HPWS, technology and flexibility in the Spanish manufacturing industry: the moderating role of social capital

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Purpose – The purpose of this paper is to analyze a specific pattern of social capital and its pivotal role in the HPWS utilization.

Design/methodology/approach – The paper uses Spanish cross-sectional data from the manufacturing industry to examine the moderating effects of external social capital derived from buyer-supplier relationships on HPWS, technology and flexibility. We propose a model of HPWS in which external social capital not only favours the use of HPWS but also moderates the incidence of other common facilitators such as technology and flexibility.

Findings – Firms yielding external social capital use HPWS more intensely and that the effect of technology constituents on HPWS utilization is contingent to social capital accumulation. The findings are consistent with existing HR literature on the subject but broaden its perspective by analyzing a specific pattern of social capital and its pivotal role in the HPWS utilization process.

Practical implications – The paper reveals the importance of social capital in the Spanish manufacturing industry by showing how its embodiment in buyer-supplier relationships may allow firms to better understand the context in which HPWS are more likely to be useful.

Social implications – The impact of social relationships on effective human resource management practices

Originality/value – We explore the factors that facilitate HPWS utilization, with a particular focus on the extent to which external social capital derived from buyer-supplier relationships functions as a communication channel to spread effective HPWS implementation.

Keywords: High-Performance Work Systems (HPWS), social capital, computerized production technology, technological intensity, manufacturing flexibility, Spain.

1. Introduction

Human Resource Management (HRM) theory has evolved steadily during the last twenty years with substantial research supporting a significant impact of High-Performance Work Systems (henceforth, HPWS) and its constituents on organizational performance (e.g. Becker and Huselid 1998; Way 2002; Datta et al. 2005; Chi and Lin 2010; Jiang et al. 2012). In spite of their recognized importance, little is still known about the factors that influence HPWS utilization and how they interact with each other to promote HPWS use. Hence, we analyze the interrelatedness of these factors to HPWS in the search of a unifying concept that provides the missing link to these simultaneous relationships. Specifically, we argue that social capital plays a pivotal role by moderating the relationship that HPWS has with technology and flexibility in the manufacturing process.

Most of the research that has focused on HPWS utilization has looked at the different facilitators separately with few studies considering simultaneous multiple factors effects (Larraza-Kintana et al. 2006; Urtasun-Alonso et al. 2014). In this vein, technology and flexibility have been long linked to HR practices usage due to their meaningfulness in the manufacturing process (Gale et al. 2002; Urtasun-Alonso et al. 2014) while social capital has been linked to HPWS utilization by tapping in the available resources created as a result of inter and intra-firm relationships (Leana and Van Buren 1999; Baughn et al. 2011; Cabello-Medina et al. 2011; Chuang et al. 2013). We echo the current literature on factors that explain HPWS utilization by embodying their relationships in the specific context of the Spanish manufacturing industry and highlighting the important role that social capital plays in the relationships between HPWS, technology and flexibility.

More specifically, we focus on external (i.e. interorganizational) social capital and its moderation effect on the expected impact of technology and manufacturing flexibility on HPWS utilization. We argue not only that flexible firms competing in technological intense environments and using computerized production technologies will use HPWS more intensely but also that the degree of HPWS utilization by these firms will be even greater if they tap in external social capital as a result of successful buyer-supplier relationships. Thus, external social capital functions as a channel of organizational learning via which firms can acquire vital information about successful and well-established HR practices (i.e. HPWS) that are deemed critical for these firms.

Our study sheds a new light on the role that social capital plays as an important driver of HPWS utilization by particularly emphasizing the effect that buyer-supplier relationships play as organizational resource emulators. In particular, we provide specific empirical evidence of the moderator role of external social capital in the relationship between HPWS utilization, technology and flexibility in the Spanish manufacturing industry. We believe our contribution will be helpful to both researchers and practitioners seeking to uncover the hidden knowledge behind the value of social capital.

2. Theoretical background and hypotheses development

Factors that promote HPWS utilization in the manufacturing context

HPWS utilization has achieved a high degree of formality in large workplaces in which manufacturing processes are the backbone (Arthur 1994; Larraza-Kintana et al. 2006; Chi and Lin 2011; Urtasun-Alonso et al. 2012) which is why we focus on this well-developed medium. In this vein, our study serves a dual purpose: first, to include the impact of hybrid factors on HPWS utilization in the manufacturing industry and second, to analyze the simultaneous relationship

between internal, external and hybrid factors and HPWS, something which is currently missing in this subject's literature.

The importance of technology as promoting HPWS utilization in the manufacturing process is well documented (Youndt et al. 1996; Larraza-Kintana et al. 2006; Han and Liao 2010; Chi and Lin 2011; Mihail et al. 2013). In its basic form, the concept has been dichotomized into a dual constituent perspective, the production technology and technological intensity of the industry (Lepak et al. 2003; Larraza-Kintana et al. 2006; Chi and Lin 2011; Wagner et al. 2014). Production technology is referred to as the technology which the firm uses to produce goods and services (Larraza-Kintana et al. 2006). There is one central element of this technology type that is instrumental to explain the implementation of HPWS: computers. In this regard, the terminology on computerized technologies encompasses several concepts such as hard- and soft-based advanced manufacturing technology including technologies applied to the aspects of manufacturing and execution process which under the progress of information technology have developed to become an indispensable competitive strategy for manufacturers (Han and Liao 2010).

As per the link between the use of computers in the manufacturing process, in what we refer to as computerized production technology (CPT), and HPWS utilization in the manufacturing context, the dominant argument indicates that the complexity and the technical skills required to run a computerized workplace requires to develop a skilled and motivated workforce. In fact, skilled and motivated workforces are two of the central outcomes associated with the adoption of HPWS (Jiang et al., 2012). Previous literature has linked the implementation of computer-based technologies to high-skilled jobs and complex tasks (Dunne and Troske 1996; Gale et al. 2002; Autor et al. 2003; Ben-Ner and Urtasun 2013). In the same token, CPT has been positively associated with HR practices usually included in the HPWS such as above average pay, rigorous selection, extensive training, developmental performance management, performance- and competency-based rewards as well as employee stock ownership (Han and Liao 2010). In addition, it should considered that task complexity and a skilled workforce often demands an organization of work with high levels of employee participation and group based structures (Gale et al. 2002). This implies that possibly greater employee autonomy will be observed in computerized workplaces, which, if not properly managed, could cause agency problems. Therefore, firms with CPT need to give employees latitude of action but also need to keep them motivated and focused in the completion of the firm goals. HPWS are particularly designed to balance these two goals (Datta et al. 2005; Jiang et al. 2012).

The other technology constituent, the industry's technological intensity is referred to as the relative level of R&D effort and pace of change in key areas of knowledge and technology which both the firm and its competitors contend on a daily basis (Larraza-Kintana et al. 2006). In this matter, Lepak et al. (2003) anticipate that the extent of technological intensity and industry's stability are two factors that influence the relationship between employment mode use and firm performance. As technological intensity of the industry increases (i.e. increasingly complex and dynamic), the industry environment becomes more knowledge-intensive (Hambrick et al. 1995) with firms confronting the need to foster cooperation to promote creativity in their workforce in order to deal with competition and demand shocks (Balkin et al. 2000). HPWS can help firms achieve the necessary cooperation and creativity from their workforce. As noticed by several HR scholars HPWS help improve the abilities of workers, promote motivation and give them latitude of action (Jiang et al. 2012). By increasing workers human capital endowment, HPWS help the firm update its knowledge base necessary to keep the rapid pace of innovation witnessed in technologically intense industries. It also favors the firm's capability to cope with the complexity of the surrounding environment. In addition to that, the implementation of HPWS provides a framework in which a highly skilled workforce finds the motivation and the restrictedness of action that is necessary to release all its creative potential (Larraza-Kintana et al. 2006). As noted before, employee

participation, group structures, higher pay motivation and firm-level incentives, are all practices included as part of the HPWS and positively impact employee motivation and commitment (Jiang et al. 2012). Furthermore, HPWS will facilitate information exchange and cooperation among firm employees, which is understood to be crucial to properly compete in the complex and dynamic environment that firms in high technology sectors face (Collins and Smith 2006). Consistent with these ideas, Larraza-Kintana et al. (2006) discover that the impact of HPWS on firm's performance is particularly strong in technologically intense environments.

In sum, based on the arguments above, we expect that technology with its constituents (CPT and intensity) would have a significant effect on HPWS utilization in the manufacturing process. This expectation is summarized in our first two hypotheses.

Hypothesis 1. CPT is positively associated with HPWS utilization.

Hypothesis 2. Technological intensity is positively associated with HPWS utilization.

Another crucial factor that favors the implementation of HPWS is manufacturing flexibility, or the firm's capacity and adaptability to react to changes in the external environment. Researchers consider manufacturing flexibility as a key ingredient of firm's competitive advantage (Seidmann 1993; Berry and Martha 1999; Zhang et al. 2003; Salvador et al. 2007; Urtasun-Alonso et al. 2014) with the term evolving into a complex, multidimensional concept recognized for its essentiality in an efficient production process. In one of the earliest definitions of the term coined by Hayes and Wheelwright in 1984 and captured by Zhang et al. (2003), manufacturing flexibility is viewed as a trade-off between efficiency in production and dependability in the marketplace. The same authors agree that manufacturing flexibility enables firms to produce the needed quantity of high-quality products quickly and efficiently through set-up time reduction, cellular manufacturing layouts, preventive maintenance, quality improvement efforts, and dependable suppliers. Firm flexibility relates with the implementation of HPWS because HPWS include several practices such as appropriate staffing, application of compensation schemes and training procedures that enhance the ability of the firm to withstand environmental changes (Urtasun-Alonso et al. 2014). In fact, it has been shown that there exists a positive relationship between manufacturing flexibility and HPWS (Cordero 1997; Zhang et al. 2003; Urtasun-Alonso et al. 2014). Hence, we expect manufacturing flexibility to favor the implementation of HPWS. Our third hypothesis reflects this expectation.

Hypothesis 3. Manufacturing flexibility is positively associated with HPWS utilization.

The importance of external social capital

Social capital has been conceptualized as the aggregate of the actual and potential resources embedded within, available through and derived from the relationships possessed by an individual or social unit within or encompassing various inter-firm organizations (Nahapiet and Ghoshal 1998; Tsai and Goshal 1998; Inkpen and Tsang 2005). These relationships which Brass et al. (2004) define as a set of nodes and ties representing a connection, encompass a firm's set of relationships, both horizontal and vertical with other organizations - be they suppliers, customers, competitors, or other entities – including relationships across industries and countries (Gulati et al. 2000). In this context, social capital has a strategic importance in increasing the firm's competitive advantage at a given industry as it provides key information and resources enabling the firm to successfully enter new markets, acquire new product technologies and utilize innovative HR practices.

The concept of social capital is dichotomized between the social relations that exist within the organization (i.e. organizational social capital) and those that exist in the interorganizational dimension. In this study, we focus on the social capital accumulated as a result of buyer-supplier

relationships, an essential part of the supply chain, and its effect on HPWS utilization. We motivate our choice of focusing solely on buyer-supplier relationships due to our unique context (i.e. Spanish manufacturing industry) and specific methodology (i.e. questionnaire), in addition to the well-proven relationship between this type of social capital and HPWS use. In fact, the relationship between social capital and buyer-supplier relationship has seen extensive academia coverage (Carey et al. 2011; Carey and Lawson 2011; Hughes and Perrons 2011; Roden and Lawson 2014) with most agreeing that social capital is the proper lens to examine the contingent effect of buyer-supplier relationship adaptations by re-shaping itself when firms consolidate their inter-organizational ties. Additionally, researches have linked both internal and external (i.e. intra- and interorganizational) social capital to the utilization of HR practices (Leana and Van Buren 1999; Erickson and Jacoby 2003, Leung 2003, Gittell et al. 2007; Baughn et al. 2011; Cabello-Medina et al. 2011; Chen et al. 2011; Chuang et al. 2013). In particular, managerial participation in both external cross-industry networks and internal networks of multi-unit firms positively affects the adoption of HPWS (Erickson and Jacoby 2003). Additionally, Leung (2003) observes how buyer-supplier relationships affect internal HR practices' implementation both directly (e.g. partnership development through knowledge sharing) and indirectly (e.g. training and cultural change). Thus, we expect that a firm, whose social capital is established as a result of buyer-supplier relationships, would have an increased chance of utilizing HR practices and in our case, HPWS. This logic is highlighted by Hypothesis 4.

Hypothesis 4. External social capital is positively associated with HPWS utilization.

The pivotal role of external social capital

As seen thus far, the literature on manufacturing industries successfully relates external social capital with the concepts of HPWS, technology and manufacturing flexibility, albeit doing so by analyzing separately each relationship. We argue that social capital represented by buyer-supplier relationships is an important and omnipresent medium that enables the manufacturing firm to successfully implement and utilize HPWS when CPT and flexible manufacturing processes require so. Knowledge gained through the network of connections that makes up social capital, allows firms to understand the important complementarities that exists between the organization of production, production technology and advanced people management practices, as well as their superior performance in technologically intense industries (Garcia-Olaverri et al. 2006; Larraza-Kintana et al. 2006). Supporting this view, Yan et al. (2013) have recently developed a theoretical framework in which social networks act as moderators in relation to the firm's HR strategy. This moderation role enables us to treat external social capital as the nexus that enhances the relationship between technology, manufacturing flexibility and HPWS utilization.

As previously stated, the skilled, motivated and flexible workforce that results from the use of HPWS fits well with the requirements of firms that have adopted CPT (Han and Liao 2010; Ben-Ner and Urtasun 2013). Additionally, studies have revealed a positive relationship between external social capital and HPWS utilization (Erickson and Jacoby 2003; Leung 2003). Although never empirically tested before by the academia, the existing studies on the separate relationships between these concepts pave the way for one of the theoretical contributions of this study by specifically considering external social capital of buyer-supplier relationships as positively associated to the relationship between CPT and HPWS utilization. Our expectation rests on the previously presented argument that buyer-supplier relationships provide the firm with an information channel to learn about effective management practices. If HPWS are suited for firms that have implemented CPT, such knowledge is most likely to be gained by firms with a strong external social capital. Thus, the positive relationship between CPT and HPWS will be stronger if the firm has a solid external social capital. The following hypothesis captures this idea.

Hypothesis 5. The positive association between firm's CPT and HPWS utilization will be stronger for firms with high external social capital.

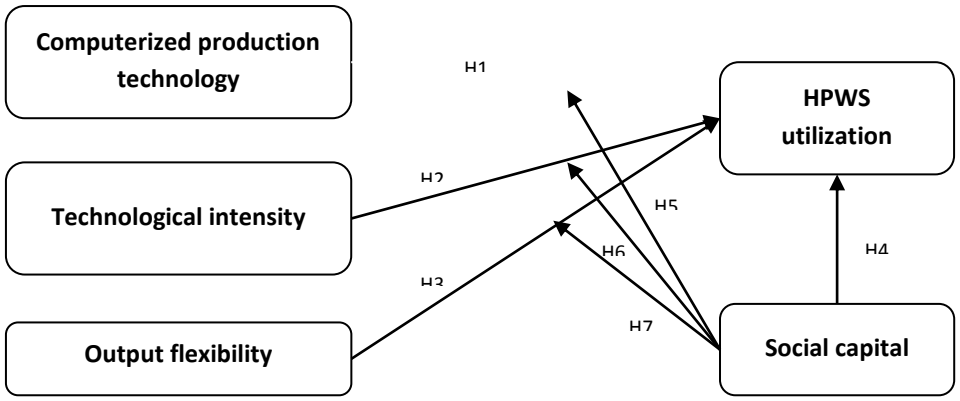
Another of our main theoretical contributions in this study is the moderating role that social capital plays in the relationship established between HPWS utilization and the technological intensity of the industry in which the firm operates. To this regard, Yli-Renko et al. (2001) show how the social interaction and network ties dimension of social capital in technologically intense industries significantly impact key customer relationships on knowledge acquisition and exploitation. Similarly but more related to production technology, Landry et al. (2002) show the significant impact that business network assets (i.e. clients, suppliers, etc.), relational assets (i.e. the degree of acquaintance between business network assets) and other structural forms of social capital have as determinants to firm's innovation. Further on this line and more apt to our research context, Delgado-Verde et al. (2011) successfully relate the role of external social capital with technological innovation in the Spanish manufacturing industry, emphasizing the critical relationship that product and process innovation have with social and relational capital accumulated as a result of interorganizational relationships among the high and medium-high technology firms with their customers and suppliers. Similar to the case of CPT, the accurateness of using HPWS in technologically intense industries will be more salient for firms with strong external social capital. Therefore, we expect that external social capital will positively moderate the relationship between technological intensity of the industry and HPWS utilization. Hence we posit:

Hypothesis 6. The positive association between the industry's technological intensity and HPWS utilization will be stronger for firms with high external social capital.

Several studies have highlighted the relationship between external social capital and manufacturing flexibility (Krause et al. 2007; Koufteros et al. 2007; Matthews and Marzec 2011). Specifically, Krause et al (2007) find a significant and positive relationship between buying firms' commitments to long-term relationships with key suppliers and buying-firms' performance improvements such as manufacturing flexibility. However, other studies reveal that the relationship between external social capital and flexibility is not always a positive one (Koufteros et al. 2007). As seen previously, extant literature positively associates flexibility with HPWS utilization. Despite conflicting results and knowing that the starting point in the study between external social capital and flexibility is a positive relationship we believe, based on the same arguments exposed in the preceding paragraphs, that this double relationship between external social capital, flexibility and HPWS utilization can be unified under the presumption of the moderating role that interorganizational social capital plays in the relationship between manufacturing flexibility and HPWS utilization. Consequently, we advance the following final hypothesis.

Hypothesis 7. The positive association between the firms's manufacturing flexibility and HPWS utilization will be stronger for firms with high external social. Figure I summarizes the conceptual model implied by the hypotheses development.

Figure I. Conceptual model for hypotheses' development



3. Methods

3.1 Sample and research process

The hypotheses are tested using a proprietary database of 401 plants in diverse Spanish manufacturing industries, each with over 50 employees. To ensure the representativeness and randomness of this sample, establishments were selected through a process of stratification based on size and industry from a total population on 6,013 Spanish manufacturing firms. For each of these establishments, primary information was obtained through a series of in-depth personal interviews conducted in 2006 by a person knowledgeable in management issues and answered, in all cases, by a company manager (general manager, production manager or human resources manager). No multiple production sites of the same company were interviewed at any stage. The interviews where arranged by telephone well in advance to give time to the interviewees (e.g. company managers) to answer a questionnaire which covered a number of important issues concerning production, IT, quality, HR practices, internal organization, relationships with suppliers and customers, as well as a series of questions on general information about the plant. The interview process resulted in 965 valid questionnaires which represent about 16.05 percent of the total population. For more details on the questionnaire and overall sampling methodology, please refer to Huerta Arribas et al. (2003).

3.2 Variable measurement

Dependent variable

We ascribe to the view that our chosen dependent variable, the HPWS Index, is based on the existing HPWS literature (Becker and Huselid 1998; Pfeffer 1998; Way 2002; Larraza-Kintana et al. 2006; Kehoe and Wright 2013; Urtasun-Alonso et al. 2014) which stresses that six advanced HR practices possess the potential to improve the firm's performance by developing a knowledge-based committed workforce including: (1) Staffing process; (2) Formal training; (3) Compensation of high-performance practices; (4) Evaluation of performance; (5) Knowledge-based communication and (6) Participation opportunities. Thus, HPWS Index is a concept we use to construct a HPWS-based variable as the average of all the above-mentioned HR practices. Deductively, if a firm has deployed these HR practices in its organizational activity, chances are it is actively utilizing HPWS.

We proceed by analyzing each of these practices from both a theoretical background and our research's empirical perspective.

Staffing process. Previous research suggests that an appropriate staffing process can improve work productivity by specifying in advance the required skills, behaviors and attitudes that are being sought in potential job-seeking candidates (Pfeffer 1998; Larraza-Kintana et al. 2006). Since according to Larraza-Kintana et al. (2006), potential candidates' knowledge, learning capacity, interpersonal characteristics and even personality features are considered as key criteria in the selection of the staffing procedure, we approach each firm's staffing process in a similar way. In addition, the relevancy of the staffing source including hiring agencies, temporary work agencies and public institutions of employment is deemed crucial for the proper functionality of the staffing process within a legal framework. The questionnaire of our study includes several items which aim at isolating the above-mentioned factors that affect a staffing selection. These include: (1) a variety of selection tools during the staffing process such as interviews, personality and ability tests defined by variable STAFF1; (2) various selection criteria which account for employees knowledge and learning capacity, interpersonal skills and personality features defined by variable STAFF2 and (3) relevance of several recruitment sources including Spanish National Employment Institute, staffing firms and temporary work agencies defined by variable STAFF3. The answers for variables STAFF1 and STAFF2 were given on a 5-point Likert scale (1 = none/very low, totally disagree; 5 = very high, totally agree) while those for variable STAFF3 were given on a 5-point Likert scale (0 = not important; 5 = extremely important). Normalized variables rated on a [0, 1] interval for STAFF1, STAFF2 and STAFF3 were obtained by dividing each original variable by its maximum value. We then proceed by generating a final variable (STAFFt) as the mean of previously normalized variables.

Formal training. Formal training can have a positive impact on employee's skills, behavior, motivation and output. It can further develop these traits and motivate the employees to apply them in their work-related activities, thus enhancing the firm's ability to gain access to a high-performance workforce (Way 2002). Based on this argument, we follow Urtasun-Alonso et al. (2014) in defining extensive training as both an investment in hours and money spent (TRAIN1) as well as the yearly average of formal training that the employee receives by the firm (TRAIN2). The answers for variable TRAIN1 were given on a 5-point Likert scale (1 = none or very low; 5 = very high) while those for variable TRAIN2 where given as an interval of hourly numbers. Normalized variables rated on a [0, 1] interval for TRAIN1 and TRAIN2 were obtained by dividing each original variable by its maximum value. We then proceed by generating a final variable (TRAINt) as the mean of previously normalized variables..

Compensation of high-performance practices. Compensation practices have been identified as a key player in the relationship between firm performance and HPWS (Becker and Huselid 1998). These practices can enhance employees' retention and motivation to apply their skills and commit to the task at hand (Way 2002). With this in mind, the variables that make up this HR practice are constructed to capture the firm's compensation policy (Larraza-Kintana et al. 2006) in which we include: (1) wages paid to employees compared to firm's direct competitors (COMP1); (2) percentage of employee's wage linked to firm's performance (COMP2) and (3) formal performance evaluation linked to incentives or affecting wages (COMP3). The answers for all three variables were given on a 5-point Likert scale with slight differences for each variable (COMP1: 1 = extremely lower; 5 = extremely higher), (COMP2: 1 = none or very low; 5 = very high), (COMP3: 1 = totally disagree; 5 = totally agree). Normalized variables rated on a [0, 1] interval for COMP1, COMP2 and COMP3 were obtained by dividing each original variable by its maximum value. We then proceed by generating a final variable (COMPt) as the mean of previously normalized variables.

Evaluation of performance. We construct this variable (EVAL) based on both Way (2002) and Urtasun-Alonso et al. (2014), who define performance evaluation as a measure of employee's productivity. The answers for this variable were given on a 5-point Likert scale ranging from 1 = totally disagree to 5 = totally agree. We then produce a final variable EVALt by normalizing the EVAL variable to a [0, 1] interval.

Knowledge-based communication. Way (2002) considers communication as a formal process in which employees provide their opinions and/or express their views. This perspective is crucial as it enables information-sharing between employees which itself leads to knowledge acquisition. However, communication can also mean a received regular up-to-date information regarding firm's performance (Urtasun-Alonso et al. 2014) which is the basis for the construction of our variable (INFOR1) representing this measure. The questionnaire answers for this variable were given on a 5-point Likert scale (1 = totally disagree; 5 = totally agree). We then produce a final variable INFORt by normalizing the INFOR1 item to a [0, 1] interval.

Participation opportunities. Employee participatory programs which include quality circles, quality of work life programs and work management participation platforms are based on multiple team work (Becker and Huselid 1998; Way 2002). Based on this assumption and following Larraza-Kintana et al. (2006) as well as Urtasun-Alonso et al. (2014), we construct our variable which includes: (1) employee self-dependence in task selection and performance (PART1) and (2) participatory, team-style meetings between employees (PART2). The answers for variable PART1 were given on a 5-point Likert scale (1 = none or very low; 5 = very high) while those for variable PART2 where given on another 5-point Likert scale (1 = totally disagree; 5 = totally agree). Normalized variables rated on a [0, 1] interval were obtained by dividing each original variable by its maximum value. We then proceed by generating a final variable (PARTt) as the mean of previously normalized variables. Finally, we generate the HPWS Index variable as a summary of the six above-mentioned HR variables, STAFFt, TRAINt, COMPt, EVALt, INFORt and PARTt, that gives the same weight to all the included HR practices. A Cronbach's alpha of .76 verifies the internal consistency of the HPWS Index.

Independent variables

Following our hypotheses and based on the existing literature cited in the theoretical part of this study, we include four independent variables in our analysis: (1) Computerized production technology (CPT); (2) Technological intensity (Intensity) (3) Output flexibility (Flexibility) and (4) Social capital (SC). We use the percentage of workers who employ computer equipment in their daily work activities for CPT measurement. The use of computers by employees is a common measure to approach the use of advanced technologies in firms as well as to capture the extent of influence that they exercise on the tasks of employees (Autor et al. 2003). In this study, the computer is used to access both communication channels (i.e. intranet, e-mail) within the firm and software necessary to run automation programs of the manufacturing process.

Similar to other authors (e.g. Larraza-Kintana et al. 2006), we capture the *technological intensity of the industry* through a dummy variable that takes a value of 1 if the plant belongs to an industry of high or medium-high technological intensity and 0 if the plant belongs to an industry of low or medium-low technological intensity. For this purpose, industrial sectors were classified as high-tech, mid-tech or low-tech according to the classification of the Organization for Economic Cooperation and Development (OECD) and the 'Instituto Nacional de Estadística' (INE). With regards to the measurement of *manufacturing flexibility*, we apply a procedure similar to that used by Urtasun-Alonso et al. (2014) and construct a well-known variable considered one of the 'first-order' flexibility dimensions (Suarez et al. 1996) in terms of (product) mix flexibility called output flexibility and defined as the average of three variables including: (1) the existence of a high

number of product references manufactured by the plant (Flexibility1); (2) the fact that products manufactured at the plant differ substantially from each-other (Flexibility2) and (3) the ease with which the "mix" of products manufactured in the plant can be changed (Flexibility3). Table I summarizes the information regarding all independent variables and their analysis.

Table I. Independent variables of the analysis

Survey item	Variable name	Type of response	% of frequency
Computerized production technology		*Scaled Interval*	
• Percentage of computer use by each employee to access work-related info (software, communication, browsing, etc.)	CPT		0.64 (mean)
Technological intensity		*Dummy variable*	
• Industry sector codification according to technological intensity	Intensity		
		0 'low or medium low'	71.32
		1 'high or medium high'	28.68
Output flexibility		*5-point scale*	
• There exists a high number of product references manufactured by the plant	Flexibility1		
		1 'totally disagree'	3.99
		2 'disagree'	9.48
		3 'neither agree nor disagree'	6.73
		4 'agree'	52.62
		5 'totally agree'	27.18
• Products manufactured at the plant differ substantially from each-other	Flexibility2		
		1 'totally disagree'	7.00
		2 'disagree'	24.25
		3 'neither agree nor disagree'	15.00
		4 'agree'	43.00
		5 'in all cases'	10.75
• The "mix" of products (mixture) manufactured in the plant can be easily changed	Flexibility3		
		1 'totally disagree'	5.50
		2 'disagree'	16.25
		3 'neither agree nor disagree'	18.00
		4 'agree'	52.00
		5 'totally agree'	8.25

(continued)

Table I. Independent variables of the analysis (cont.)

Survey item	Variable name	Type of response	% of frequency
Social capital		*5-point scale*	
• The relationship with suppliers is constantly evaluated via auditing measures	SC1		
		1 'in no case'	19.75
		2 'in a minority of cases'	10.75
		3 'in half of the cases'	7.50
		4 'in the majority of the cases'	25.75
		5 'in all cases'	36.25
• Collaboration with suppliers on technical issues related to production	SC2		
		1 'in no case'	7.07
		2 'in a minority of cases'	10.10
		3 'in half of the cases'	15.91
		4 'in the majority of the cases'	32.07
		5 'in all cases'	34.85
• Established systems of quality agreements with suppliers	SC3		
		1 'in no case'	14.32
		2 'in a minority of cases'	10.23
		3 'in half of the cases'	11.00
		4 'in the majority of the cases'	30.69
		5 'in all cases'	33.76
• The relationship with buyers is constantly evaluated via auditing measures	SC4		
		1 'in no case'	17.54
		2 'in a minority of cases'	14.54
		3 'in half of the cases'	11.53
		4 'in the majority of the cases'	21.80
		5 'in all cases'	34.59
• Collaboration with buyers on technical issues related to production	SC5		
		1 'in no case'	11.84
		2 'in a minority of cases'	9.32
		3 'in half of the cases'	11.08
		4 'in the majority of the cases'	30.73
		5 'in all cases'	37.03
• Established systems of quality agreements with buyers	SC6		
		1 'in no case'	19.04
		2 'in a minority of cases'	9.90
		3 'in half of the cases'	13.96
		4 'in the majority of the cases'	25.89
		5 'in all cases'	31.22

Number of observations = 401. Some variables have missing observations: 1, SC1; 5, SC2; 10, SC3; 2, SC4; 4, SC5; 7, SC6; 14, CPT; 1, Flexibility2; 1, Flexibility3

We follow extant literature (Landry et al. 2002, Delgado-Verde et al. 2011), to capture external social capital and measure the extent to which a firm develops collaboration mechanisms with its buyers and suppliers and construct the SC variable as the average of the responses to questions related to (1) the evaluation of the firm's relationship with its suppliers and buyers via auditing measures (SC1 & SC4); (2) the collaboration with suppliers and buyers on technical issues related to production (SC2 & SC5) and (3) established systems of quality agreements with suppliers and buyers (SC3 & SC6). Principal component analysis of the six survey items (SC1 – SC6) shows a high internal consistency of the constructed SC variable as observed in Table II.

Table II. Principal Component Analysis

	PC 1:
Survey items	
1. The relationship with suppliers is constantly evaluated via auditing measures	0.76
2. Collaboration with suppliers on technical issues related to production	0.76
3. Established systems of quality agreements with suppliers	0.75
4. The relationship with buyers is constantly evaluated via auditing measures	0.76
5. Collaboration with buyers on technical issues related to production	0.76
6. Established systems of quality agreements with buyers	0.82

Number of observations = 401. Factor loadings after varimax rotation.

Control variables

According to Chi and Lin (2010), firms with superior resources are more likely to pursue unique strategies that competitors find difficult to imitate, meaning that large firms have greater resource possibilities to allow them to execute more elaborated HR practices, including the utilization of HPWS. Hence, we include plant *size* as a control variable rated on a 4-point scale containing the quartiles of the number of employees working in the plant during the year 2005. We also control for the *multinational* effect to count for the effect that belonging to a larger organizational structure has on the plant itself by measuring whether the organization where the plant belongs has established or not production plants in foreign countries. Multinational is a dummy variable taking a value of 1 if the plant belongs to a multinational company and 0 if it does not. Finally, we also count for *age*, which corresponds to the year in which the plant is founded and which we measure as a difference from the year 2006 chosen as our base reference year.

3. **Results**

Table III provides descriptive statistics and Pearson correlations among the variables used in the regression analysis. The number of observations varies across variables because of missing observations in the various items of the used questionnaire. Several significant and positive correlations are observed in the analysis. Specifically, column 4 shows that HPWS is significant and positively correlated with CPT, technological intensity, output flexibility and social capital. The correlation is more significant between HPWS and social capital ($r = .40$, $p < .001$) followed by HPWS and CPT ($r = .35$, $p < .001$). Thus, it appears that firms that use advanced HR practices more intensely are also firms that tend to accumulate external social capital, use CPT more intensely, belong to a technologically intense industry and exhibit a higher degree of flexibility during the manufacturing process. Besides, among our independent variables, CPT and social capital show the highest positive correlation ($r = .37$, $p < .001$). Additionally, the correlation between CPT and technological intensity is low ($r = .17$, $p < .001$) meaning that these two variables measure different dimensions of technology which confirms the constituents of this concept as proposed in the theoretical overview. We also observe a negative correlation between plants that belong to multinational firms and HPWS, explainable by the fact that larger organizations and their own HR structure may not necessarily be related to HPWS.

Table III. Means, Standard Deviations and Pearson correlations

Variable	Obs.	Mean	s.d.	1	2	3	4	5	6	7	8
1. Age	395	41.47	30.36								
2. Size	401	2.43	1.13	0.12*							
3. Multinational	399	1.72	0.69	-0.26***	-						
4. HPWS Index	323	3.29	0.68	-	-	-0.11*					
5. CPT	383	3.60	3.28	-	-	-	0.35***				
6. Intensity	401	0.29	0.45	-	-	-	0.13*	0.17***			
7. Flexibility	399	3.52	0.81	-	-	-0.10*	0.14**	0.10*	-		
8. SC	383	3.59	1.10	-	0.19***	-0.22***	0.40***	0.37***	0.25***	0.22***	

Only significant correlations are reported.
*p < 0.05; **p < 0.01; ***p < 0.001

The hypotheses of this study are tested using linear regression analysis (OLS) by applying several models including the control variables (age, size, multinational), the main effect variables (CPT, Intensity, Flexibility, SC) and the interaction variables (CPT x SC, Intensity x SC, Flexibility x SC). Additionally, we perform Harman's one-factor test to address concerns over common method variance (henceforth, CMV) as described by Podsakoff et al. (2003). The unrotated factor analysis of the dependent, independent and moderating variables reveals 4 factors with eigenvalues greater than one and the variance explained by the first factor is around 40%. This coupled with the fact the respondents to our questionnaire were chosen randomly and that anonymity was strictly observed, increases our confidence that CMV is not present in our data. The results of the regression analysis are summarized in Table IV.

Table IV. Results of Linear Regression Analyses (OLS)

	HPWS Index					
Variables	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Controls						
Age	-0.000089	-0.000090	0.000126	-0.000051	-0.000126	0.0000870
Size	0.0477	0.0294	0.0420	0.0309	0.0301	0.0425
Multinational	-0.150†	-0.054	-0.0606	-0.0480	-0.0551	-0.0528
Main effects						
CPT		0.045***	0.041***	0.044***	0.041**	0.037**
Intensity		0.0194	0.0119	-0.0044	0.0245	0.0034
Flexibility		0.0180	-0.00656	0.0174	0.0297	0.0059
SC		0.184***	0.184***	0.187***	0.188***	0.191***
Two-way interactions						
CPT x SC			0.0392**			0.0350*
Intensity x SC				0.0766		0.0447
Flexibility x SC					0.0738†	0.0575
Model statistics						
Root MSE	.664	0.592	0.585	0.593	0.591	0.585
R^2	.022	0.214	0.236	0.215	0.222	0.243
Adjusted R^2	.012	0.195	0.215	0.193	0.200	0.217
F	2.70	13.86	14.72	11.86	12.55	11.41
N	319	303	301	301	301	301

Standardized coefficients are reported.
† $p < 0.1$ * $p < .05$ ** $p < .01$ *** $p < .001$

As a first step, we enter in the regression model 1 just the control variables in which the presence of the multinational variable showed a statistically significant and negative association with HPWS index. As a second step observed in model 2, we included the main effects which reasonably explain the variance share in HPWS index and make a significant contribution over and above model 1. Looking at the main effects, Hypothesis 1 is supported by the positive and significant effect of the CPT on HPWS. Results of the main effects' regression analysis (model 2) show that intensity has no significant effect on HPWS; same applies for flexibility rejecting both hypotheses 2 and 3. Hypothesis 4 is supported by the positive and significant value of the relationship between HPWS and social capital. As a third step, we separately entered the two-way interaction terms to test our contingency hypotheses seen in models 3, 4 and 5. In order to avoid the multicollinearity issue in these regression models and specifically between the two-way interaction items, we mean center all the interaction variables and applied multicollinearity diagnosis based on a calculation of the Variance Inflation Factor (VIF) of each interacted variable which in our case gives a maximum value of 1.16, being well below the critical value of 4.0 observed by Hair et al. (1998). Supporting Hypothesis 5, the results in model 3 show that the interaction between the CPT and social capital has a statistically significant and positive effect on HPWS while model 4 shows that the interaction between the Intensity and SC is indeed positive but not statistically significant rejecting Hypothesis 6. On the other hand, results in model 5, show that the interaction between flexibility and social capital has a statistically significant, and positive effect on HPWS, supporting Hypothesis 7.

As a fourth and final step, we enter all the variables of interest including control variables, main effects and interaction terms into a linear regression analysis. Model 6 results show that from all the variables involved in this regression analysis, only two main effects have a statistically significant and positive relationship with the HPWS index: CPT and SC. In addition, the two-way interaction variable between CPT and SC is again deemed positively significant in its relation to the HPWS index. Also, it can be observed that the positive and significant relationship of both CPT and SC

with the HPWS Index is present in all six models of the regression analysis. To posit further interpretations of our analysis, we follow the standard procedure and plot the interaction effects for two levels of social capital, defining the low level as minus one standard deviation from the mean and the high level as plus one standard deviation from the mean. Thus, we plot the relationships of HPWS Index with CPT and output flexibility (Flexibility) variables, each for low and high levels of social capital.

Figure II (a, b) show the results which we obtain by performing a simple plot analysis for each regression line to test whether the equation's slope is significantly different from zero. We omit the inclusion of technological intensity in the plot analysis since its significance is not present in the regression models. Specifically, figures are based on models 3 [figure II (a)] and 5 [figure II (b)] in Table IV. The plots further reiterate the moderating role of social capital for both CPT and output flexibility. In particular, figure II (a) shows that the relationship between HPWS and CPT is positive and significant for both high and low social capital but the positive effect is stronger for high social capital, thus confirming the support for Hypothesis 5.

Figure II (a). Moderating effects of Strategic social capital on the HPWS – CPT relationship

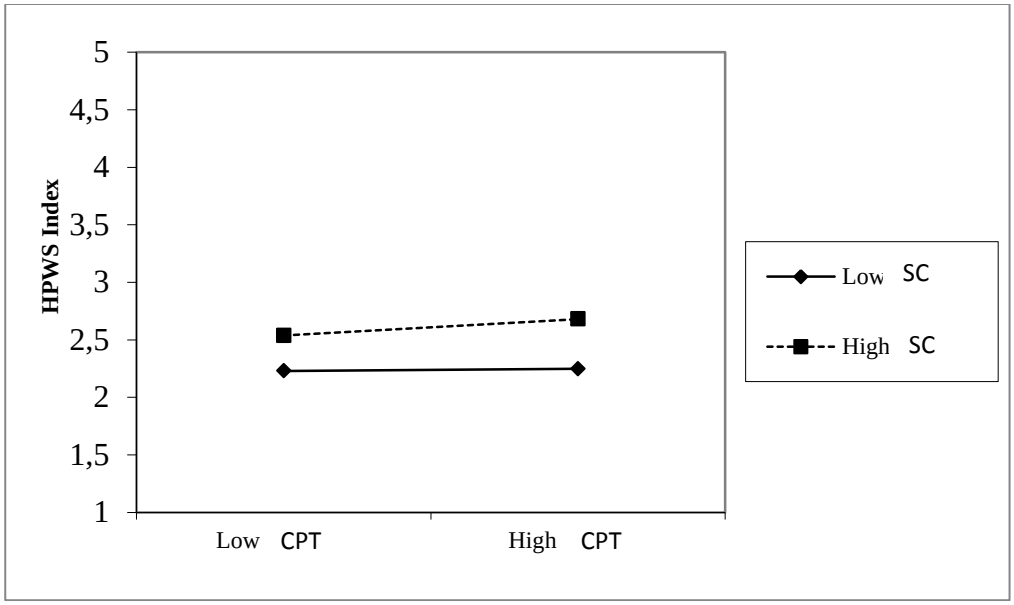
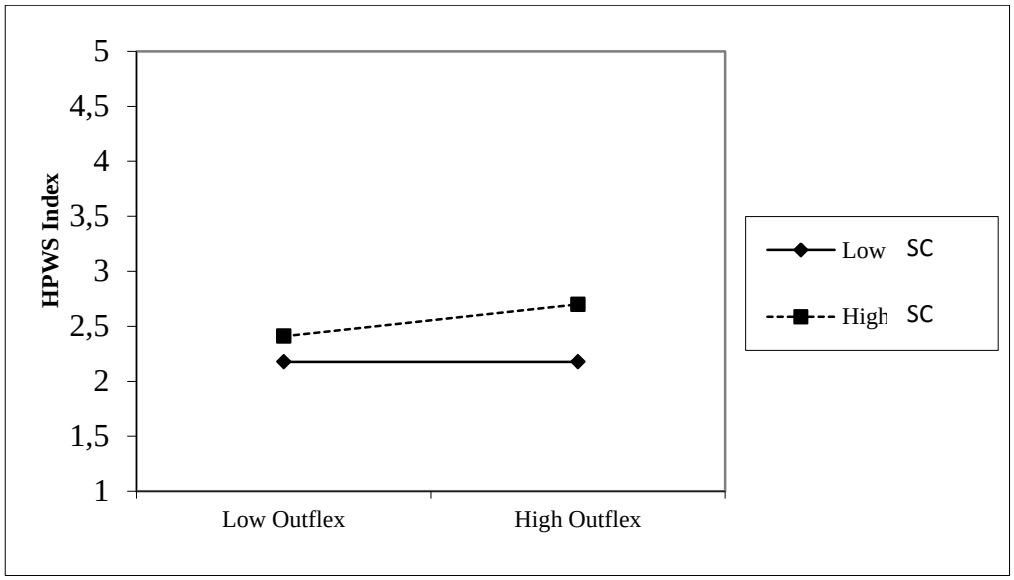


Figure II (b) shows that the relationship between HPWS and output flexibility is positive and significant for high social capital but neutral and not significant for low social capital confirming the support for Hypothesis 7.

Figure II (b). Moderating effects of social capital (SC) on the HPWS – output flexibility relationship



4. Discussion

The present study seeks to enlarge our knowledge about the factors that facilitate HPWS utilization, with a particular focus on the role of external social capital as an element that not only favors the use of HPWS, but also enhances the connection between technology and flexibility with HPWS. The study results confirm the importance that external social capital has on HPWS utilization and in particular for firms with CPT and flexible manufacturing processes. In this vein, they support the role of interorganizational social capital as a medium that allows firms to learn about HR practices that may benefit their performance. However, the effect of the technology constituents on HPWS utilization does show some variation. In fact CPT's positive influence with HPWS utilization shows the usefulness of computers in the production process and their positive association with advanced HR practices. However, the individual effects of technological intensity of the industry and manufacturing flexibility on HPWS as seen by the literature (Larraza-Kintana et al. 2006; Urtasun-Alonso et al. 2014), as well as the interaction effect of technological intensity with external social capital, are not significant. A possible explanation for this result may rely on the fact that increasingly more firms across industries, whether intensive or not, are sorting to HPWS utilization in the wake of their popularity. Additionally, the effectiveness that has been attributed to these advanced HR practices suggests that in some cases HPWS utilization may be driven not only by efficiency considerations but by management fads or simply by imitation. The extent to which interorganizational social capital contributes to disseminate these fads is a question that may lay critical foundations for future research. The study results also suggest a complementary effect among all the workplace practices studied. Indeed, we confirm that the positive effect of CPT and manufacturing flexibility on HPWS utilization is enhanced each time firms accumulate external social capital as a result of buyer-supplier relationships. As far as manufacturing flexibility is concerned, we believe the lack of significance may also be due to the type of flexibility used in our analysis (i.e. mix flexibility) and that a combination of other flexibility types (e.g. volume, new product, etc.) could yield different results.

While our results successfully relate to other empirical findings of the current literature, in terms of external social capital relationship with HPWS, technology and flexibility (Yli-Renko et al. 2001; Krause et al. 2007; Delgado-Verde et al. 2011; Chuang et al. 2013), we depart from the mainstream by combining these concepts under a single conceptual framework and apply them in an empirical setting. In this vein, the paper's theoretical contribution resides in its ability to demonstrate the

pivotal role that external social capital has on HPWS, technology and flexibility. As such, this study is one of the first attempting to explore the moderating role of external social capital on the HPWS relationship with CPT and manufacturing flexibility, with results showing that there exist different patterns of these relationships at plant level. The omnipresent effect of external social capital on HPWS utilization throughout all regression models seems to stress the idea that firms use HPWS more intensely if they have actively accumulated this interorganizational social capital from its buyer-supplier collaborations and when the firm's CPT and manufacturing flexibility infrastructure guarantee an effective production process. On the practical viewpoint, the paper reveals the importance of external social capital in the Spanish manufacturing industry by showing how its embodiment in buyer-supplier relationships may allow firms to better understand the context in which HPWS are more likely to be useful. In this context, interorganizational social capital allows firms to reach that knowledge and consequently the use of HPWS in firms with computerized manufacturing technologies is greater when firms have accumulated social capital via buyer-suppliers collaborations.

Suggesting benefits from social capital accumulation, our results attest that social interdependences among firms can foster management advanced practices. In particular, we find that interorganizational social capital plays an important role as diffuser of HPWS. This result holds evident managerial implications for practice. First, to the extent that positive externalities, in the form of experience and information sharing, can arise from interorganizational networks, there may be an incentive for firms to network. Therefore, if there are positive spillovers associated with interorganizational networking, managers should focus their attention on building solid networks of relationships with other organizations. Second, when networking with other firms, a symbiotic type of relationship that develops intangible learning capabilities stands out as a particularly valuable way of interacting with other firms. Building a solid network of relationships with other organizations may become a valuable channel to obtain key information for business success. Finally, in today's' competitive and complex business environment where firms need to cooperate more than ever, firms should start seeing each other as potential cooperators rather than simple competitors and develop strategies that could generate more value for all.

Despite the given explanations, our study is not free of limitations. First, the cross-sectional nature of our database leaves open the possibility of causality relationship exploration between the variables of interest which means that any causal interpretation should be cautious and properly motivated. This is the reasoning behind our choice to model the hypotheses based on associations rather than variable influence over each-other, avoiding any reverse causality ambiguity on the matter. Another problem of the cross-sectional data is its failure in capturing the dynamic play between HPWS and strategic social capital which is the base relationship for all proposed interactions. A suitable option that would pave the way to a more clear causality view could be the use of a longitudinal analysis which unfortunately was unavailable at the time of our research. Second, the study is conducted in the Spanish manufacturing industry context, hence aims to generalize its results by explaining the logic behind the coexistence of HPWS and external social capital on a same conceptual level should be carefully treated and could be further strengthened by other country-level research. Third, our study approach fails to consider the internal synergic mechanisms and the integration of HR practices (Martín-Alcázar et al. 2005). Future analysis of the synergic integration of the HRM elements could be made possible by the implementation of the configurational perspective which enables the study of the multidimensionality of these elements. Additionally, the influence of environmental factors such as social and institutional conditioning analyzed in the contextual perspective could further provide solidity to our analysis. Finally, we only were able to identify whether the firm has a more or less accumulated social capital via its buyer-supplier relationships. However, we fail to capture other potentially relevant characteristics of social capital (e.g. structural, relational and cognitive), the number of firms yielding social capital,

or simply the existence of social capital as a result of relationships with neither buyers nor suppliers (e.g. firms in the same geographic location, competitors). In this sense, this research could be expanded by looking at the role of these social capital characteristics may play in HPWS utilization.

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