solid component of RL. The essence of the green innovation process is the co-creation, transmission and accumulation of technological and environmental knowledge that can be incorporated into new products, services and processes that will satisfy clients.

The study is not without limitations. First, we were able to provide just a snapshot of ongoing processes. Consequently, we were unable to explore the subtleties of the processes over time. Future research should include a longitudinal study that takes measures at different points in time and allows us to verify the relations established in the theoretical model. Second, although the constructs were defined as strictly as possible, were taken from relevant literature and were validated by specialists, they were only proxies for underlying unmeasurable latent phenomena. For subsequent research, the use of additional items may help to capture the richness of the constructs addressed in this research. Third, the model in this study was general and did not capture possible moderating effects of environmental turbulence. Previous research has shown that the influence of cognitive issues on individual, group and organisational performance can change considerably depending on environmental conditions. Moreover, other factors or variables not included in this study are also likely to affect the constructs discussed herein. Fourth, successful RL needs a high organisational absorptive capacity, shown to play a role in RL and innovation (Leal-Rodriguez *et al.*, 2014). Another research opportunity is to show that absorptive capacity can affect knowledge creation both positively and indirectly through interaction with IT. Fifth, the study only considers firms belonging to a specific sector (i.e. the ACMS) and within a particular geographical context (Spain). Therefore, researchers must be cautious when generalising these results to different scenarios and non-industrial sectors. Finally, future research should examine the life-cycle effects of an RL context. A cross-national study may be necessary to examine relationships between CC and the existence and nature of an RL context. We are aware that different cultures adopt different attitudes towards learning and green innovation, so culture may have significant effects on the results of the analysis conducted in this study.

Acknowledgment

This research has been supported by the Junta de Andalucía (Regional Government of Andalusia) (Consejería de Economía, Innovación y Ciencia), Spain (Proyecto P10-SEJ-6081).

References

Adams, G.L. and Lamont, B.T. (2003), “Knowledge management systems and developing sustainable competitive advantage”, *Journal of Knowledge Management*, Vol. 7 No. 2, pp. 142-154.

Akgün, A.E., Byrne, J.C., Lynn, G.S. and Keskin, H. (2007a), “Organizational unlearning as changes in beliefs and routines in organizations”, *Journal of Organizational Change Management*, Vol. 20 No. 6, pp. 794-812.

Akgun, A.E., Keskin, H., Byrne, J.C. and Aren, S. (2007b), “Emotional and learning capability and their impact on product innovativeness and firm performance”, *Technovation*, Vol. 27 No. 9, pp. 501-513.

Alavi, M. and Leidner, D.E. (2001), “Review: knowledge management and knowledge management systems: conceptual foundations and research issues”, *MIS Quarterly*, Vol. 25 No. 1, pp. 107-136.

Ashworth, M.J. (2006), “Preserving knowledge legacies: workforce aging, turnover and human resource issues in the US electric power industry”, *International Journal of Human Resource Management*, Vol. 17 No. 9, pp. 1659-1688.

Barclay, D., Higgins, C. and Thompson, R. (1995), “The partial least squares (PLS) approach to causal modelling: personal computer adoption and use as an illustration”, *Technological Studies*, Vol. 2 No. 2, pp. 285-309.

Barney, J.B. and Wright, P.M. (1998), “On becoming a strategic partner: the role of human resources in gaining competitive advantage”, *Human Resource Management*, Vol. 37 No. 1, pp. 31-46.

Benet-Martınez, V., Leu, J., Lee, F. and Morris, M. (2002), “Negotiating biculturalism: cultural frame switching in bicultural with oppositional versus compatible cultural identities”, *Journal of Cross-Cultural Psychology*, Vol. 33 No. 5, pp. 492-516.

Benitez-Amado, J., Perez-Arostegui, M.N. and Tamayo-Torres, J. (2010), "Information technology-enabled innovativeness and green capabilities", *Journal of Computer Information Systems*, Vol. 51 No. 2, pp. 87-96.

Bharadwaj, A.S. (2000), "A resource-based perspective on Information technology capability and firm performance: an empirical investigation", *MIS Quarterly*, Vol. 24 No. 1, pp. 169-196.

Bontis, N., Crossan, M.M. and Hulland, J. (2002), "Managing an organizational learning system by aligning stocks and flows", *Journal of Management Studies*, Vol. 39 No. 4, pp. 437-469.

Bossink, B.A.G. (2002), "The development of co-innovation strategies: stages and interaction patterns in interfirm innovation", *R&D Management*, Vol. 32 No. 4, pp. 311-320.

Carmines, E.G. and Zeller, R.A. (1979), "Reliability and validity assessment", *Sage University Paper Series on Quantitative Applications in the Social Sciences*, Vol. 7 No. 17.

Cepeda-Carrion, G., Cegarra-Navarro, J.G. and Jimenez-Jimenez, D. (2012), "The effect of absorptive capacity on innovativeness: context and information systems capability as catalysts", *British Journal of Management*, Vol. 23, pp. 110-129.

Chan, A.L.-C. and Wang, W.-Y. (2012), "The causal relationships between aspects of customer capital", *Industrial Management & Data Systems*, Vol. 112 No. 6, pp. 848-865.

Chang, C.-H. (2011), "The influence of corporate environmental ethics on competitive advantage: the mediation role of green innovation", *Journal of Business Ethics*, Vol. 104, pp. 361-370.

Chang, C.-H. and Chen, Y.-S. (2013), "Green organizational identity and green innovation", *Management Decision*, Vol. 51 No. 5, pp. 1056-1070.

Chen, J.-S. and Tsou, H.-T. (2012), "Performance effects of IT capability, service process innovation, and the mediating role of customer service", *Journal of Engineering and Technology Management*, Vol. 29 No. 1, pp. 71-94.

Chen, Y.-S. (2008), "The positive effect of green intellectual capital on competitive advantages of firms", *Journal of Business Ethics*, Vol. 77, pp. 271-286.

Chen, Y.S., Lai, S.B. and Wen, C.T. (2006), "The influence of Green innovation performance on corporate advantage in Taiwan", *Journal of Business Ethics*, Vol. 67, pp. 331-339.

Chesbrough, H. (2003), *Open Innovation: The New Imperative for Creating and Profiting From Technology*, Harvard Business School Publishing, Cambridge, MA.

Cheung, M.-S., Myers, M.B. and Mentzer, J.T. (2011), "The value of relational learning in global buyer-supplier exchanges: a dyadic perspective and test of the pie-sharing premise", *Strategic Management Journal*, Vol. 32, pp. 1061-1082.

Chin, W.W. (1998), "The partial least squares approach to structural equation modelling", in Marcoulides, G.A. (Ed.), *Modern Methods for Business Research*, Lawrence Erlbaum Associate, Mahwah, NJ, pp. 295-336.

Chin, W.W. (2003), *PLS-Graph (Version 03.00, Build 1058) (Computer Software)*, University of Houston, Houston , TX.

Chin, W.W. and Gopal, A. (1995), "Adoption intention in GSS: relative importance of beliefs", *Data Base for Advances in Information Systems*, Vol. 26 Nos 2/3, pp. 42-63.

Choo, C.W. and Bontis, N. (2002), *The Strategic Management of Intellectual Capital and Organizational Knowledge*, Oxford University Press, New York, NY.

Crossan, M.M., Lane, H.W., White, R.E. and Djurfeldt, L. (1995), "Organizational learning: dimensions for a theory", *International Journal of Organizational Analysis*, Vol. 3 No. 4, pp. 337-360.

Dai, Q., Kauffman, R.J. and March, S.T. (2007), "Valuing information technology infrastructures: a growth options approach", *Information Technology Management*, Vol. 8, pp. 1-17.

Dewett, T. and Jones, G. (2001), "The role of information technology in the organization: a review, model, and assessment", *Journal of Management*, Vol. 27 No. 3, pp. 313-346.

Duffy, J. (2000), "Measuring customer capital", *Strategy and Leadership*, Vol. 28 No. 5, pp. 10-14.

Edvinsson, L. and Malone (1997), *Intellectual Capital: Realizing your Co.'s True Value by Finding its Hidden Roots*, Harper Collin Publishers, New York, NY.

Edvinsson, L. and Sullivan, P. (1996), "Developing a model for managing intellectual capital", *European Management Journal*, Vol. 14 No. 4, pp. 356-365.

Falk, R.F. and Miller, N.B. (1992), *A Primer for Soft Modelling*, The University of Akron, Akron, OH.

Fornell, C. and Larcker, D.F. (1981), "Evaluating structural equation models with unobservable variables and measurement error", *Journal of Marketing Research*, Vol. 18, pp. 39-50.

Geisser, S. (1974), "A predictive approach to the random effects model", *Biometrica*, Vol. 61, pp. 101-107.

Gold, A.H., Malhotra, A. and Segars, A.H. (2001), "Knowledge management: an organizational capabilities perspective", *Journal of Management Information Systems*, Vol. 18 No. 1, pp. 185-214.

Hansen, M.T., Nohria, N. and Tierney, T. (1999), "What's your strategy for managing knowledge?", *Harvard Business Review*, Vol. 77 No. 2, pp. 106-116.

Huber, G.P. (1991), "Organizational learning: the contributing processes and the literature", *Organization Science*, Vol. 2 No. 1, pp. 88-115.

Hulland, J. (1999), "Use of partial least squares (PLS) in strategic management research: a review of four recent studies", *Strategic Management Journal*, Vol. 20 No. 2, pp. 195-204.

Husain, Z., Altameem, A. and Gautam, V. (2013), "Technology based management of customer relational capital: human-touch still a necessity", *Journal of Services Research*, Vol. 13 No. 1, pp. 53-74.

Kettinger, W.J., Grover, V., Guha, S. and Segars, A.H. (1994), "Strategic information systems revisited: a study in sustainability and performance", *MIS Quarterly*, Vol. 18 No. 1, pp. 33-51.

Knoppen, D., Sáenz, M. and Johnston, D. (2011), "Innovations in a relational context: mechanisms to connect learning processes of absorptive capacity", *Management Learning*, Vol. 42 No. 4, pp. 419-438.

Leal-Rodríguez, A.L., Roldán, J.L., Ariza-Montes, A. and Leal-Millán, A. (2014), "From potential absorptive capacity to innovation outcomes in project teams: the conditional mediating role of the realized absorptive capacity in a relational learning context", *International Journal of Project Management*, Vol. 32, pp. 894-907.

Leonard-Barton, D. (1995), *Wellsprings of Knowledge*, Harvard Business School Press, Boston, MA.

Lohmöller, J.B. (1989), *Latent Variables Path Modelling with Partial Least Squares*, Physica-Verlag, Heidelberg, Berlin.

Loveman, W. (1994), "An assessment of productivity impact on information technologies", in Allen, T.J. and Scott, M.S. (Eds), *Information Technology and the Corporation of the 1990's: Research Studies*, MIT Press, Cambridge, MA, pp. 84-110.

Lu, Y. and Ramamurthy, K. (2011), "Understanding the link between information technology capability and organizational agility: an empirical examination", *MIS Quarterly*, Vol. 35 No. 4, pp. 931-954.

Lucas, H.C. (1999), *Information Technology and the Productivity Paradox*, Oxford University Press, New York, NY.

Melville, N., Kraemer, K. and Gurbaxani, V. (2004), "Information technology and organizational performance: an integrative model of IT business value", *MIS Quarterly*, Vol. 28 No. 2, pp. 283-322.

Mesquita, L.F., Anand, J. and Brush, T.H. (2008), "Comparing the resource-based and relational views: knowledge transfer and spillover in vertical alliances", *Strategic Management Journal*, Vol. 29 No. 9, pp. 913-941.

Nahapiet, J. and Ghoshal, S. (1998), "Social capital, intellectual capital, and the organizational advantage", *The Academy of Management Review*, Vol. 23 No. 2, pp. 242-266.

Nonaka, I. (1994), "A dynamic theory of organizational knowledge creation", *Organization Science*, Vol. 5 No. 1, pp. 14-37.

Nonaka, I., Toyama, R. and Byosiére, P. (2001), "A theory of organizational knowledge creation: understanding the dynamic process of creating knowledge", in Dierkes, M., Berthoin, A., Child, J. and Nonaka, I. (Eds), *Handbook of Organizational Learning and Knowledge*, Oxford University Press, New York, NY, pp. 491-517.

Nunnally, J. (1978), *Psychometric Theory*, McGraw-Hill, New York, NY.

Pawlowsky, P., Forslin, J. and Reinhardt, R. (2001), "Practices and tools of organizational learning", in Dierkes, M., Berthoin, A., Child, J. and Nonaka, I. (Eds), *Handbook of Organizational Learning and Knowledge*, Oxford University Press, New York, NY, pp. 775-793.

Petruzzelli, A.M., Dangelico, R.M., Rotolo, D. and Albino, V. (2011), "Organizational factors and technological features in the development of green innovations: evidence from patent analysis", *Innovation: Management, Policy & Practice*, Vol. 13 No. 3, pp. 291-310.

Porter, M.E. and Van der Linde, C. (1995), "Green and competitive", *Harvard Business Review*, Vol. 73 No. 5, pp. 120-134.

Powell, C.T. and Dent-Micallef, A. (1997), "Information technology as competitive advantage: the role of human, business, and technology resources", *Strategic Management Journal*, Vol. 18 No. 5, pp. 375-405.

Real, J.C., Leal, A. and Roldan, J.L. (2006), "Information technology as a determinant of organizational learning and technological distinctive competencies", *Industrial Marketing Management*, Vol. 35, pp. 505-521.

Robey, D., Boudreau, M.-C. and Rose, G.M. (2000), "Information technology and organizational learning: a review and assessment of Research", *Accounting Management and Information Technologies*, Vol. 10 No. 2, pp. 125-155.

Rodriguez, E. and Edwards, J. (2009), "People, technology, processes and risk knowledge sharing", *Proceedings of the 10th European Conference on Knowledge Management*, *ECKM*, Vol. 2, pp. 684-694.

Sambamurthy, V., Bharadwaj, A. and Grover, V. (2003), "Shaping agility through digital options: reconceptualizing the role of information technology in contemporary firms", *MIS Quarterly*, Vol. 27 No. 2, pp. 237-263.

Santhanam, R. and Hartono, E. (2003), "Issues in linking Information technology capability to firm performance", *MIS Quarterly*, Vol. 27 No. 2, pp. 125-153.

Selnes, F. and Sallis, J. (2003), "Promoting relationship learning", *Journal of Marketing*, Vol. 67 No. 1, pp. 80-95.

Sherry, R. and Stubberud, H.A. (2013), "Green innovation in Germany: a comparison by business size", *Journal of International Business Research*, Vol. 12 No. 1, pp. 47-56.

Stone, M. (1974), "Cross-validatory choice and assessment of statistical predictions", *Journal of the Royal Statistical Society*, Vol. 36, pp. 111-147.

Teece, D.J. (2002), *Managing Intellectual Capital*, Oxford University Press, Oxford.

Teo, T.S.H. and Ranganathan, C. (2003), "Leveraging IT resources and capabilities at the housing and development board", *Journal of Strategic Information Systems*, Vol. 12 No. 3, pp. 229-249.

Tippins, M.J. and Sohi, R.S. (2003), "IT competency and firm performance: is organizational learning a missing link?" *Strategic Management Journal*, Vol. 24 No. 8, pp. 745-761.

Van Buren, M.E. (1999), "A yardstick for knowledge management", *Training and Development*, Vol. 53 No. 5, pp. 71-77.

Vargo, S.L. and Lusch, R.F. (2004), "Evolving a new dominant logic for marketing", *Journal of Marketing*, Vol. 68, pp. 1-17.

Wade, M. and Hulland, J. (2004), "The resource-based view and information systems research: review, extension, and suggestions for future research", *MIS Quarterly*, Vol. 8 No. 1, pp. 107-142.

Wensley, A., Cegarra-Navarro, J., Cepeda-Carrión, G. and Leal-Millán, A. (2011), "How entrepreneurial actions transform customer capital through time. Exploring and exploiting knowledge in an open-mindedness context", *International Journal of Manpower*, Vol. 32 No. 1, pp. 132-150.

Wold, H. (1979), *Model Construction and Evaluation When Theoretical Knowledge is Scarce: An Example of the Use of Partial Least Squares*, Cahiers du Départment D'Econométrie, Faculté des Sciences Économiques et Sociales, Université de Genève, Genève.

Wong, S.K.S. (2012), "The influence of green product competitiveness on the success of green product innovation. Empirical evidence from the Chinese electrical and electronics industry", *European Journal of Innovation Management*, Vol. 15 No. 4, pp. 468-490.

Zhang, M.J. and Lado, A.A. (2001), "Information systems and competitive advantage: a competency-based view", *Technovation*, Vol. 21 No. 3, pp. 147-156.

Appendix

Table AI Individual reliability, composed reliability and average variance extracted for the first-order factors and second-order factors and dimensions

Construct/Dimension and indicator	*Loading*	*Cronbach alpha*	*Composed reliability*	*AVE*
Information technology (IT)		0.940	0.944	0.587
IT1	0.681			
IT2	0.685			
IT3	0.751			
IT4	0.806			
IT5	0.729			
IT6	0.782			
IT7	0.794			
IT8	0.763			
IT9	0.804			
IT10	0.819			
IT11	0.781			
IT12	0.782			
Relationship learning (RL)		0.792	0.945	0.775
Information sharing (RL_IS)	0.779	0.916	0.932	0.604
RLIS1	0.831			
RLIS2	0.774			
RLIS3	0.836			
RLIS4	0.758			
RLIS5	0.718			
RLIS6	0.832			
RLIS7	0.810			
Joint sensemaking (RL_JS)	0.862	0.937	0.946	0.639
RLJS1	0.794			
RLJS2	0.841			
RLJS3	0.776			
RLJS4	0.830			
Knowledge integration (RL_KI)	0.942	0.936	0.948	0.672
RLKI1	0.811			
RLKI2	0.872			
RLKI3	0.866			
RLKI4	0.833			
RLKI5	0.810			
RLKI6	0.825			
Green innovation performance (GIP)		0.977	0.978	0.646
GIP1	0.733			
GIP2	0.723			
GIP3	0.712			
GIP4	0.753			
GIP5	0.795			
GIP6	0.816			
GIP7	0.864			
GIP8	0.809			
Customer capital (CC)		0.834	0.900	0.750
CC1	0.859			
CC2	0.867			
CC3	0.910			
CC4	0.812			
CC5	0.835			
CC6	0.826			

About the authors

Antonio Leal-Millán, PhD, is Full Professor and Head of the Business Administration and Marketing Department (Universidad de Sevilla, Spain). His research topics include organisational culture, knowledge management and firm innovativeness. He has supervised several national research projects and many completed PhD projects. He has been Visiting Professor at different European and Latin American universities. His recent publications have appeared in *Journal of Business Research, British Journal of Management, International Journal of Project Management, Industrial Marketing Management, International Journal of Manpower* and *Total Quality Management and Business Excellence*, among others. In addition, he has, besides, published several book chapters for Springer, Nova Science Publisher, Idea Group Publishing and Kluwer Academic Publishers. Antonio Leal-Millán is the corresponding author and can be contacted at: aleal@us.es

Jose Luis Roldán, PhD, is an Associate Professor of Management and Information Systems in the Department of Business Administration and Marketing at the Universidad de Sevilla (Spain). He has been Visiting Professor at different European and Latin American universities. His current research interests include technology acceptance models, business intelligence, knowledge management, organisational culture, social network sites and partial least squares (PLS). His recent contributions have been published in *Behaviour & Information Technology, Journal of Business Research, British Journal of Management, International Business Review, European Journal of Information Systems, International Small Business Journal, Computers in Human Behavior, Computer Standards & Interfaces, Industrial Marketing Management* and *Internet Research*, among others. He is currently on the editorial board of *The Data Base for Advances in Information Systems*. He has also served as Guest Editor of the *European Journal of Information Systems* (EJIS) along with Wynne Chin (University of Houston) and Iris Junglas.

Antonio L. Leal-Rodríguez, PhD, is Assistant Professor in the Business Administration Department (Universidad Loyola Andalucía, Seville, Spain). At present, his main research topics are related to relational learning, knowledge management systems and organisational culture. He has been Visiting Professor at Lancaster University and University of Surrey. He has published in *Journal of Business Research, International Journal of Environmental Research and Public Health, International Journal of Project Management, Nonprofit Management & Leadership* and *Management Decision*, among others.

Jaime Ortega-Gutiérrez, PhD, is Assistant Professor of Marketing in the Department of Business Administration and Marketing at the Universidad de Sevilla (Spain). At present, his main research topics are related to organisational learning, knowledge management and qualitative and quantitative research methods. He has published in *Journal of Business Research, The Service Industries Journal* and *Management Decision*, among others.

This article has been cited by:

1. SharmaRevti Raman Revti Raman Sharma Revti Raman Sharma is based at the School of Marketing and International Business, Victoria University of Wellington, Wellington, New Zealand. He is a Senior Lecturer in International Business in the School of Marketing and International Business at Victoria University of Wellington, New Zealand. His major teaching and research interests are in the areas of international business and international management with specific interests in outsourcing, strategy, firm performance, cross border knowledge management and emerging economy firms. ChadeeDoren Doren Chadee Doren Chadee is based at the Department of Management, Deakin University, Melbourne, Australia. He is currently a Professor of Management and Chair of the International Business and Strategic Management discipline at Deakin University, Melbourne. Professor Chadee has teaching and research interests in the areas of international business and international management with a particular focus on Asian and emerging economies. RoxasBanjo Banjo Roxas Banjo Roxas is based at the Department of Management, Deakin University, Melbourne, Australia. He is a Senior Lecturer in the Department of Management at Deakin University, Australia. His main teaching and research interests are in the broad areas of sustainable strategic management and international business with particular focus on firms from emerging economies in Asia. School of Marketing and International Business, Victoria University of Wellington, Wellington, New Zealand Department of Management, Deakin University, Melbourne, Australia . 2016. Effects of knowledge management on client-vendor relationship quality: the mediating role of global mindset. *Journal of Knowledge Management* **20**:6, 1268-1281. [Abstract] [Full Text] [PDF]