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Previous research has defined resilience as a desirable characteristic for an organization and its members to possess when circumstances adversely change. Resilience is analysed through different perspectives as organizational responses to external threats, organizational reliability, or employee strengths. However, the role of resilience in enhancing organisational effectiveness is not fully understood. Grounded in organisational ambidexterity, the current research tests the value of resilience capabilities developed through specific Human Resource Practices (HRPs) in the context of ever changing market conditions. This paper argues that as well as technological capabilities, HRPs that build resilience within an organisation are needed to successfully implement technological change. Resilience capabilities are a mediating factor between technological capabilities and organisational effectiveness, whilst environment dynamism and competitive intensity are moderators of this relationship. Using a primary sample of 205 manufacturing firms, a model is presented and tested using Structural Equation Modelling. The results reinforce the importance of HRPs in building resilience which helps firms to continuously adjust to change and subsequently enhance their organisational effectiveness.

Keywords– Resilience Capabilities, Technological Capabilities, Organizational Effectiveness, Human Resource Practices, Structural Equation Modelling.

Paper type– Research paper

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Introduction

In their influential book 'The Other Side of Innovation', Govindarajan and Trimble (2010) ask why most of the leading global organizations in 1985 had, by 2010, lost their industry leadership position. Their compelling answer was based on 10 case studies (Blockbuster, Dell, Eastman Kodak, Microsoft, Motorola, Sears, Sony, Sun Microsystems, Toys "R" Us, and Yahoo) and suggests that successful companies tend to fall into 'catch 22' situations that make their glory days appear ephemeral These situations have two points in common, the under-valuation of the effect of future changes and the resistance to organizational change. Rapid technological breakthroughs characterise current business markets and, to avoid the repeating mistakes of the past, firms must continuously anticipate and adjust to changes (Hamel & Välikangas, 2003).

The competitive environment is characterised by high levels of uncertainty and change (Cummings & Worley, 2013). In this context, innovation is a central feature of competition and firms possessing technological capabilities create innovations through successfully implementing new techniques (Chen, Tang, Jin, Xie, & Li, 2014; Prajogo, 2015). Technological capabilities reduce the inherent risk associated with breakthrough innovations (Teece, 2007) and facilitate the introduction of new or improved products and services to the market (Chang, Chang, Chi, Chen, & Deng, 2012). Technological capabilities exist within the context of additional organizational capabilities which help organizations and the individuals within them, to respond better when faced with challenges.

Key amongst the extensive set of possible organizational capabilities is resilience (Jenkins, Wiklund, & Brundin, 2014) that, as Bardoel, Pettit, De Cieri, and McMillan (2014) stated, could be hypothetically developed through Human Resource Practices (HRPs). In general terms, resilience is the ability to dynamically reinvent an organisation when circumstances change, facilitating a firms' capacity to respond to uncertain conditions at the organizational level (Bhamra, Dani, & Burnard, 2011; King, Newman, & Luthans, 2015; Lengnick-Hall, Beck, & Lengnick-Hall, 2011; Linnenluecke, 2015). Resilience is associated with the ability to react to disruptions in a timely manner (Limnios, Mazzarol, Ghadouani, & Schilizzi, 2014; Shin, Taylor, & Seo, 2012). To be able to react, a firm's employees need to have a high tolerance for unpredictable events and HRPs are a strategic tool that can be employed to help individuals minimize the effect of such external contingencies (Ortin-Angel & Sánchez, 2009; Wright, McMahan, & McWilliams, 1994) and sustain competitive advantage (Campbell, Coff, & Kryscynski, 2012). The link between HRPs and performance in unpredictable environments has been demonstrated (Huselid, 1995; Schuler & Jackson,

1987; Subramony, 2009; Wright, Gardner, & Moynihan, 2003). However, literature lacks a comprehensive model to explain how unpredictable technological events can create opportunities for a firm if they have the capabilities to react. We propose that firms first respond to technological changes through their technological capabilities, then, the resilience capabilities of the firm facilitate the realisation of an improvement in organizational effectiveness. As an illustration we consider the current digital challenge faced in higher education institutions, where new digital business models based on massive open online courses (MOOCs) require the development of new technological capabilities and further requires organizational resilience in the academics to adopt and adapt to the challenge (Weller & Anderson, 2013).

The relationship between technological capabilities and firm performance has been analysed in the literature (Zander & Kogut, 1995). Technological capabilities are represented by the capacity to generate, implement, and manage technological change. These capabilities arise from organizational knowledge and experience, as well as from the particular institutional structures and linkages with firms who provide inputs to technical change (Bell & Pavitt, 1995). Thus, the relationship between technological capabilities and performance is complex and further analysis has been undertaken to examine the interaction with other organizational capabilities to better explain this relationship (Hao & Shon, 2015).

Resilience capabilities, as part of the organizational capabilities of the firm, are sustained in complex routines and processes which are amenable to improvement through appropriate HRPs (Jenkins et al., 2014). The role of resilience is not fully understood and the objective of this research is to propose that resilience capabilities act as a mediator in the relationship between technological capabilities and organizational effectiveness. Employees are exposed to multiple HRPs simultaneously (Jiang, Jiang, Lepak, Hu, & Baer, 2012a), but not all are useful for enhancing capabilities such as resilience. Paauwe, Guest, and Wright (2013) stated that there is a positive association between the adoption of high-commitment HRPs (Whitener, 2001) and organizational outcomes. Likewise, Bello-Pintado (2015) showed that HRPs that motivate workers to put in discretionary effort are the most important variable when explaining improvements in manufacturing outcomes. We propose that enhancing the HRPs that develop resilience capabilities contributes towards improving organizational effectiveness.

The current research defines human resource resilience as those capabilities developed through specific HRPs that enhance the firm's ability to impact performance by instilling in the workforce the capacity to overcome uncertainty. Resilience is an underlying and complex

variable that enables organizations to better face challenges, and it is one that can be cultivated through HRPs (Starbuck & Farjoun, 2009). However, there is a lack of empirical studies that analyses the particular HRPs that relate to resilience and organizational performance (Cooper, Liu, & Tarba, 2014). In particular, this research analyses how resilience capabilities leverage the impact of implementing innovations on the measures of organizational effectiveness, such that resilience capabilities help to foster and implement technological changes in organizations.

Given these premises, the goals of this research are twofold: a) to analyse if resilience capabilities mediate the relationship between technological capabilities and organizational effectiveness, and b) to analyse if environmental dynamism and industrial competitive intensity moderate the same relationship. The work is important because this evidence can explain if the costly development of technological capabilities is essential for all firms, or is relevant only for firms in highly competitive business environments.

This study contributes to the on-going debate about the relationship between resilience at an organizational level and organizational performance through analysis of a dataset of 205 manufacturing firms based in Spain. By construction all the firms in the sample faced at least one homogeneous external technological event, the implementation of an Enterprise Resource Planning (ERP) system (Lengnick-Hall & Lengnick-Hall, 2006). The relationships established in the model are tested through the Structural Equation Modelling (SEM) approach. This methodological design permits the conceptualization of latent variables, reporting of mediation paths, and hypothesizing several relationships simultaneously (Shen, 2015), providing more generalisable results with regards the role of the variables under study (Feldman & Bolino, 1996).

The study begins with a description and argument for the variables selected to investigate the relationship between resilience and performance. Then, the paper proceeds as follows. First, a description is given of the main concepts involved in this paper and establishes the hypotheses. The research methodology and results are then presented. A discussion of results leads to the conclusions and limitations of the study, and finally future research.

Theoretical development

Organizational capabilities and Organizational effectiveness

From a general point of view, organizational capabilities are embedded in the firm and constitute a set of distinctive resources manifested as critical assets, knowledge or firm specific capabilities (Luo, 2001). Organizational capabilities involve bundles of skills and the

collective learning reflected in organizational processes that improve the coordination of functional activities (Day, 1994). Organizational capabilities are socially complex routines that determine firm's efficiency in production processes (Collis, 1994; Guillaume, Dawson, Otaye-Ebede, Woods, & West, 2015). Winter (2000) pointed out the importance of routines in configuring organizational capabilities, stating that these capabilities facilitate a set of decision options for producing significant outputs. With regards to performance indicators, organisational effectiveness is the most comprehensive variable (Sparrow & West, 2002) as it encompasses different and increasingly more complex performance outcomes that include (Sparrow & Cooper, 2014): proximal (i.e. commitment, satisfaction), intermediate (customer service) and distal or organizational performance outcomes (financial performance). Technological capabilities and resilience capabilities are part of organizational capabilities, but are developed in a different way and hence have a distinctive effect on organizational effectiveness.

Technological capabilities

Product and process technology changes are closely related to competition, which relates to the adoption of an innovation that is sustained by the firm in the production, distribution and sale of new products or services (Zander & Kogut, 1995). Organizational capability can confer to the firm the ability to adopt industrial innovations, and in this case these capabilities are defined as Technological capabilities. Through technological capabilities, firms are able to successfully adopt technology that enables them to implement new techniques of production and in turn solve problems arising from the use of out-dated production systems (Chen et al., 2014; Shin, Taylor, & Seo, 2012). Technological capabilities often leverage external resources, thereby reducing the risk inherent in breakthrough innovations (Teece, 2007; Chen et al., 2014). Technological capabilities are a knowledge-based comprehensive set of organizational capabilities that enable a firm to search, recognize, organize, apply and commercialize innovative products and services (Chang et al., 2012). As part of the organizational capabilities of a firm (Barney, 2001), technological capabilities also enable a firm to use resources to generate competitive advantage. Technological capabilities are considered a dynamic capability held by a firm to better adapt to technological opportunities (Teece, 2007) and hence are positively linked to organizational effectiveness. Given the findings described the following hypothesis is proposed:

> *Hypothesis 1: Technological capabilities are positively related to organisational effectiveness.*

Resilience capabilities

Human Resource (HR) decisions play an important role in the development of organizational capabilities. A HR system generates organizational capabilities through the integration of a specific set of HRPs such as training, promotion and compensation. (Saa-Perez & Garcia-Falcon, 2002). To improve analysis of organizational outcomes Jiang et al. (2012b) categorized HRPs into three different bundles (one bundle that enhances workers' abilities, a second that increases motivation and the third that generates opportunities to participate). Through developing these practices, firms are able to configure the HR system as a strategic tool for achieving organizational goals. As HRPs can contribute to the creation of organizational capabilities and specific bundles of HRPs directly affect performance, it could be stated that HRPs can enhance those specific capabilities related to organizational resilience and, at the same time, specific bundles of HRPs are related to performance (Bello-Pintado, 2015). The association between resilience and organizational capabilities has been analysed (Jüttner & Maklan. 2011), and work identifies the need for future research on models to empirically test if these concepts are related (Powley, 2009).

The theoretical underpinnings used to frame Resilience capabilities frequently reference the Resource Based View (RBV) and the Dynamic Capabilities View (DCV), paradigmatic theoretical approaches that link capabilities, competitive advantage and superior performance (Barrales-Molina, Bustinza, & Gutiérrez-Gutiérrez, 2013; Colbert, 2004). Theories related to the management of resources within organisational environments, such as organisational ambidexterity (Junni, Sarala, Tarba, Liu, & Cooper, 2015; Xing, Liu, Tarba, & Wood, 2016), establish links between organisational design and action, and highlight the dynamic role that resources play within organizational contexts and business environments (Stokes et al., 2015). The dynamic characteristics of these theoretical approaches are a suitable frame to analyse resilience capability as it can be considered as an organisational capacity that may be dynamically reinvented (Hamel & Valikangas, 2003). Combining these theories and the contingency and universal approaches, it is possible to analyse how a firms' strategic approach affects its performance, which is dependent upon the underlying critical variables such as organizational capabilities (Youndt, Snell, Dean, & Lepak, 1996), and how bundles of specific HRPs can generate organizational capabilities (Cooper et al., 2014; Hu, Wu, & Shi, 2015).

Traditional HRPs include selective recruitment, formal training systems, participation, results oriented appraisal, internal career opportunities, employment security, profit sharing,

security, and clear job descriptions (Boxall & Purcell, 2000; Delery & Doty, 1996). These HRPs have an effect on the organisational capabilities of firms and are related to other contextual factors such as environmental uncertainty (Hu et al., 2015). In creating the capability to cope with this uncertainty, organizational capabilities are associated with superior performance (Collins & Smith, 2006; Gambardella, Panico, & Valentini, 2015; Guest, 1997; Heywood, Siebert, & Wei, 2010; Nabi, 2001; Helfat & Peteraf, 2015), and thus resilience capabilities, as one of the organizational capabilities, are expected to be positively linked to organizational effectiveness. Building on this argument the following hypothesis is proposed:

> *Hypothesis 2: Resilience capabilities developed through resilience-enhancing HRPs are positively related to organisational effectiveness.*

Technological capabilities and Resilience capabilities

Contingency theory can be applied in the context where organizations try to reach the most favourable organizational outcomes through the best fit between external contingency factors and organisation structure, procedures and practices (Delery & Doty, 1996). These contingency factors have an effect on other internal organisational variables of firms exposed to environmental uncertainty (Schuler & Jackson, 1987).Technology is one of the contingency factors often studied that affect firm's strategies (Hamel & Välikangas, 2003). The contingency perspective shows that the relationship between HRPs and performance depends on the organisation's strategic positioning (Bae & Lawler, 2000). Five primary manufacturing strategies have been described as antecedents of superior performance: cost, quality, time, flexibility, and innovativeness (Kroes & Ghosh, 2010; Leong, Snyder, & Ward, 1990; Ward, McCreery, Ritzman, & Sharma, 1998). According to Youndt, Snell, Dean, and Lepak (1996), some of these strategies directly affect the relationship between HRPs and performance.

Innovativeness is related to the introduction of new products and processes (Leong et al., 1990), and is formed of three main components: product innovation, technological capabilities and technology sharing (Krause, Pagell, & Curkovic, 2001). Technology-related capabilities constitute the firm's capacity to better adapt to technological change (Song, Droge, Hanvanich, & Calantone, 2006). A firm's ability to react to technological change is one of a firm's strategic capabilities, and the management of HR a critical internal organisational capability (Luo, 2000). The RBV and DCV literatures posit that technological

capabilities support the HR functions, not the other way round (Barrales-Molina et al., 2013; Ortin-Angel & Sánchez, 2009; Teece, 2007).

Overall contingency theory, RBV, DCV and organizational ambidexterity (Junni et al., 2015) are used together to indicate that organizations implementing existent or new technologies require resilience at the organizational level and must revise their resources and competences. From a human resource management perspective this implies firms developing technological capabilities must implement resilience-enhancing HRPs to develop resilience capabilities in the workforce. Therefore, it can be proposed that:

> *Hypothesis 3: Technological capabilities are positively related to resilience capabilities.*

Unpacking the role of Resilience capabilities

In the framework presented in Figure 1 the mediation role of the variable 'resilience capabilities' encapsulates the effect of resilience as an outcome of 'resilience-enhancing HRPs'. In methodological terms mediation effects can be tested through the use of structural equation models, which enrich analysis of simple relationships by allowing the effect of a third variable to be measured (Baron & Kenny, 1986; Bustinza, Arias-Aranda, & Gutierrez-Gutierrez, 2010). The conditions to be fulfilled in order to guarantee a mediation effect are: (1) a direct relationship between the exogenous variable (Technological capabilities) and the possible mediator (Resilience capabilities developed through resilience-enhancing HRPs); (2) a direct relationship between the mediator variable and an endogenous variable (Organisational effectiveness); (3) a positive relationship between the exogenous and the endogenous variables that decreases (partial mediation) or drops to almost zero (total mediation) when the mediator variable is included in the model. Mediation analysis will show if the effect of the exogenous variable (Technological capabilities) on the endogenous (Organisational effectiveness) is partially or totally driven by the mediator variable (Resilience capabilities). Therefore, the following hypothesis is proposed:

> *Hypothesis 1a: Resilience capabilities mediate the relationship between a firm's Technological capabilities and Organisational effectiveness.*

Business environment and competition

The development of Technological capabilities requires significant organizational resource. Firms engaging in the development of Technological capabilities need to internalize mechanisms of talent management, R&D management or business intelligence. As such, it is

important to understand if technological capabilities are essential to all firms, or only those firms operating in highly dynamic environments (Lepak, Takeuchi, & Snell, 2003; Ward & Duray, 2000), with high competitive intensity (Acquaah & Amoako-Gyampah, 2003).

Environmental dynamism is associated with the unpredictability of change in the external environment of the firm (Jansen, Vera, & Crossan 2009), and is closely related to contingent factors including 'technological change' and/or 'product/service demand fluctuations' (Bardoel et al., 2014). HRPs can be developed in response to or even ahead of environmental dynamics, providing competitive advantage (Chan et al., 2004) and enhancing firm's capabilities (Becker & Gerhart, 1996).

Competitive intensity plays an important contingency role in explaining the relationship between exploitative and explorative resources (Auh & Menguc, 2004) that support the Ambidexterity Organisational lens of the firm (Stokes et al., 2015; Xing et al., 2016). Both environmental dynamism and competitive intensity variables can be considered as measures of the stability of the competitive environment. To get an appropriate fit between firm's external and internal factors, firms need to calibrate the influence of external variables such as competitive intensity on internal variables such as strategy, culture or HRPs (Morris, 1998). Firms need to develop aligned HRPs to address market forces (Cunha, Cunha, & Morgado, 2003). Usually, competitive intensity is considered as a catalyst that helps firms to better adapt to environmental demands (Schilling & Steensma, 2001).

The complex interaction of these external variables needs to be tested using moderating analysis (Youndt et al., 1996). Two models must be generated through median multi-group analysis measuring the goodness of fit. The final objective of this research will be to study the effect of Technological capabilities on organizational effectiveness in response to technological uncertainties through an interaction methodological approach which is explicit in testing the following hypotheses:

> *Hypothesis 1b: Environmental dynamism moderates the relationship between a firm's Technological capabilities and Organisational effectiveness.*
>
> *Hypothesis 1c: Competitive intensity moderates the relationship between a firm's Technological capabilities and Organisational effectiveness.*

Figure 1 shows the model of relationships between the variables involved in this study. As it can be seen, resilience capabilities can be determined by the effect of resilience-enhancing HRPs in mediating between technological capabilities and organisational effectiveness (H1a). Environmental dynamism and competitive intensity act as moderators. The underlying hypotheses of this model are discussed below.

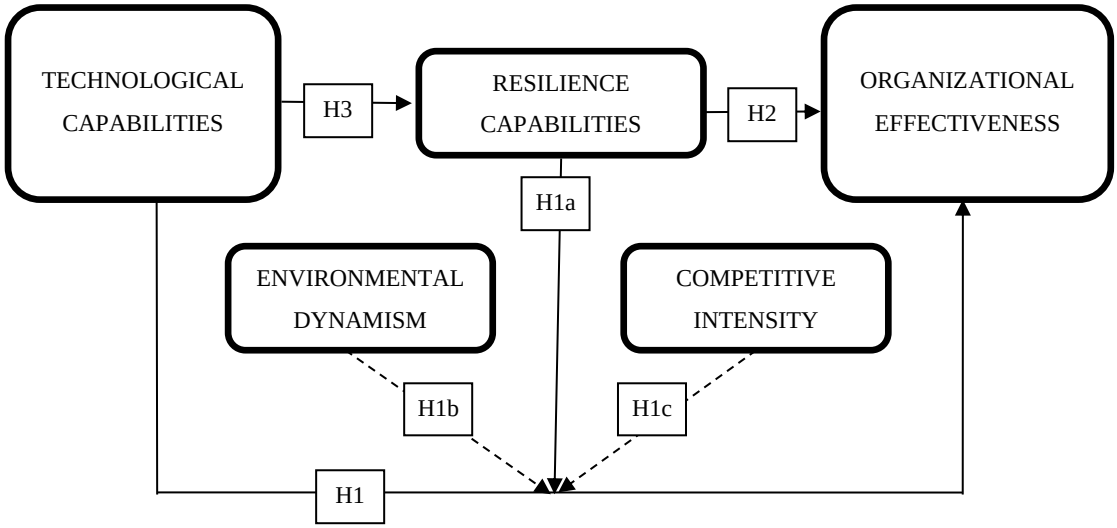

Figure 1 *Model: The role of resilience capabilities, environmental dynamism, and competitive intensity in the relationship between technological capabilities and organizational effectiveness*

Research design and empirical methodology

Sampling

The sample of firms was chosen from SABI[1] database, which includes information about the leading 50,000 companies operating in Spain. Data was collected through a survey using the contact information provided in this database. Firms with more than 20 employees were chosen from the manufacturing sector, sub-selecting only those companies that were facing at least one homogeneous technological event, which provided a population close to 1,200 firms. Firms were contacted via Computer Aided Telephone Interviewing (CATI) following procedures supported by the literature (Bustinza et al., 2010). This method has the advantage of being cost effective in obtaining a good response rate, and has the ability to continuously measure behaviours of interest (Couper, 2000). The survey was addressed to the engineering director, or if this title didn't exist, to the general director.

The responses were collected during the months of October and November 2012. The study obtained 205 valid surveys, achieving a response rate of 26.67%, and used survey protocols to encourage response and maintain confidentiality (Anagnostopoulos & Siebert, 2015; Parry; Vendrell-Herrero, & Bustinza, 2014). The geographical distribution (NUTS-2) of the sample matches with Spanish economic activity, as the sample has more observations for regions such as Catalonia (20%), Valencia (13.66%), Madrid (12.68%), Basque Country (11.22%) and Andalusia (8.29%). To guarantee respondent validity the survey first requested

[1] More information can be found on Bureau Van Dijk's website (http://sabi.bvdep.com).

information to determine if the company had implemented or were in the process of implementing a new business-management technology within the firm, in our case specifically an ERP/EDI systems, and the respondent's knowledge of the areas investigated, educational level, seniority in the job, and seniority in the firm. To evaluate non-response bias, the procedure developed by Podsakoff, MacKenzie, Lee, and Podsakoff (2003) was used. This procedure uses two-tailed t-tests to compare whether there are differences between first respondents and later respondents based on a set of demographic variables. At a level of $p < 0.1$ no differences were found, so non-response bias does not seem to be a problem. For further details about the sample see Table 1. From the 205 questionnaires, 57% of the firms had between 51–250 employees, 19% had between 251–1000 employees, and around 16% had fewer than 50 employees. The remaining percentage was composed of firms with over 1000 employees. Most of the firms in our sample are between 20 and 40 years old (44%).

Table 1 *Sample: Technical specifications*

Universe	***Manufacturing firms with more than 20 employees***
Source	SABI database (Bureau van Dijk)
Geographical area	Settle in Spain, operating EU
Methodology	Structured questionnaire
Type of interview	CATI (Computer Aided Telephone Interviewing)
Population	1,208 manufacturing firms
Sample size	N=205
Response rate	26,67%
Confidence level	95 percent
Sampling error (p=q=0.50)	+/- 6.19%
Sample design	Random selection of sampling units
Sector	Manufacturing
Age	0-20 (34%) / 20-40 (44%) / +40 (22%)
Number of employees	20-50 employees (16.49%) 51–250 employees (57.38%) 251–1000 employees (18.76%) More than 1000 employees (7.37%)

Measures and justification

Technological capabilities for better adaptation to change: A 7-point Likert scale (from 1=disagree completely to 7=agree completely) was used (Table 2), according to the classification established by Kroes and Ghosh (2010), and Zahra, Neubaum, and Larrañeta (2007) to measure access and use of technological resources. It is composed of four items: capability to access specific labour technology expertise, capability in accessing new technology, skill in conducting applied R&D, and the ability to upgrade existing products. Principal component analysis with Varimax rotation and Kaiser normalization (Hair, Anderson, Tatham, & Black, 2001) confirms the existence of one dimension producing values for the Kaiser-Meyer-Olkin test of 0.902; Barlett's test of sphericity χ^2=18,536.173 (p=0.000) and a Total Variance Extracted of 56.432%. With regards to the analysis of the scale's internal consistency, Cronbach's Alpha value was 0.794 (Cronbach, 1951); with a Mean Inter-item Correlation of 0.407; scale reliability was tested through Composite Reliability of 0.893, and Average Variance Extracted of 0.667. These values demonstrated the internal consistency and reliability needed to use the scale in the proposed model.

Resilience capabilities through resilience-enhancing HRP: A 7-point Likert scale (from 1=disagree completely to 7=agree completely) was used with the most representative indicators for this variable employed by Delaney and Huselid (1996), Lengnick-Hall et al. (2011), Siebert (2006), and Sila (2007). This variable is measured using 5 items: employee involvement, employee empowerment, teamwork employee capacity, employee resilience training and self-motivated learning, and employee capacity to adapt to changes emphasising problem-solving responses. Principal component analysis determines that the scale has one dimension with the following values: Kaiser-Meyer-Olkin test of 0.921; Barlett's test of sphericity χ^2=17,534.530 (p=0.000); Total Variance Extracted of 59.289%; Alpha Cronbach of 0.791; Mean Inter-item Correlation of 0.424; Composite Reliability of 0.932, and Average Variable Extracted of 0.733 (Table 2).

Organisational effectiveness: A 7-point Likert scale was used for this variable following the measurements and suggestions proposed by Connolly, Conlon, and Deustche (1980), Hitt (1988), Sparrow and Cooper (2014), and Sila (2007). Following these authors organisational effectiveness is defined as a set of important performance outcomes covering proximal, intermediate, and distal or organizational performance indicators. The variable to measure organisational effectiveness is composed of 5 items measuring: commitment for continuous improvement, stability of production process, knowledge about customers' requirements, business models process improvement, and operational and financial results. Principal component analysis confirms one dimension, with the following values: Kaiser-Meyer-Olkin

test of 0.884; Barlett's test of sphericity χ^2=17,721.39 (p=0.000); Total Variance Extracted of 58.63%; Alpha Cronbach of 0.779; Mean Inter-item Correlation of 0.398; Composite Reliability of 0.919, and Average Variable Extracted of 0.694 (Table 2).

Environmental dynamism: This variable is composed of four items for rating change (from 1=slow to 7=rapid) in the external environment following Ward and Duray's scale (2000, pp. 128): "the rate at which products and services become obsolete, the rate of innovation in product/service and in process, and the rate of change in customers' tastes and preferences". The measure is used to split the sample and perform a median multigroup analysis. Environmental dynamism is a binary variable taking value 1 when the observations are above the median and zero otherwise. 58.4% of the firms are situated in the median and above, which indicates they show higher rates of environmental dynamism than their counterparts.

Competitive intensity: To measure the competitive intensity four items are used following the Grewal and Tansuhaj (2001) scale. These items measure the extent of competition in general, including price competition and new competitive moves. The variable is also used to split the sample and perform a median multigroup analysis similar to that proposed for environmental dynamism. Competitive intensity is a dummy variable taking the value 1 when the observations are above the median and zero otherwise. 68.0% of the firms are situated in the median or above which implies they face higher competition than their counterparts in the sample.

Table 2 *Factor loadings and reliability analysis*

Construct / items	Mean (S.D.)	Factor Loading (t-values)	R^2	Composite Reliability	Average Variance extracted
TECHNOLOGICAL CAPABILITIES				0.893	0.667
TECH1	5.12 (1.691)	0.726 (10.405)	0.527		
TECH2	5.115 (1.678)	0.824 (15.337)	0.679		
TECH3	5.080 (1.714)	0.826 (13.173)	0.682		
TECH4	4.720 (1.793)	0.812 (14.342)	0.659		
RESILIENCE CAPABILITIES				0.932	0.733
RESI1	5.100 (1.571)	0.795 (9.137)	0.632		
RESI2	5.205 (1.576)	0.821 (10.125)	0.674		
RESI3	5.430 (1.365)	0.837 (11.024)	0.701		
RESI4	5.015 (1.609)	0.844 (12.563)	0.712		
RESI5	5.510 (1.452)	0.863 (11.789)	0.744		
ORGANIZATIONAL EFFECTIVENESS				0.919	0.694
ORGA1	5.675 (1.334)	0.787 (11.024)	0.619		
ORGA2	5.650 (1.283)	0.769 (10.125)	0.591		
ORGA3	5.765 (1.193)	0.766 (10.332)	0.587		
ORGA4	5.801 (1.184)	0.786 (9.137)	0.618		
ORGA5	5.712 (1.193)	0.803 (9.057)	0.645		

All of the factor loadings are significant for a level of $p<0.01$

Results

The model proposed is tested through SEM analysis. The results of this analysis are included in Table 3 and 4, which show the goodness-of-fit indexes (Hair et al., 2001), and a resume of hypotheses supported. The statistical process followed was Robust Maximum Likehood. Absolute-fit and incremental-fit indicators presented values above the levels of acceptance. The parsimonious fit index also presented a satisfactory value, as can be seen on Table 3.

Table 3 *Goodness-of-fit indices for constructs and model*

TYPES OF FIT	MEASURES	NOMEN	LEVELS OF ACCEPTANCE	TECH	RESI	ORGA	MODEL
ABSOLUTE	Chi-Square Likelihood Test	CMIN	Significance test	36.735 (p<0.001)	23.535 (p<0.001)	35.991 (p<0.001)	89.786 (p<0.001)
	Goodness-of-Fit Index	GFI	> 0.900	0.973	0.978	0.962	0.944
	Root Mean Square Error of Approximation	RMSEA	0.050-0.080	0.072	0.067	0.059	0.063
	Root Mean Residual	RMR	< 0.050	0.042	0.028	0.033	0.035
INCREMENTAL	Compared Fit Index	CFI	> 0.900	0.968	0.981	0.975	0.957
	Normed Fit Index	NFI	> 0.900	0.958	0.946	0.948	0.938
	Tucker-Lewis Index	NNFI	> 0.900	0.923	0.927	0.932	0.923
	Adjusted Goodness-of-Fit Index	AGFI	> 0.900	0.919	0.926	0.918	0.921
PARSIMONY	Normed Chi-square	CMINDF	Range (1-5)	2.342	1.998	2.567	2.453

Table 4 *Results: Hypotheses supported*

STRUCTURAL MODEL		COEFFICIENT	INTERPRETATION
TECHNOLOGICAL CAPABILITIES	ORGANISATIONAL EFFECTIVENESS	0.389 (p<0.001) *** to 0.193 (n.s)	H1: Supported (Resilience partially mediates the relationship)
RESILIENCE CAPABILITIES	ORGANISATIONAL EFFECTIVENESS	0.482 (p<0.001) ***	H2: Supported
TECHNOLOGICAL CAPABILITIES	RESILIENCE CAPABILITIES	0.602 (p<0.001) ***	H3: Supported
Significance Level: n.s non-significance; ** p<0.01; *** p<0.001			

The mediation effect of resilience capabilities on the relationship between technological capabilities and organisational effectiveness (see Figure 2) was tested following standard procedures (Baron & Kenny, 1986). The parameters for H1 were calculated (0.389; p-value<0.001) supporting the relationship between the variables technological capabilities and organizational effectiveness; the parameters for H2 were calculated (0.482; p-value<0.001) showing that the variable Resilience capabilities is positively related to organizational effectiveness; finally, the parameters for H3 were calculated (0.602; p-value <0.001) supporting the relationship between technological capabilities and resilience capabilities.

When this final relationship was introduced in the model, the original parameter for H1 (0.389; p-value<0.001) decreased to almost half of the value and became non-significant (0.193; p-value>0.01) showing the partial mediation effect (partial as it decreased to almost half of the original value, total mediation would have been if the parameter decreased to almost zero). These results show that resilience capabilities mediate the positive effect of technological capabilities on organisational effectiveness.

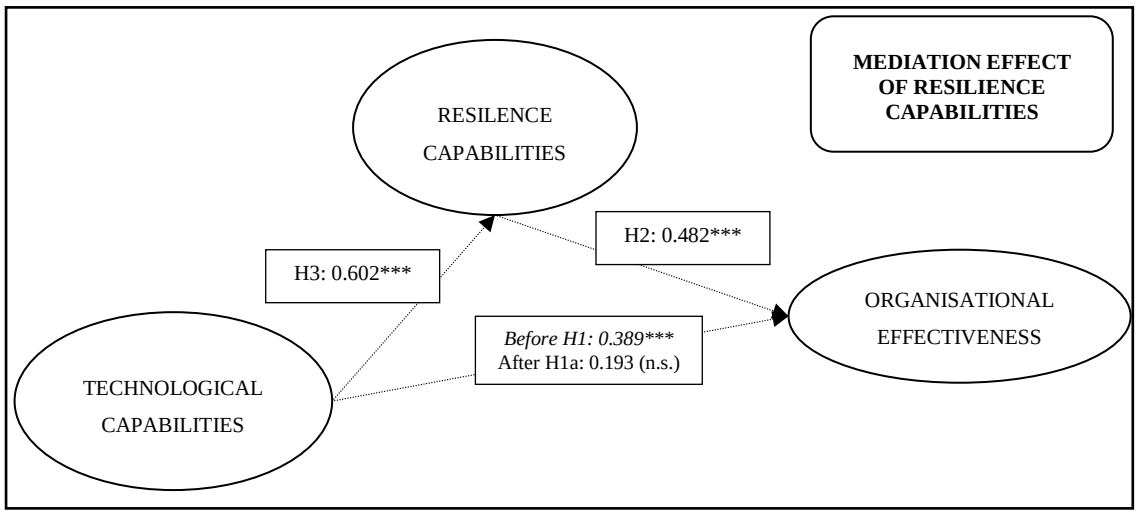

Figure 2 *Mediation effect of resilience capabilities in the relationship between technological capabilities and organizational effectiveness*

With regards moderating effects, the process followed was to analyse the relationship between organizational capabilities and organizational effectiveness splitting the sample through median multi-group analysis according to the variables environmental dynamism and competitive intensity perceived. The process for both variable analyses was the same. First, the goodness-of-fit of the model (χ^2 Satorra-Bentler of 68,289.657) were obtained without restricting the parameters that relate technological capabilities and organisational effectiveness. Then the parameters were restricted, making them equal in the different subsamples, and χ^2 Satorra-Bentler estimates moved to 72,112.709 and 74,523,828. This revealed significant differences between the models according to the χ^2 differences test. Therefore, environmental dynamism and competitive intensity turned into positive moderating variables of the relationship between technological capabilities and organisational effectiveness.

When estimating the relationship between technological capabilities and organisational effectiveness for the subsample containing firms with low environmental dynamism, the parameter associated to H1 decreased from 0.389 to 0.368 (H1b). Additionally, for the subsample containing firms with low competitive intensity, the parameter associated to H1 decreased from 0.389 to 0.325 (H1c). These results suggest that the effect of technological

capabilities on organizational effectiveness is moderately stronger in firms operating in markets with high environmental dynamism or high competitive intensity. Interestingly, the decrease of the parameter associated to H1 is not statistically significant at the usual levels. This seems to suggest that regardless the conditions of the context the positive effects on the organization of building technological capabilities remain stable.

Discussion of the results

The purpose of this study was to examine if resilience capabilities mediate the impact of organisational technological changes on organizational effectiveness. The study proposed that resilience capabilities are generated through specific resilience-enhancing HRPs, thus encapsulating the effect of resilience as an outcome of those HRPs. The results support these hypotheses as resilience capabilities are directly linked to organisational effectiveness and also mediate the positive effect that a firm's technological capabilities has on organisational effectiveness. As proposed in the introduction, resilience capabilities help organisations to respond better in the face of challenge (Jenkins et al., 2014). Resilience capabilities are underpinned by complex routines and processes that can be improved by appropriate HRPs, supporting the proposed definition of resilience capabilities as those capabilities developed through specific HRPs that enhance the firm's ability to impact performance by instilling in the workforce the capacity to overcome uncertainty.

The role of employees is essential in recovering quickly from change that produces disruption in function (Shin et al., 2012). Consequently, resilience capabilities in the context of technological change create a capacity within firms to better implement strategic decisions related to technological positioning, recovering quickly and thus mitigating the effect of dysfunctions in organisational effectiveness. Technological capabilities develop the capacity of a firm to implement production processes faster than their competitors, facilitating discovery and correction of problems that may arise from out-dated production systems (Chen et al., 2014). Technological capabilities constitute the dynamic capacity of a firm to adapt to technological changes, such as the ability to improve performance after implementing new techniques of production (Prajogo, 2015). Results show the positive effect of technological capabilities on organizational effectiveness and the important role of resilience capabilities in mediating this effect. Results support previous studies stating that resilience, at an organisational level, facilitates firms' capacity to respond to uncertain conditions (Bhamra, Dani, & Burnard, 2011).

With regards the organizational ambidexterity lens (Junni et al., 2015; Stokes et al., 2015), organizational capabilities can be considered as a determinant of the dynamic relationship between exploitative (extant) and explorative (evolving) resources within organizational environments and competitive contexts. We propose this as an explanation for the positive relationship between technological capabilities and resilience as a firms´ evolution requires the appropriate mind-set (O'Reilly & Tushmann, 2008).

The results add clarity to the specific aspects of organisational effectiveness affected by a HR department's practices which build resilience and which has positive effects on performance (Boselie et al., 2001; Collins & Smith, 2006; Huselid, 1995; Wright et al., 2003). These results support the HR universal perspective (Delery & Doty, 1996) and the idea that specific HRPs (Bello-Pintado, 2015) influencing employee involvement, empowerment, self-motivation, adaptability and teamwork skills can generate resilience capabilities for superior performance. The employee's involvement is related to organisational commitment (Guest, 1997). Employee's capacity to adapt to change, and HR emphasising the employee's importance in providing problem-solving responses, leads to continuous organisational improvement (Schuler & Jackson, 1987; Siebert, 2006). Development of employees capacity to work as a team during process improvement (Sila, 2007), and HR delivery of employee resilience training and self-motivated learning helps firms develop better understanding of customer's requirement (Sparrow & West, 2002). Overall, resilience capabilities lead to organisational effectiveness, shown through their positive effect on proximal, intermediate and distal or organizational performance indicators (Sparrow & Cooper, 2014).

Finally, results demonstrate the unimportant role of environmental dynamism and competitive intensity in the relationship between technological capabilities and organizational effectiveness. Whilst previous research has identified that environmental dynamism (Ward & Duray, 2000; Youndt et al., 1996) and competitive intensity (Grewal & Tansuhal, 2001) have a moderating role between organizational capabilities and firm performance, our evidence shows that, for the particular case of the link between Technological capabilities and Organizational effectiveness, the variables do not have a significant moderating role. This suggests that investment in Technological capabilities is worthwhile, regardless of the contextual business environment in which the firm operates.

Conclusions, limitations and future research

Theoretical implications

This article contributes to theory by providing a new perspective on the study of resilience capabilities at the organizational level. Resilience capabilities are developed through specific bundles of HRPs, confirming the importance of both HR enhancing practices (Bardoel et al., 2014) and the Universal approach to analyse HR decisions (Hu et al., 2015). Conclusions about resilience capabilities can be summarized as: a) resilience is a capability that can be developed (Bardoel et al., 2014) and enhanced through HRPs ; b) HRPs are at the heart of organizational capabilities (Kamoche, 1996); c) organizational capabilities enable firms to develop and deploy their resources to achieve superior performance (Dierickx & Cool, 1989); d) when competitive circumstances change, firms have to maintain strategic fit between organizational assets and capabilities to sustain competitive advantage (Hamel & Välikangas, 2003; Peteraf & Reed, 2007); e) in general, organizational capabilities of the firm are related to superior performance, in particular, resilience capabilities are related to organizational effectiveness.

The current research also contributes to understanding of the relationship between technological and resilience capabilities. Both are positively related and need to effect organizational effectiveness, contributing to understanding of the Contingency perspective of HR decisions. The Contingency perspective goes further than establishing a simple linear relationship, as used in other universal theories (Delery & Doty, 1996). The theoretical foundations are aligned with critical aspects identified in the RBV, DCV, and organisational ambidexterity literatures (Barrales et al., 2013; Colbert, 2004; O'Reilly & Tushmann, 2008; Xing et al., 2016). The current study demonstrates that firms' resilience mediates between technological change and organizational effectiveness. Resilience is a complex and underlying variable and results support the existence of resilience through a complex set of variables interacting through a mediation effect.

Empirical evidence provides an explanation for why HRPs are essential in enhancing organizational resilience. Resilience capabilities involve bundles of skills and collective learning reflected in organizational processes that are developed through resilience-enhancing HRPs. HR decisions therefore have a crucial role in developing organizational capabilities (Ortin-Angel & Sanchez, 2009; Saa-Perez & Garcia-Falcon, 2002), and this research demonstrate that HRPs can be configured in specific bundles to generate capacities to overcome uncertainty. Overall, the analysis provides an explanation as to why leading global organizations unable to adjust to changes have lost their industry leadership position (Govindarajan & Trimble, 2010; Hamel & Välikangas, 2003).

Managerial implications

Results provided are instructive to practitioners. Our evidence suggests that technological capabilities are positively linked to organizational effectiveness. This result suggests that managers need to implement mechanisms for ensuring firms develop good practices in talent management, R&D management or business intelligence. Since all those practices consume significant resources, we have assessed whether technological capabilities are important for all firms, or only for those operating in highly competitive business environments. Our results suggest that all firms can obtain organizational benefits from building these capabilities.

Furthermore, we find that the full potential of technological capabilities is realized by developing appropriate and congruent HRPs. Managers realizing the importance of HRPs that contribute towards developing resilience will increase the success of both their technological implementations and competitiveness. Managers can help employees through the adoption of practical guidelines for strengthening resilience (Siebert, 2006). Building on current research the work identifies factors that differentiate resilient organizations, namely that they implement systems that involve employee engagement in the decision-making and problem-solving processes, they have internal training programmes that help employees to learn how to better adapt to new technologies or market conditions, and they demonstrate the capacity to understand the organization as a team, with all employees sharing goals and objectives.

Future research avenues

The aim of this research is to assess whether resilience capabilities can be developed through the intervention of HRPs. In this regard there is a large body of literature exploring the topic; and for the case of other contexts to technological change implementations, resilience developed through HRPs has been associated with a better work-life balance (Heywood et al., 2010), working autonomy (Gambardella et al., 2015), established methods of knowledge exchange (Collins & Smith, 2006), encouraging diversity of ideas or people (Bardoel et al., 2014), and well-structured promotion and career development schemes (Nabi, 2001). Future research is needed to examine the extent to which these variables are linked to resilience.

One important result of this study is that environmental dynamism and competitive intensity do not moderate the relationship between technological capabilities and organizational effectiveness. This result needs further validation. A further line of inquiry would examine the moderating role of environmental dynamism and competitive intensity through the construction of samples containing firms in different countries and sectors.

Finally, as with most studies based on survey data (Parry et al., 2014), our analysis is cross-sectional and so whilst capturing the significance of relationships it does not capture the dynamic nature of the factors that determine the relationship between the variables. As such, even if the relationships are significant other factors not included in the current model may also play an important role, and hence future research will be needed to validate the analysis in a longitudinal setting.

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