Flexibility and Innovation

Moderator Effects of Cooperation and Dynamism

Angel Martínez-Sánchez[a] (*), Silvia Abella-Garcés[b], María-José Vela-Jiménez[c] & Sophie Gorgemans[d]
University of Zaragoza (Spain)
[a] (*author for correspondence) Departamento de Dirección y Organización de Empresas. Escuela de Ingeniería y Arquitectura. Zaragoza. SPAIN. anmarzan@unizar.es
[b] Departamento de Dirección y Organización de Empresas. Facultad de Ciencias de la Salud y del Deporte. Huesca. SPAIN. sabella@unizar.es
[c] Departamento de Dirección y Organización de Empresas. Facultad de Economía y Empresa. Zaragoza. SPAIN. mjvela@unizar.es
[d] Dirección y Organización de Empresas. Escuela de Ingeniería y Arquitectura. Zaragoza. SPAIN. sgorge@unizar.es

Abstract

This paper analyzes the relationship between external human resource flexibility and innovation in a sample of Spanish manufacturing firms. Innovative firms have developed a greater internal flexibility than non-innovative firms. Logit and linear regressions test the moderator effects of inter-organizational technology cooperation and environmental (market) dynamism in the external flexibility-innovation relationship.

Introduction

Global competition and expanding customer expectations create nowadays the need for more and faster innovation. The literature indicates there are a few important determinants or influencing factors of the firm´s innovation capacity. A firm's capacity to innovate is the ability to adopt or implement new ideas, processes, or products successfully. This capacity enables the firm to respond more successfully to its environment and develop new capacities to achieve a competitive advantage and higher performance. Among the factors influencing innovation, several scholars have recently paid attention to how different workplace relationships impact on human resources´ attitude and commitment towards innovative behaviors. For example, while there are models of firm strategy which emphasize the need to build and sustain committed and capable human resources, others argue that looser employment relationships could be beneficial for innovation because they would exert a discipline upon labor which counteracts complacency, and would also enable firms to gain access to external knowledge from contingent employees (Martinez-Sánchez et al., 2011; Storey et al., 2002). Scholars suggest that analyzing moderator effects could be the key to understand how each type of human resource contributes to innovation performance.

This paper explores links between human resource flexibility and innovation in a large sample of Spanish industrial firms. Firms pay attention to human resource flexibility because it is a common base to develop other dimensions of flexibility (Karuppan, 2004; Upton, 1995). For instance temporary employment may contribute to enhance manufacturing volume flexibility since both flexibility dimensions allow firms to adapt to changes in production levels. Whereas the literature usually agrees that internal human resource flexibilities, like functional flexibility, enhance employees' innovative behaviors and performance, external dimensions are not so clearly related to innovation. The purpose of this paper is to analyze

simultaneously two moderator effects on the relationship between external human resource flexibility and innovation: (1) inter-organizational cooperation in technological activities, and (2) environmental (market) dynamism.

Discussion and hypotheses

Innovative products and processes are the 'outgrowths' of underlying resources and capabilities. Capability theory (Teece et al., 1997) predicts that the firm's ability to build and reconfigure internal and external competencies to respond to rapid changes in their environment lies at the centre of innovation. Some scholars (Wu, 2010) find that the explanatory power of the dynamic-capability view exceeds that of research-based view in volatile environments. Firms that possess dynamic capabilities can effectively enhance their competitive advantages, despite facing uncertain and turbulent environments.

Flexibility options have the potential to broaden the range of capabilities necessary to innovate. To attain the level of organizational flexibility that customers value (i.e., quick delivery of a variety of innovative, high-quality, low-cost products), firms must manage different types of flexibility. An overview of the literature reveals that the taxonomy of flexibility is very extensive, due to the fact that this concept is widely applied to different areas of the organization. This paper focuses the analysis on flexibility dimensions related to human resources and external relations because labor flexibility constitutes a platform to build other levels of flexibility and because external relations are a source of knowledge that contribute to innovation.

Since the seminal contribution of Atkinson (1984) about the flexible firm, the literature distinguishes between internal and external human resource flexibility. Internal flexibility involves efforts to increase the firm's ability to adjust to uncertainty by changing the internal labor market or work organization, whereas external flexibility uses changes in the external labor market through layoffs or temporary employees.

From the resource based view of the firm, it might be expected that emphasize secure, long-term and high-commitment-based employment policies, would be more conducive to innovation. On the contrary, flexible employment contracts, such as fixed-term contracts or external work arrangements, could damage innovation. Thus, Michie and Sheehan (2003) in a survey of 242 UK manufacturing organizations found that the use of short-term and temporary contracts was negatively correlated with all categories of innovation. Storey et al. (2002) also found that employers rarely used flexible working to achieve innovation in a large-scale survey of 2,700 UK companies.

However the increasing complexity of markets makes it difficult for firms to have all of the resources required to innovate. External technology sources are sometimes the only option for firms that wish to keep up-to-date. Barney (1999) suggests that firms do not need to own all relevant capabilities to innovate, as long as they have sufficient access to them. While the capability to manage resources in the innovation process may be internal to the organization, the resources to be mobilized may be external – they are complementary assets.

This line of argument begins to suggest that even quite extensive use of flexible employment contracts may be compatible with the in-house capabilities of innovation in dynamic environments to ensure the presence of knowledge and technological resources that may be beyond existing internal capabilities. Matusik and Hill (1998) argue that contingent work, although so far mainly introduced for cost reasons, can be more positively used for the creation and accumulation of new knowledge. Externals may bring knowledge and industry best practices into a firm, and they may stimulate exploration of new processes and ideas outside the firm's knowledge stock. For instance, Nesheim (2003) found in a sample of 26 Norwegian firms that firms in dynamic environments often use external personnel

deliberately in core value-creation areas: the use of external arrangements in the core value-creation areas was positively related to innovation strategy.

There are even studies that challenge the assumption that the use of flexible employment (e.g., temporary contracts) will have negative consequences for innovation. For example, Guest et al. (1999) report that, overall, contingent workers displayed no differences in levels of motivation, organizational commitment or innovative behavior compared with permanent employees. Indeed, the authors suggest that those on fixed term and temporary contracts, especially when they have chosen this form of employment, sometimes actually report a more positive 'psychological contract' and a potential higher propensity for innovation. Other scholars find positive relationships between flexible employment contracts and innovation but they suggest a different causal relationship because innovation may sometimes influence flexibility.

Then, prior research has established more consensuses about the impact of internal human resource flexibility (e.g., functional flexibility) than on the influence of external human resource flexibility. Whereas some theoretical perspectives and empirical research suggest the need to build and sustain committed human resources with full-time and permanent contracts, others argue that looser employment relationships are beneficial to innovation. The failure to analyze moderators could explain the non-conclusive relationships between external human resource flexibility and innovation.

Several scholars have analyzed more recently moderator effects on the relationship between human resource and flexibility. For instance, Martinez-Sánchez et al (2009) found that inter-organizational cooperation moderated the relationship between flexibility and innovation performance in a sample of Spanish manufacturing and service firms: high-cooperation firms may have more opportunities to take advantage of flexibility for innovation performance because it facilitates the access and dispersion of knowledge within the firm. Similarly, Martinez-Sánchez et al (2011) in a study of first-tier automotive Spanish suppliers found that internal flexibility practices are positively related to the firm´s innovation capabilities but regarding external flexibility, the association depended on the type of contingent employee: negative association for 'short-term hires' and positive association for 'consulting/contracting firms'. The authors also found that these relationships to innovativeness are moderated by environmental dynamism for practices associated with knowledge transfer, but the non-knowledge related practices are not related: firms in highly dynamic environments can benefit more from flexible human resource practices than firms in less dynamic environments.

This paper focuses on external human resource flexibility and innovation by proposing a research model that integrates two moderator effects in order to explore this topic beyond recent studies: (1) inter-organizational cooperation in technological activities, and (2) environmental (market) dynamism.

(1) Moderator effect of inter-organizational cooperation

The role of inter-organizational cooperation is important because as a firm increases interactions among other agents within or outside its supply chain (suppliers, technology centers, etc.), it may experience changes in its organizational flexibility. External cooperation may modify (increase or decrease) the need of in-house flexibility and this could have implications for the firm's innovation performance. For instance, firms that cooperate in new product development within the supply chain can broaden their knowledge base and contribute to diffuse innovative work practices along the supply chain. High-cooperation firms can access a broader knowledge base than low-cooperation firms, and therefore they

may be more able to deploy a wider dispersion of knowledge through human resource flexibility that contributes to greater innovation performance (Martinez-Sánchez et al., 2009).

Firms that combine resources may gain a competitive advantage over firms that are unable to do so, and this is viewed as one of the key benefits of inter-organizational cooperation. For instance, Baptista and Swann (1998) found that firms in clusters are more product-innovative. Gupta et al. (2000) also found that involvement of suppliers and participation in joint-venture/strategic alliances in the R&D process is greater in high-R&D effective organizations than in low R&D-effective.

Previous experiences of inter-organizational cooperation in the supply chain forge close bonds over time and increase confidence that exchange partners will pursue mutually compatible interests thereby facilitating the exchange of knowledge crucial for innovation performance. Accordingly, cooperation experiences may foster supports adaptability, and deters opportunism that can positively contribute to innovation performance. Besides, inter-organizational cooperation will require the use of inter-organizational systems which other studies have demonstrated that provide flexibility in relationships with connected trading partners, improving responsiveness and other flexibility dimensions relevant to innovation (Golden and Powell, 2004).

Inter-organizational cooperation in technological activities constitutes a relevant mechanism for a firm to increase its knowledge base concerning new products and processes. Thus, cooperation may positively moderate the relationship between external human resource flexibility and innovation, which enables high-cooperation firms to benefit from external flexibility. Employing contingent workers in combination with internal employees might be advantageous to upgrade the firm's knowledge stock. Externals from inter-organizational cooperation activities may also bring knowledge of occupational and industry best practices into a firm, and stimulate exploration of new processes and ideas outside the firm's knowledge stock.

(2) Moderator effect of environmental dynamism

Environmental dynamism describes the rate and unpredictability of change in a firm's external environment. Dynamic environments are characterized by changes in technologies, and variations in customer preferences and product demand. In low-dynamic environments, firms might efficiently fit their human resources with the demands of the competitive environment, by developing a human capital pool with a narrow range of skills. However, when the firm's operating environment is highly dynamic, previously developed capabilities may not be able to keep up with the frequent changes in technological conditions. The misfit between a firm's existing capabilities and the firm's operational environment may be mitigated if the firm can explore new areas and build new capabilities. Firms engaging in continuous exploration of knowledge are likely to have technical groups with varied perspectives and are then better able to reframe problems and overcome competitive traps when the environment demands organizational change (Wang and Li, 2008).

Firms in highly dynamic environments may also need more access to relevant external knowledge than firms in more stable environments. These externals may bring knowledge of occupational and industry best practices into the firm. External knowledge may leverage the internal stock of knowledge to develop innovations in order to overcome greater environmental uncertainty. At the same time, firms in highly dynamic environments may need to enhance the in-house dispersion of knowledge and the deployment of employees´ skills through core innovation activities.

Firms in highly dynamic environments may need more adjustments than firms in low-dynamic environments. If environmental dynamism raises the rotation of temporary

employees, then the negative influence of short-term hires and temporary help agencies would be enhanced in terms of lower organizational commitment which in turn would negatively affect innovativeness.

Procedures for collecting data

To analyze the relationships between human resource flexibility and innovation we used the Survey of Business Strategies (SBS) questionnaire which contains a set of statements that permit the study of human resources and innovation for a great number of Spanish industrial firms. The SBS is an annual survey conducted by the Spanish SEPI Foundation[1] in collaboration with the Spanish Ministry of Industry with the objective of knowing the evolution of the characteristics and strategies of Spanish industrial firms. This survey contains information about markets, customers, products, employment, technological activities and economic & financial data of the firms. The reference population comprises industrial firms operating in Spain and with more than 10 employees, with representativeness being one of its characteristics. We use data available from 1,864 industrial firms in the year 2012 for our analysis although the SBS includes more firms in the database for that year.

The two moderator effects were tested through logit and linear regression hierarchical analyses: we entered the control variables in the first step, the three 'main effects' in the second step, and then the three interaction terms for each moderator (cross products) in the next two consecutive steps. To reduce the potential negative effect of multicollinearity after introducing interaction terms of moderator variables, we used Lance's (1988) residual centering technique to control this problem.

The dependent variable in the study is innovation performance at the firm level. We differentiate three variables to run two logit regressions and one linear regression: product innovation (dummy), process innovation (dummy), and number of patents granted. We also run a logit regression with a dummy for innovative firms (firms that have developed at least a product innovation, a process innovation or a patent). The independent variables are three measures of external human resource flexibility: the percentage of temporary employees in the workforce, the use of R&D external employees with private experience (dummy), and the use of external employees with experience in the public R&D sector (dummy).

The two moderator variables are: inter-organizational cooperation in technological activities with customers, competitors, suppliers and R&D centers (categorical variable from 0 to 4), and market dynamism (index of change in the marketplace). The regressions control for: firm size (logarithm of number of employees), R&D effort (percentage of R&D expenditures on sales), percentage of sales exported, percentage of foreign capital, firm age (logarithm of years) and industry.

Results

Descriptive statistics of the SBS´ 1,864 firms indicate that in the year 2012, 37.9% were innovative firms (had developed at least a product innovation, a process innovation or a patent that year): 17.7% of firms developed at least a product innovation, 31.5% obtained at least a process innovation, and 5.8% filed at least an utility model or patent.

Table 1 shows the mean differences of some human resource flexibility measures between innovative and non-innovative firms. Measures related to internal flexibility such as training and full-time qualified employees indicate that innovate firms have larger percentages of employees which are more qualified and receive more training than non-innovative firms.

[1] The SEPI Foundation is responsible for the survey design and control through the Economic Research programme.

Innovative firms also hire more external R&D employees to contribute to innovation developments. All these differences are statistically significant. Innovative firms have a greater percentage of temporary employees but this difference is not statistically significant.

Table 2 shows the results from the multivariate analysis (logit and linear regressions). Regarding control variables, only firm size and R&D effort are positively related to the innovation measures. Innovative firms are larger and invest more in R&D. Other control variables are not statistically significant along the four measures but process innovations seem to be dependent of industry, product innovation and patents are negatively related to foreign capital, patenting is positively related to firm age, and innovative firms export more than non-innovative firms.

Two out of three independent variables are significantly related to innovation measures. Temporary employment is negatively related to product innovation and the use of R&D external private employment is positively related to all innovation measures in logit regressions although it is not significant for patenting. The use of external personnel with experience in public R&D is not significantly related to any measure of innovation.

We found some moderator effects regarding inter-organizational cooperation. Cooperation itself is positively related to all measures of innovation, and moderates both temporary employment and the hire of R&D personnel. Firms that cooperate more intensively in technological activities need less temporary employment but more R&D external private employment to innovate. The other moderator variable is market dynamism. It is negatively related to the measures of innovation in logit regressions but we have not found any moderator effect in this sample. This means that the innovative impact of external employment is not influenced by the level of market dynamism.

Conclusion and managerial implications

This empirical research of our sample of Spanish industrial firms finds that internal human resource flexibility is more developed in innovative firms than in non-innovative firms. Regarding external flexibility, the percentage of temporary employment in the workforce is negatively related to product innovation at the firm level, whereas the use of R&D external experts is positively related.

These results indicate that we have to differentiate between the influences of external flexibility on the decision to innovate. Thus, firms with greater percentages of temporary employment have less probability to obtain product innovations. On the contrary, the access to external knowledge through private R&D individual experts may positively contribute to a successful innovation. However, the analysis of patenting indicates that external workplace flexibility is not beneficial for patenting.

Therefore, we can deduct relevant managerial implications when we take into account moderator effects like those studied here that contribute to analyze the different impact of external workplace flexibility on innovation performance. First, the influence of inter-organizational technological cooperation compensates the influence, either positive or negative, of external workplace flexibility on innovation. Thus, there is a less positive effect of R&D external experts on innovation in highly cooperative firms than in less cooperative firms. Inter-organizational cooperation in technological activities can be interpreted as a substitute for contractual access to external technological knowledge through R&D consultants. At the same time, the negative impact on patenting of temporary employment is less important in highly cooperative firms than in low-cooperative firms. Inter-organizational cooperation may leverage the use of external work arrangements to facilitate the creation and dissemination of knowledge that contributes to patenting. To benefit from external relations, cooperative rather than adversarial relations in external transactions should be sought when

the level of core-related change is high. As the cooperative relationship develops, the persons brought in may be given more vital tasks closer to the core of the firm. In combination with employees and internal competence, the firm's innovative capabilities may be strengthened. Thus, high-cooperation firms that use more external flexibility practices could develop more innovations faster and cheaper.

Low-dynamic environments are less uncertain to develop innovations regarding the level of external employment. This means that the negative effects of temporary employment could be less relevant in low-dynamic environments because firms are more able to integrate temporary employees in innovation teams due to less uncertainty. On the contrary, R&D external employees are less necessary if firms are more able to forecast future scenarios and navigate the development of innovations in a more certain way.

The results reported and commented so far indicate that it is important to differentiate even further the implications of moderator effects on the impact of external human resource flexibility dimensions on firm performance. Our research suggests that future studies should integrate more moderator effects in these models at the same time that formulate separate hypotheses for each dimension of external flexibility. It is also important to differentiate among several dimensions of innovation performance, at least for dimensions focused on the decision to innovate and for dimensions that measure quantitative outputs of innovation.

Future studies could also extend the group of moderator effects that may influence the relationship between external human resource flexibility and firm performance. For instance, the level of product innovativeness may also be relevant. When an innovation is less familiar, a project team may require more face-to-face communication as opposed to that involved in more familiar tasks and smaller changes which would reinforce the positive impact of functional flexibility on innovation performance but it would reinforce the negative impact of external flexibility as well.

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Table 1. Mean differences of human resource flexibility measures between innovative and non-innovative firms

	Innovative firms (n=706)	Non-innovative firms (n=1,158)
Percentage of full-time permanent employees in the workforce	84.67**	80.95
Percentage of part-time permanent employees in the workforce	2.65**	3.86
Percentage of R&D employees in the workforce	4.30**	1.35
Percentage of engineers and scientists in the workforce	8.80**	5.43
Percentage of sales invested in external training of employees	7.64**	3.45
Percentage of firms that invest in engineering & technical training for employees	43**	15
Percentage of firms that invest in computer training for employees	34**	12
Percentage of firms that hire external R&D personnel with private experience	11**	1
Percentage of firms that hire external personnel with experience in public R&D	4**	1
Percentage of temporary employees in the workforce	96.13	88.23
Percentage of employees from Temporary Help Agencies in the workforce	3.36**	1.41

Notes: Level of significance +p<0.1 *p<0.05 **p<0.01

Table 2. Regression analysis of innovation performance in Spanish manufacturing firms

	Logit		Linear	Logit
	Product Innovation	Process Innovation	Number of patents	Innovative firm
Control variables				
Firm size (log)	0.535** (12.997)	0.818** (43.870)	0.087** (2.901)	0.742** (36.124)
R&D effort (R&D on sales)	18.079** (33.789)	5.787** (6.907)	0.116** (4.607)	17.099** (20.122)
Exports/Sales	-0.001 (0.069)	0.003 (2.295)	-0.039 (1.426)	0.003+ (2.835)
% Foreign capital	-0.004* (3.940)	0.001 (0.319)	-0.050+ (1.914)	0.000 (0.038)
Firm age (log)	0.131 (0.266)	-0.290 (2.015)	0.042+ (1.786)	-0.060 (0.087)
Industry	-0.003 (0.052)	-0.018+ (2.714)	-0.004 (0.178)	-0.008 (0.520)
% Temporary employment (TE)	-3.697+ (2.998)	0.884 (0.475)	0.086 (1.002)	0.778 (0.370)
R&D external private employment (RDEF)	1.742* (4.148)	1.827* (3.935)	-0.021 (0.254)	2.989** (6.832)
R&D external public experience (RDPE)	0.587 (0.172)	-0.203 (0.018)	0.016 (0.197)	-0.705 (0.184)
Inter-organizational technology cooperation (TC)	0.634** (58.611)	0.437** (35.099)	0.117** (3.446)	0.540** (44.036)
TE x TC	1.048* (4.410)	0.963* (3.828)	-0.086** (2.859)	1.202* (4.292)
RDEF x TC	-0.646** (9.228)	-0.631** (7.882)	0.018 (0.358)	-0.709** (6.648)
RDPE x TC	-0.527 (1.812)	-0.085 (0.041)	-0.052 (0.855)	-0.176 (0.138)
Market dynamism (MD)	-0.247+ (3.757)	-0.226* (5.061)	0.031 (1.089)	-0.176+ (3.153)
TE x MD	1.244 (2.289)	-0.291 (0.292)	-0.076 (0.907)	-0.333 (0.384)
RDEF x MD	-0.064 (0.034)	-0.022 (0.004)	0.000 (0.003)	-0.471 (1.056)
RDPE x MD	0.322 (0.304)	0.431 (0.407)	0.003 (0.045)	0.646 (0.682)
Model statistics	R^2 Nagelkerke=0.316 R^2 Cox&Snell=0.191 Chi-square = 394.66 p = 0.000 n = 1,861 firms	R^2 Nagelkerke=0.270 R^2 Cox&Snell=0.192 Chi-square = 396.93 p = 0.000 n = 1,861 firms	Adjusted R^2 =0.033 F = 4.711 p = 0.000 n = 1,861 firms	R^2 Nagelkerke=0.326 R^2 Cox&Snell=0.239 Chi-square = 508.08 p = 0.000 n = 1,861 firms

Notes: Level of significance +p<0.1 *p<0.05 **p<0.01
Logit regressions – Wald values between parentheses
Linear regression – t-values between parentheses