

An open-minded strategy towards eco-innovation: a key to sustainable growth in a global enterprise

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An open-minded strategy towards eco-innovation: a key to sustainable growth in a global enterprise

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Abstract

This study examines the extent to which business performance in global enterprises can be influenced by three key factors in the current dynamic, socio-economic context. These are: (1) an open organisational culture derived from an open-mindedness attitude, (2) an organisation's investments in innovation in environmentally friendly and health-conscious products and services, and (3) customers' perception of risk of information security and privacy concerns derived from their engagement with the organisation and its products and services. Taking Apple as the basis for our study, an empirical investigation of 161 of its customers from a variety of socio-economic and cultural backgrounds, our results indicate that a culture of open mindedness relates, indirectly and though environmental product innovation, to the way the firm addresses the privacy concerns of end users. This, in turn, helps addressing the privacy concerns of the customer base and, simultaneously improve firms' performance, offering a mix-blended source of strategic advantage. Based on a leading innovation company in the U.S. and globally, and one of the most important names in the technology industry, lessons can be learned from our study both for further theoretical developments and for management practice in a variety of knowledge-intensive, global enterprises.

Keywords: eco-innovation, global enterprise, privacy concerns, open-mindedness, organisational performance; technology users

1. Introduction

Digital transformation has become an imperative in the last two decades. Management research and practice have been driven to exploring and exploiting the potential benefits of information and communication technologies for the firm and its collaboration with stakeholders towards achieving new levels of operational and network excellence. The mainstream literature recognises that technology has enabled an unprecedented growth in corporate partnering and venture dependency for various types of external knowledge relationship (Hagedoorn and Schakenraad, 1992; Morris and Hergert, 1987; Vrontis, Thrassou, Santoro, and Papa, 2017). The most common grounds offered for collaborative innovation approaches involve a mixture of risk sharing, new market developments and technology exploration. All of these require new knowledge management processes for a combination of complementary intellectual skills that exist within and outside the firm (Eisenhardt and Schoonhoven, 1996; Hagedoorn, 1993; Li, Vanhaverbeke, and Schoenmakers, 2008; Scuotto, Del Giudice, and Obi Omeihe, 2017; Santoro, Vrontis, Thrassou, and Dezi, 2018b). Inbound collaborations have therefore become critical for a firm's innovation (Santoro, Bresciani, and Papa, 2018a).

Simultaneously, the management discipline shows a growing interest in the analysis of the relationship between the firm, its customer base and the environment. Organisations increasingly seek to align their operation and innovation process to the needs of both stakeholders and the environment, generating a competitive scenario in which firms compete for environmentally sensitive and digitally skilled customers (Yalabik and

Fairchild, 2011; Weber, 2009). As environment-friendly products and processes are in greater demand than ever before (Muller, 2009), scholars and practitioners work to identify the drivers of responsible and sustainable innovation strategies that enhance the firm's capacity to integrate stakeholder insights into both their value proposition and their innovation performance (Ayuso, Rodriguez, and Ricart, 2006; Halme and Korpela, 2014; Stilgoe, Owen, and Macnaghten, 2013).

The concept of environmental innovation has been received limited attention in the management literature. Despite the potential of organisation's focus on external network as a mechanism of improving firms' ambidexterity –a crucial way for the business competitive advantage (Dezi, Ferraris, Papa and Vrontis, 2019), relative few studies have been found to consider the strategic role of customer knowledge –as a measure of open-mindedness, in enhancing sustainable organisational performance. On these basis, this study seeks to highlight the complementarities and emerging contingencies of such a new domain, starting from the assessment of privacy and information concerns. Our attention is particularly focused on knowledge-intensive organisations (KIOs), i.e. firms that make an extensive use of external sources of knowledge in their innovation processes (Enkel, Gassman and Chesbrough 2009). This knowledge-based approach constitutes the reason why we aim at filling a research gap in knowledge on global enterprises. In particular, examples of such drivers have included the presence of a knowledge management perspective in the organisation (Del Giudice, Carayannis, and Della Peruta, 2012), competitiveness of the firm, its technology base, and stakeholder-related capabilities (Teece, 2009; Sher and Lee, 2004). However, there is still a need for an exhaustive framework that enables organisations to understand the full impact of their stakeholder relations on the outcomes of their efforts for sustainable innovation (Song, Massey, and, Montoya-Weiss, 2001; Ferraris, Santoro, and Dezi, 2017).

A third element that has gained in importance as a combination of technology developments and stakeholder engagement is the privacy concerns of potential customers. Privacy, understood here as the desire of individuals to control or have some influence over data about themselves (Bélanger and Crossler, 2011; Fogel and Nehmad, 2009), has gained a new perspective with recent technological developments. Currently studied from different dimensions, it can be argued that the need for environmentally friendly products may open a new avenue for addressing privacy concerns. In fact, it has been found that customers who perceive a firm as committed to the environment automatically assume that the firm manages their personal data appropriately (Dimitropoulos, Patel, Scheffler, and Posnack, 2011). Furthermore, efforts to address issues associated with recycling, carbon emissions or waste management in sectors such as the hospitality industry often involve careful consideration of which data are collected and how data are acquired, used, stored and shared (Martínez-Martínez, Cegarra-Navarro, and García-Pérez, 2015). This research is built on the authors' understanding of a positive relationships between environmental innovation efforts in global enterprises, initiatives targeting the increasing consumer demand for environmentally friendly and health-promoting products (De Marchi and Grandinetti,

2013; Ali and Ahmad, 2012; Tee, Abdullah, Din, Abdullah, and Wu, 2017) and the proactive approach to data privacy. The study investigates how concepts such as open culture (Daniel, Agarwal, and Stewart, 2013; Nakagaki, Aber, and Fetterhoff, 2012) and open mindedness (Cegarra-Navarro and Cepeda-Carrion, 2008; Fujita, Gollwitzer, and Oettingen, 2007; Hernández-Mogollon, Cepeda-Carrión, Cegarra-Navarro, and Leal-Millán, 2010; Mitchell, Parker, and Giles, 2012) can help address environmental concerns, and how environmental innovation can, in turn, help the firm address privacy concerns and improve performance.

The digitisation of markets and trends is having a profound effect on business models for every global product-market firm, especially those concerning ICT firm's capabilities in the form of privacy and information security strategies (Dezi, Cillo, Usai, and Pisano, 2018). This confirms the findings from previous leading literature that the role of knowledge novelty in terms of the ability of organisations for the search of external knowledge and their absorptive capacity stimulate the more innovative firms in pursuing environmental organisational performance (Li, Li, Yu and Yuan, 2019; Segarra-Ciprés and Bou-Llusar, 2018).

To support a global outlook, the research aims at sustaining the above-identified gap in knowledge with a robust methodological contribution. In particular, a case study analysis of the strategic context and implementation of an IT global group is presented. We set up a quantitative analysis using a partial least square regression model to investigate and verify the hypotheses and then built on novel interpretations on open-mindedness and organisational performance according to the emergent literature (Carmeli and Tishler, 2004; Lee and Yu, 2004; Chang and Ahn, 2005).

As a matter of novelty, this paper contributes to extending a conceptual framework derived from the literature assuming the basis of customer's insights in terms of information security and privacy attributes mediates the relationship between organisational performance and open-mindedness, accordingly environmental innovation for global firms. This confirm the assumption that knowledge transfer from end-users had a strong influence on innovative capabilities development and process and product innovation (Rhodes, Hung, Lok, Lien, and Wu, 2008).

Finally, the findings aim at extending the international literature, emphasising our understanding of the factors affecting the value proposition (e.g. quality, performance and service) in terms of customer satisfaction and loyalty .They illustrate the impact of the organisational and technical complexity of a environmental conglomerate strategy. The case analysis demonstrates and further identifies the factors that determine opportunities for improving the performance's growth.

The rest of this paper is organised as follows: the theoretical framework and hypotheses development are presented in section 2. Section 3 describes the methodological approach to conducting the research and details of the approach to data collection and analysis. The theoretical contribution and managerial implications of the research are

discussed in section 4, while the conclusions of the research, managerial implications, limitations and recommendations for future research are included in section 5.

2. Theoretical framework and hypotheses development

2.1 Open-mindedness as an antecedent of environmental innovation

Open-mindedness has been defined as having “the belief that others should be free to express their opinions and that the value of others’ knowledge should be recognised” (Mitchell and Nicholas, 2006). Peterson and Seligman, 2004, p. (144) referred to the concept of open-mindedness as a “willingness to actively search for evidence against one’s favoured beliefs, plans, or goals; and to weigh such evidence fairly when available”. Individuals with an open-minded attitude would likely believe that adopting new beliefs is a sign of strength and that all evidence should be considered in the thought process.

When translated to a business environment, open-mindedness has been referred to as the willingness to critically evaluate existing routines in an organisation and to accept new ideas (Calantone, Cavusgil, and Zhao, 2002). That is, how much the organisational members avoid being trapped in processes already being used, how often they think flexibly, and how active they are in accommodating new knowledge and ideas (Baker and Sinkula, 1999; Soto-Acosta, Popa, and Martinez-Conesa, 2018).

In management disciplines, references to competitive advantage can be reinterpreted in the light of “organisational values, standards and behaviours” (Day and Nedungadi, 1994), in tandem with “changes in identifiable structures, mental models, existing logic and main hypotheses” (Shaw and Perkins, 1991). On this basis, Cho, Park, and Cho, (2013) found that open-mindedness becomes an organisational value necessary for an organisational learning behaviour which, in turn, becomes an advantage. This relationship between open-mindedness as a behaviour and a learning orientation is better understood in the use of key interpretations that cross the meaning given to investigation, openness, dialogue and critical reflection (Dewey, 1933; Kolb, 1984; Argyris, 1976). We can therefore assume that open mindedness of an organisation has a strong impact on innovation learning through knowledge acquisition (Papa, Dezi, Gregori, Mueller, and Miglietta, 2018).

Innovation is defined as the development of new knowledge and artefacts (Troyer, 2005) and described by scholars as the activity of people and organisations to change themselves and the environment. When such new knowledge or improved crafts, technologies, systems and products are aimed at avoiding or reducing the damage to environment, the process leading to their development is referred to as environmental innovation (Long, Chen, Du, Oh, Han, and Yan, 2017). A key research question in this field has been related to finding effective ways of stimulating environmental innovation. Pavitt (1984) argue that environmental innovation is driven by both technology push and market pull. That is, innovation in eco-efficient technologies can be subsumed under technological development factors as well as factors related to consumer preferences for environmentally friendly products or image.

The above considerations on the effects of open-mindedness on management practices, together with Theyel's (2000) understanding of the characteristics of the firm and its management practices as determinants of environmental innovation and performance, led the authors to propose that open-mindedness is an antecedent to environmental product innovation performance in modern business organisations. Hence, the more open an organisation is to critically evaluate existing routines and to accept new ideas, the more likely it is that it will be successful in environmental product innovation, as in the following hypothesis:

H1: Open-mindedness has a positive effect on environmental product innovation

2.2. Linking environmental product innovation with organisational performances though addressing the privacy concerns of end-users

According to Klepper (1996), regardless of its nature, an innovation will only be successful if its potential customers perceive its value. Service and product innovators must therefore not only form and progress their innovations, but also disseminate it efficiently (Parthasarthy and Hammond, 2002). The current socio-economic environment is driven by developments in information and communication technologies (ICTs). Specifically, ICTs support firms in strengthening their absorptive capacity and interconnection with the ecosystem, sustaining the preference for informal inbound open innovation processes (Scuotto, Del Giudice, Bresciani, Meissner, 2017).

Connectivity, increased storage capacity and decentralised computational power have reduced the time scale for potential interactions between customers and service and product innovators, often supporting innovators in the efficient dissemination of their products. Furthermore, new technologies make it possible for firms to combine information on the same client held in different databases and use it to inform their innovation efforts. For example, the use of clickstream data about users' behaviour can be used by online advertising networks to select ads to display to individuals as they browse the Internet, in new ways of advertising that makes ads more relevant and informative to the user.

In this context the concept of data-driven innovation performance has emerged, built on the underlying belief that 'new knowledge or valuable innovative ideas are embedded somewhere in the data', leveraging on new forms of human and structural capital (i.e. intellectual assets), as discussed by authors such as Kusiak and Tang (2006), and Campanella, Del Giudice, Della Peruta (2014). Since the collected data may document the environmental variables, the decision process and the limiting constraints, valuable insights are usually hidden in it and therefore past knowledge could be improved and applied in other areas. It is estimated that more than 75% of the new design initiatives use the previous design knowledge (Iyer, Jayanti, Lou, Kalyanaraman, and Karthik, 2005). For data-driven innovation to succeed, a successful data ecosystem must "bring together data owners, data analytics companies, skilled data professionals, cloud service providers, companies from the user industries, venture capitalists, entrepreneurs, research institutes and universities" (DG Connect 2013).

Technology developments and in particular the data sets that result from their use create enormous value for the global economy, driving innovation, productivity, efficiency, and growth. Kesidou and Demirel (2012) found that a firm's technological capability is

a key driver of eco-innovation, while Doran and Ryan (2016) found that, amongst other factors, technological developments have spurred top management teams into integrating environmental innovation into their business strategies with a view to achieve technological and non-technological results such as reduced material use, reduced energy use and reduced pollution.

It seems intuitively clear that in order to address privacy concerns and comply with privacy legislation, organisations that collect personal data during their routine business must prepare and publish privacy policies to assure their clients. Such privacy policies determine the way, modalities, time period after which, conditions/situation under which, and with whom such personal information can be shared (Oberoi, Jagtap, Joshi, Finin, and Kagal, 2011). If we interpret privacy as the claim of individuals, groups, or institutions to determine for themselves when, how, and to what extent information about them is communicated to others (Westin, 1968), then it can be understood that the harvesting of large data and the use of analytics to draw conclusions that potentially become exposed to scrutiny, clearly implicate privacy concerns. Such technology-based collection and analysis of data about individuals' health, location, use of resources, online activity and many other parameters, may lead to individuals' profiling, discrimination, exclusion, and loss of control (Tene and Polonetsky, 2011).

Although individuals have no easy way to prevent the collection of their data, and they have no guarantee it will not be shared with entities that could use it in ways harmful to the environment, a company that is truly committed to the environment is seen as a better option to give the company some information about oneself (Dimitropoulos, Patel, Scheffler, and Posnack, 2011). In other words, a company that is committed to the environment is a company that is committed to a society that is becoming more and more aware of environmental matters and that is beginning to make end-users committed to working toward combining efforts in addressing environmental issues (Dimitropoulos, Patel, Scheffler, and Posnack, 2011). As a matter of fact, the propensity to product innovation is positively associate to how a firm handles knowledge processes inside and outside its environment. The more effective the human capital management practices of training, the higher the organisational performance (Biscotti, D'Amico, Monge 2018).

As pointed out by Paine, Reips, Stieger, Joinson and Buchanan (2007), the trust of Internet users is constantly being challenged by mounting concerns around privacy and security of data. It must be highlighted, however, that when organisations take explicit actions to address the privacy concerns of their customers, they are successful in creating a positive image as a business that uphold individuals' privacy and dignity (Sutanto, Palme, Tan, and Phang, 2013). Such a customer perception is often perceived as an added value for the company (Alharbi, Zyngier, and Hodkinson, 2013), which implies that addressing privacy concerns creates a perception of technical and scientific expertise, and becomes an opportunity for improving business performances (Eastlick, Lotz, and Warrington, 2006). This is further supported by a study performed by KPMG International (KPMG 2016), which showed that addressing privacy concerns is inextricably linked to customer satisfaction, with 55 percent of consumers surveyed globally arguing that they had decided against buying online due to privacy concerns.

The analysis in this section has led us to hypothesise that, although beneficial for the firm, for its customers and the environment, efforts spent by the organisation on

environmental innovation could positively determine the way the organisation addresses the privacy concerns of end-users (Goldfarb and Tucker, 2012). This argument is summarised in the following hypothesis:

H2: The extent to which environmental product innovation exists will positively determine the way the company addresses the privacy concerns of end-users

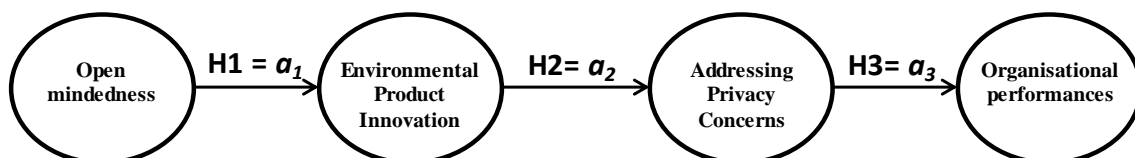
In terms of environmental innovation, Cleff and Rennings (1999) argued that firms that are innovative in environmentally friendly products frequently see improved environmental performance as a component in a comprehensive company efficiency strategy. Their success, however, often depends on the characteristics of the platform used for their communication with customers. In particular, the perceived risk of information security and privacy concerns has been found to affect consumers' purchase intention in online stores, even when these feature environmentally sustainable products (Tsai and Yeh, 2010). By integrating environmental innovation into a comprehensive strategy (i.e. one that addresses information security and privacy concerns), a firm can improve its performances in several ways, such as an increase in its sales, attracting new markets, enhancing its competitive advantage, improving its financial performance, enriching its corporate impact, differentiating its product(s) and improving the environment (Doran and Ryan, 2016; Rossi, Festa, Papa, Scorrano, 2019). Moreover, as argued by Franceschelli, Santoro and Candelo (2018), the raising of sustainable business models is particularly important for all industries because the importance of human and environmental issues are emerging as a milestone of new technology domain.

As noted above, a significant number of scholars have concluded that 'privacy' is a key to an understanding of online behaviour and experience (Birnbaum, Borycki, Karras, Denham, and Lacroix, 2015; Brown and Muchira, 2004; Manyika, Chui, Brown, Bughin, Dobbs, Roxburgh, and Byers, 2011). This suggests that the presence of processes addressing privacy concerns reinforces controls and contributes to improving the performances of the organisation. Therefore, we propose:

H3. The presence of processes addressing privacy concerns positively influences the performance of the organisation

Figure 1 illustrates our model, in which open mindedness facilitates the environmental product innovation and addresses the privacy concerns that end users may have. This in turn will then be used by Apple to improve performance.

Figure 1: The conceptual framework



3. Method

3.1 Data collection

Apple is a leading innovation company in the U.S. and globally and one of the most important names in the technology industry. According to Statista (2019) – the leading provider of market and consumer data, in excess of 217 million iPhones and 163.8 million iPads were shipped in 2017 worldwide, to mention but two of Apple's most popular devices. Despite Apple's share of the global market of leading technology vendors, the company currently faces critical issues such as 'sustainable growth' and 'privacy concerns', according to Greenpeace (Mlot, 2012; Treacy, 2012). In response to such concerns, Apple is considered to be doing more than any other electronics manufacturer to address the negative effect it has on the environment. For example, Apple has taken first steps with small solar installations and has banned the use of dangerous chemicals from its Chinese factories. The nature and context of this global company and its business led us to consider Apple as an appropriate setting for this investigation.

Being a leading force in technological innovation means that awareness of Apple and/or its products is widely shared within students and professionals in the European context. On these basis, throughout January 2019 postgraduate students from three European universities (University of Turin and University of Rome Link Campus in Italy, and the Technical University of Cartagena in Spain) were selected randomly from the respective university directories as prospective participants in this research. They were initially asked to indicate whether they were aware of Apple as a company. Those students who confirmed their knowledge of the company were then invited to participate in the research. This sample then included individuals from a variety of academic and cultural backgrounds, all of them residents of either Italy or Spain at the time of this research. The questionnaire was aimed at measuring the extent to which those individuals perceived themselves as members of an open culture driven by Apple, felt that Apple's environmental innovation was of relevance for them as users, and had some degree of the presence of processes addressing privacy concerns in relation to their use of Apple's products and services.

Data were collected via a survey until responses reached a sufficiently diverse sample with the demographic differences well covered, in order to obtain a realistic sample of an average user in Spain or Italy. Of the 172 questionnaires completed, 11 of them responded to all questions with either a maximum value (7) or the minimum value (1) on the Likert scale being used. Those responses were therefore excluded. Thus, a total of 161 valid responses were considered usable and therefore included in the study. Such responses came from 78 male and 83 female individuals.

3.2 Measures

In order to avoid response bias, three statistical analyses were conducted to ensure the absence of non-response bias (Podsakoff, MacKenzie, Lee, and Podsakoff, 2003). Firstly, a factor analysis of all the variables to identify non-response bias showed three factors with eigenvalues greater than 1.0 and the total variance explained was 54.70% of the total variance. Secondly, in a comparison of the country of the survey (1= Spain and 2= Italy) in terms of open mindedness, environmental innovation, the presence of processes addressing privacy concerns and performances, the independent sample t-test revealed no significant difference between the two groups ($p=0.515$, $p=0.617$, $p=0.272$ and $p=0.564$, respectively). Thirdly, this study has also used a confirmatory factor-

analytic approach to the Harman one-factor test as a way of testing for the presence of bias (Podsakoff, MacKenzie, Lee, and Podsakoff, 2003). A worse fit for the one-factor model would suggest that common method variance does not pose a serious threat. The one-factor model yielded a Satorra-Bentler $\chi^2_{(104)}= 296.26$; $\chi^2/d.f=2.81$ (compared with the Satorra-Bentler $\chi^2_{(98)}= 135.82$; $\chi^2/d.f=1.38$). The fit is considerably worse for the one-dimensional model than for the measurement model, suggesting no substantial common method bias (Armstrong and Overton, 1977).

A list of 16 items was evaluated with exploratory techniques to assess the reliability and dimensionality of the measures. All items in the final version of the questionnaire are available in Appendix. The questionnaire constructs were as follows:

- a) Open mindedness (OM): The measures related to the presence of a context of open-mindedness consisted of four items adapted from a scale originally designed by Baker and Sinkula (1999) to measure the construct. These items described the way management is perceived to deal with change, innovate in the business operation and learning from the users' experience in their interaction with the products.
- b) Environmental product innovation (EF): The measures relating to environmental product innovation were informed by the work of Cleff and Rennings (1999) on integrated approaches to environmental protection by firms. In particular, we use customers' perspective of longevity and recyclability of Apple products as well as of Apple's use of harmful substances as measures of product-integrated innovations.
- c) The presence of processes addressing privacy concerns (PC): The presence of processes addressing privacy concerns was measured by adapting four items from an instrument originally designed by Smith, Milberg, and Burke (1996), considered the first and most influential approach to measure the construct (Preibusch, 2013). The instrument designed by Smith, Milberg, and Burke (1996) was structured into four sub-scales, namely collection, errors, unauthorised secondary use, and improper access (Smith, Milberg, and Burke, 1996). Each of the four items used in our research has been aligned with at least one these sub-scales.
- d) Organisational performances (OP): The relevance of the customer perspective for the value proposition provided by an organisation led us to measure organisational performance on the basis of customers' perceptions of Apple's products and services. In line with the work of Carmeli and Tishler (2004), and Lee and Yu (2004) the measures employed cover both the value that customers perceive Apple to deliver (e.g. quality, performance and service), and the outcomes that arise as a result of this value proposition, in the form of customer satisfaction.

3.3 Data analysis

The data collected was analysed using the PLS-Graph software version 3.2.8 Build 1058.

Since the model does not include multidimensional constructs, the measurement and the structural models can be estimated and evaluated simultaneously (Benitez, Henseler, and Roldán, 2016). While open mindedness (OM), environmental innovation (EI) and the presence of processes addressing privacy concerns (PC) are specified as composite reflective construct mode 'A' given that there is a high level of correlation between indicators (Dijkstra and Henseler, 2015; Henseler, Hubona, and Ray, 2016a), performances (OP) were specified as composite formative construct mode 'B' given its indicators are the ingredients to be combined to shape the construct (Cepeda-Carrion, Cegarra-Navarro, and Cillo, 2019).

As shown in Table 1, the fit statistics for the model indicate a reasonable data fit. The standardised root mean square residual (SRMR) value of the measurement model was 0.068 and all discrepancies were below the 95%-quantile of the bootstrap discrepancies (HI_{95}), which suggests very good measurement model fit (Henseler, Hubona, and Ray, 2016a).

Insert Table 1 about here

The results provided in Table 2 show the validity of the composite constructs. With regard to the reliability of open mindedness (OM), environmental innovation (EI) and the presence of processes addressing privacy concerns (PC) constructs, the Dijkstra and Henseler's rho (ρ_A) and the average variance extracted are above the common standards of 0.7 and 0.5 respectively (Dijkstra and Henseler, 2015; Henseler, Ringle, and Sarstedt, 2016b). In addition, all factor loadings from all constructs are statistically significant, with the lowest value for the item measuring "OP3" being "0.668". Regarding the performances (OP), since this construct was operationalized as formative constructs, weights measured the relative contribution of each indicator to its construct. In all cases the weights were statistically significant, with the lowest value for the item measuring "OP3" being "0.286". The generated variance inflation factors (VIFs) for all the study variables ranged from 1.316 to 2.382 showing that multicollinearity was not present.

Insert Table 2 about here

The constructs correlation matrix, the Cronbach's Alpha, means and standard deviations are presented in Table 3. As shown in Table 3, discriminant validity was determined by comparing that each construct related more strongly to its own measures than to others' (Fornell and Larcker, 1981). In addition, all HTMT are below the value of 0.90, thereby providing evidence of discriminant validity (Henseler, Hubona, and Ray, 2016a; Henseler, Ringle, and Sarstedt, 2016b).

Insert Table 3 about here

4. Results

The next step was the evaluation of the predictive relevance and hypothesised relationships developed from consideration of relevant literature. Since in all cases Stone-Geisser's Q^2 value has been found to be higher than 0 (Geisser, 1974; Stone, 1974), the results demonstrate that the inner model has satisfactory predictive relevance for Environmental Innovation ($Q^2=0.028$), the presence of processes addressing privacy

concerns ($Q^2=0.218$), and Performances ($Q^2 = 0.321$). As Table 4 shows, the proposed model also explains the 43.4 percent of the variance in Performance (R^2).

A two-step procedure for testing hypothesised relationships was followed: (1) we used the specific model in question with both direct and indirect paths included to perform 10000 bootstrap resampling and explicitly calculate the product of the direct paths that form the indirect path being assessed (Streukens and Leroi-Werelds, 2016); and (2) we estimated the significance using 95% confidence intervals generated by repeated subsample calculations (Nitzl, Roldan, and Cepeda, 2016).

As Table 4 shows, the results of the hypothesis tests using PLS-Graph software show that a positive relationship exist between Open mindedness and Environmental Innovation ($a_1=0,259$, $p<0.001$). In addition, a positive relationship was found between Environmental Innovation and the presence of processes addressing privacy concerns ($a_2=0.594$, $p<0.001$) and between addressing privacy concerns and the performances ($a_3=0.558$, $p<0.001$). In addition, as the intervals determined through bootstrapping do not contain the zero value, the indirect effects of Open mindedness on performances via Environmental Innovation and addressing privacy concerns are statistically significant. Consequently, the results provided full support for both hypotheses H1, H2 and H3.

Insert Table 4 about here

5. Discussion

The role of external stakeholders in sharing knowledge has long been a source of debate in the innovation management literature. There seems to be consensus in the literature on the relationship between the dynamic interactions between the firm and its external stakeholders as a source of knowledge, and an improved innovation performance (Holmqvist, 2004; Darroch, 2005; Papa, Dezi, Gregori, Mueller, and Miglietta, 2018). However, although a facilitator of stakeholder involvement, many investigators in the area of information and communication technology in business and management emphasise that these facilitate organisational learning without necessarily taking into account people's concerns (e.g. Escribano, Fosfuri, and Tribó, 2009; Fey and Birkinshaw, 2005). Therefore, the first contribution made by this research is raising awareness of the existing concerns and fears resulting from the use of technological products, and its potential effects on the business. Our results suggest that addressing data privacy concerns and environmental sustainability contribute significantly to better achieve the organisational goals of the firm. This is an important finding, as the innovation literature lacks empirical evidence to support these relationships. Moreover, many IT managers, overloaded either with the daily operation of a business IT infrastructure or with research and development strategies, are not being able to actively listen to their end user. As a result, businesses may find themselves unconsciously over-investing in new product design while under-investing in mechanisms to address the privacy concerns of their existing and potential customers. Therefore, our findings help both academics and practitioners to find new ways to deal with global concerns such as privacy and environmental sustainability.

The second contribution of this research derives from the results of the empirical test of its theoretical model. In particular, this relates to demonstrating the importance of a culture of open mindedness and the environmental sustainability strategy of the firm for

a reduction of customers' privacy concerns, through an empirical investigation of 161 Apple customers from a variety of socio-economic and cultural backgrounds. It should be noted that the contextual settings of a global firm like Apple can help in recognise and verify the level of such multi-dimensional innovativeness in the organisation, particularly in terms of the identification of external sources of knowledge (Ali and Ahmad, 2012). The theoretical and managerial implications derived from these relationships observed across those constructs are discussed in further detail in the following paragraphs.

Regarding hypothesis H1, our research provides evidence that a culture of open mindedness helps firms create an environment where enquiry and stakeholder dialogue can flourish. In this regard, Campbell (2003) reports that while increasingly demanding customers have prompted many firms to strengthen the degree of social responsiveness, very little is known about the internal processes that support the learning about customer relationships. Therefore, this paper helps a deeper understanding of how open mindedness may enables organisations to be more proactive through environment and social responsiveness (Bueren, Schierholz, Kolbe, and Brenner, 2004). Our findings support the views of scholars such as Anderson and Narus (1991), Von Hippel (2005), Sawhney and Prandelli (2000), Davenport and Pruzak (2000) and Chen and Huang (2009), who have drawn attention to the fact that 'an open culture' provides opportunities for the firm to learn from their customers, which, in turn, helps address some of the challenges faced by the organisation, such as the environmental sustainability of their products.

The results of the analysis also support hypothesis H2, showing that environmental product innovation can be referred to as a prerequisite for addressing privacy concerns. A possible explanation for these findings may relate to the fact that the environmental product innovation not only fosters the development of energy efficient products with high levels of longevity and recyclability. It also serves to guide future strategies in the digital security and privacy domains, and in all other policy areas that may bring benefits to both customer and the firm performances (e.g. Tene and Polonetsky, 2011; Dimitropoulos, Patel, Scheffler, and Posnack, 2011; Kesidou and Demirel, 2012; Doran and Ryan, 2016). In the current context of digital transformation, these findings emerge as critical patterns of the business process management (BPM) for successfully satisfying new market needs, while generating business process customisation due the interaction with knowledge and technology from outside the firm (Adams, Jeanrenaud, Bessant, Denyer, and Overy, 2016; Choudhary, Mital, Pani, Papa, and Vicentini, 2018).

The analysis of the data collected also provides full support for hypothesis H3 (privacy concerns → organisational performances). Our findings suggest that when Apple considers global issues such as legal barriers to information, digital security and individuals' privacy concerns when implementing strategies for improvement of their business performances, then these issues may have a positive impact on the company achieving the expected results. A possible explanation for this result would be derived from the fact that addressing privacy concerns through a continued commitment to the data protection and digital security frequently results in increased customer satisfaction and the likelihood of recommendation and repetition of purchase of the company products and services (e.g. Birnbaum, Borycki, Karras, Denham, and Lacroix, 2015; Brown and Muchira, 2004; Manyika, Chui, Brown, Bughin, Dobbs, Roxburgh, and Byers, 2011).

Managerial and Theoretical implications

The arguments outlined above seem to gain particular relevance in the context of technology-based organisations, given the role they play in helping individuals and society deal with the privacy concerns that result from the continuous collection and analysis of their personal information and data reflecting their behaviour. In this regard, on a practical ground, the fully mediated model developed by the research, in which open mindedness has an indirect effect on organisational performance via the environmental product innovation and the privacy concerns, also supports the indirect effect of open mindedness on addressing data privacy concerns by way of the environmental sustainability. This means that the positive effects associated with open mindedness are channelled through to the firm's performance via the success in environmental product innovation and in addressing their customers' privacy concerns.

A plausible explanation for the above findings may be the fact that a more service-oriented attitude towards end users on the part of businesses through proper training and information and knowledge sharing promotes the integration of environmental considerations into new products and services. That is the view of many users of the current technologies, who are increasingly concerned about both health-related issues linked to the use of technologies (e.g. the presence of electromagnetic fields), and the challenges of sustainable development (e.g. recycling, carbon emissions or waste management). We think that this is an important finding, as providing an overall view of relationship between the environmental product innovation with addressing data privacy concerns may help in the particular case of Apple, as it allows customers a voice in determining the key features of the company offering. We may also extrapolate these realities to other global enterprises due to its large number of customers and the variety of socio-economic context where they come from offer insights into a wide range of expectations and requirements that –when considered, result in sustainable innovations and therefore better performance for the firm (Statista, 2019).

From a theoretical standpoint, we argue that this study offers two further contributions. The first of these is the realisation that the views initially outlined by Fletcher (2003) of privacy concerns as an excellent research perspective and a new pathway for effectively responding to the changing nature of customer relationship management, gains relevance in the current socio-economic context. It is even more important in the light of the growing importance of the management of customers' knowledge (Campbell, 2003; Gebert, Geib, Kolbe, and Brenner, 2003). Secondly, our empirical study also contributes to a new modelling of organisational ambidexterity, where the firm's alignment to new user expectations and its adaptability to the dynamics of its context are facilitated through practices and processes of internal orientation and external engagement with its stakeholders (Carneiro, 2000; Wu and Wu, 2016).

6. Conclusions

There is a general lack of understanding as to how data privacy concerns that impede IT utilization can be overcome. This research examined the relationship between open

mindedness and organisational performance, hypothesising that a route to sustainable product innovation relies on the arrangement of privacy and information concerns. In this vein, this article makes three contributions to the management literature because all three of hypotheses are supported by empirical verification.

First, our results indicate that establishing a culture of open mindedness, whereby an organisation encourages end users to have “a voice” relates indirectly through the environmental product innovation to the way the company addresses the privacy concerns of its end users. This finding is important in the ongoing debate surrounding the relationship between the role of an open collaboration strategy, and confirms what authors such as Hamel, Doz, and Prahalad, 1989; Podolny and Page, 1998, Calantone, Cavusgil, and Zhao, 2002, say when they argue that a company’s ability to sharing information, knowledge, data and competencies is a key source of its sustainable competitive advantage.

Second, this research provides evidence to test the positive association between environmental product innovation and addressing privacy concerns on the basis of empirical tests. Even though research in the innovation field indicates that environmental concerns are able to simultaneously improve firms’ performance and offer a mix-blended source of strategic advantage (e.g. Del Giudice, Soto-Acosta, Carayannis, and Scuotto, 2018; Cegarra Navarro, Soto-Acosta, and Wensley, 2016), the innovation literature lacks empirical evidence to support the relationship between environmental product innovation and addressing privacy concerns. The study helps to fill the gap in empirical work in the sustainable development field, in which measures of data privacy concerns are rare, and often rely on crude proxies.

Third, the results also shed light on the tangible outcomes for companies to address the privacy concerns of users through environmental product innovation. Our findings indicate that addressing privacy concerns improves organizational performances. This could be interpreted as meaning that the presence of environmental product innovations might help to contain and overcome data privacy concerns. In this aim, we highlight how a knowledge-centric approach impacts operational performance by contributing to the sustainable behaviour and effective operation of firms in a knowledge-driven society, in line with the views of authors such as Vakharia, Vecco, Srakar and Janardhan (2018). Furthermore authors such as Chan and Hsu (2016) and Martínez-Martínez, Cegarra-Navarro, and García-Pérez (2015) did assert that the utilization of environmental product innovations by companies enables common knowledge base and understanding between the company and the society (e.g. trust, mutual knowledge and a tradition of cooperation), which in turn facilitates the easy transcription of relevant data, and enables the users to type and upgrade valuable knowledge to support innovation (Kramer and Gray, 1990; Makri, Hitt, and Lane, 2010). As a consequence, we argue that the higher the investment in open mindedness, the better the effects of pursuing both environmental and organisational innovation performance can become.

Limitations and Future Research Perspectives

Surely this paper presents some limitations that can be considered spur for further research. The first limitation is related to the research design with items and measures that is deduced from the mainstream literature. This study points to the need for further avenues of research, including more precise measurement constructs. Also, only a single

research methodological approach was employed and further research through interviews and observational case studies could be undertaken to triangulate. In addition, other IT companies should be empirically tested with further studies by assuming or emphasizes such correlation in order to verify and increase this reliability. The findings might also not be representative of all industries and there is an opportunity to review how other industry sectors in other countries are addressing data privacy concerns and how the environmental sustainability could contribute to such development. Hence, it could be helpful investigate empirically other business realities and other sectors (i.e. healthcare, manufacturing, particularly through a multiple case-study approach). Finally, the influence of the sectors in which firms operate may affect the interplay between factors investigated in this study. Thus, future context-specific studies may provide additional insights into the extent to which firms react to changes in the environment for sustainable competitiveness.

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Appendix: Questionnaire items

Open mindedness (OM)

OM1: Apple seems to be open to new ideas
OM2: Apple is able to identify problems (new ways of doing things) easily
OM3: Apple is able to reflect and learn from their own mistakes
OM4: Apple is able are able to listen to end users (e.g. complaints, suggestions)
OM5: Apple is able to adopt the suggestions of end users in the form of new routines and processes

Environmental Innovation (EI)

EF1: Apple products are energy efficient
EF2: Apple do not use toxic substances in their products
EF3: Apple make an efficient use of materials in their products (e.g. decompose and recycle materials)
EF4: Apple's products do not affect my health (e.g. do not create electromagnetic fields)
EF5: I would purchase Apple's products that have green attributes which benefit me (e.g. energy savings, durability or recycling opportunities)

Privacy Concerns (PC)

PC1: Apple products ask/store the right levels of personal information
PC2: My personal information is kept up to date in Apple products
PC3: Apple do not use my personal information for a purpose other than what I consent it to be used
PC4: Apple would never sell my personal information to other companies
PC5: I am concerned that Apple are collecting too much personal information about me

Performances (OP)

OP1: Apple products are lighter and thinner than others
OP2: Apple products are more resistant
OP3: I would repeat buying again in Apple
OP4: Apple has offered you products and services according to your needs
OP5: The quality of the services
OP6: Your loyalty towards the company

TABLE 1
Results of the Confirmatory Composite Analysis

Overall saturated model fit evaluation	Value	Hi ₉₅	Hi ₉₉
SRMR	0.068	0.087	0.112
d _{ULS}	0.710	1.150	1.915
d _G	0,292	0,334	0412

Note:

Global goodness of fit and bootstrap-based 95% and 99% quantiles (saturated model)

SRMR → Standardized Root Mean Square Residual; d_{ULS} → Unweighted Least Squares Discrepancy; d_G → Geodesic Discrepancy

TABLE 2
Construct summary, confirmatory factor analysis and scale reliability

Construct	VIF	Weight	loading	Reliability (SCR ^a , AVE ^b)
open mindedness (OM)				
OM1	2.154	0.258	0.781	AVE=0.616 SCR=0.865
OM2	2.298	0.387	0.869	
OM3	1.653	0.277	0.777	
OM4	1.316	0.350	0.705	
environmental innovation (EI)				
EI1	1.234	0.339	0.686	AVE=0.536 SCR=0.821
EI2	1.316	0.303	0.702	
EI3	1.512	0.390	0.805	
EI4	1.378	0.330	0.730	
privacy concerns (PC)				
PC1	1.631	0.278	0.775	AVE=0.705 SCR=0.905
PC2	2.151	0.314	0.860	
PC2	2.382	0.315	0.870	
PC3	2.270	0.283	0.851	
performances (OP)				
OP1	1.427	0.439	0.772	
OP2	1.712	0.321	0.800	
OP3	1.504	0.286	0.668	
OP4	1.429	0.292	0.726	

Notes:

The fit statistics for the measurement model were:

^a Scale Composite Reliability (SCR) of $p_c = (\sum \lambda_i)^2 \text{var}(\xi) / [(\sum \lambda_i)^2 \text{var}(\xi) + \sum \theta_{ii}]$ (Bagozzi and Yi, 1988).

^b Average variance extracted (AVE) of $p_c = (\sum \lambda_i^2 \text{var}(\xi)) / [\sum \lambda_i^2 \text{var}(\xi) + \sum \theta_{ii}]$ (Fornell and Larcker, 1981).

TABLE 3
Descriptive statistics

	Mean	S.D	HTMT	CA	Inter-correlations			
					1	2	3	4
1. Open mindedness	4.565	1.132	0.400	0.792	0.784			
2. Envir. innovation	4.964	0.895	0.335	0.710	0.252	0.732		
3. Privacy concerns	3.959	1.097	0.881	0.860	0.332	0.686	0.839	
4. Performances	3.998	1.092	n.a	n.a	0.493	0.624	0.657	n.a.

Note:

Mean = the average score for all of the items included in this measure; S.D. = Standard Deviation; CA = Cronbach's Alpha; n.a. = not applicable. The bold numbers on the diagonal are the square root of the Average Variance Extracted. Off-diagonal elements are correlations among constructs.

TABLE 4
Construct effects on endogenous variables

Effects	Direct effect	Confidence intervals (95%)		Significance of effect	Cohen's f-square	R ² of dependent construct
		5%CI _{lo}	95%CI _{hi}			
OM→ EI	$a_1=0,259$	0.187	0.367	Yes	0,072	0.067
EI→ PC	$a_2=0,694$	0.594	0.768	Yes	0,931	0,482
PC→ OP	$a_3=0,659$	0.558	0.764	Yes	0,766	0.434
Indirect effects on endogenous variables		Confidence intervals (95%)				
		Indirect effect		5%CI _{lo}	95%CI _{hi}	Support
	$OM \rightarrow EI \rightarrow PC = a_1 \times a_2$	0,180		0,118	0,277	Yes
	$OM \rightarrow EI \rightarrow PC \rightarrow OP = a_1 \times a_2 \times a_3$	0,118		0,077	0,188	Yes

Note:

Open mindedness → OM, Environmental Innovation → EI, Privacy Concerns → PC, Performances → OP.