Market orientation and academic spin-off firms

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Abstract
Purpose: Academic spin-off firms are considered an important mechanism to transfer technological knowledge from university to industry, although they often show a low growth rate. One possible cause is the lack of proper marketing capabilities, since spin-off managers tend to reduce the role of marketing to the implementation of mere tactical activities. This study analyses whether spin-off firms adopt a market orientation and the effect it produces on firms' economic and innovation performance.
Design/methodology/approach: The empirical analysis is based on both quantitative survey data and in-depth interviews, referring to a unique sample including Italian and Spanish spin-off companies.
Findings: Results highlight that MKTOR and MARKOR measurement scales show different abilities to capture the implementation of market orientation by sampled firms. We find that the generation and dissemination of information on customers and competitors directly affect firms' ability to develop technological innovations and gain profits. Nevertheless, market orientation also constitutes a challenge to spin-offs, and may eventually generate inefficiencies when external technological conditions require firms to respond quickly to environmental stimuli.
Practical implications: The findings of this study are relevant to academic spin-off managers who are responsible for adopting, implementing and maintaining market orientation strategies under different environmental conditions.
Limitations: The characteristics of sample used for the quantitative analysis may limit the generalization of results.
Originality/value: Even though the market orientation concept has been largely analyzed, no previous study has examined its application by academic spin-offs. By employing qualitative and quantitative analyses we provide novel insights in this respect.

Keywords: academic spin-off firms; market orientation; company performance;

1. Introduction

Academic spin-off firms (ASOs) have attracted the attention of scholars and policy makers during the last years (Wright *et al*., 2004; Lockett *et al*. 2005; Clarisse *et al*., 2005), since they are considered an important mechanism of knowledge and technology transfer from university to industry (O'Shea *et al*., 2005). Nevertheless, ASOs often show also a low rate of growth and seem unable to maintain over time a competitive advantage (George *et al*., 2002; Ensley and Hmieleski, 2005; van Geenhuizen and Soetanto, 2009; Ortin-Angel and Vendrell-Herrero, 2013). One of the possible causes that might explain this evidence is the excessive attention that spin-off managers pay to technological aspects and their widespread belief that technology should simply be promoted and commercialized, reducing de facto the role of marketing to the implementation of mere tactical activities. Being based on scientific/engineering outcomes of university research, ASOs thus believe that the superiority of their technological innovations should be sufficient to influence consumers' preferences and to make them select and adopt their new products. In doing so, the principles of marketing are applied by ASOs in a rather simplified fashion, often as a short-term response to emerging problems, rather than as an accurate and rigorous planning process. However, the complexity and turbulence of high-tech environments highlight that technological superiority alone is insufficient for achieving the success of high-tech products. In particular, high-tech firms must integrate their technological competencies with a set of marketing capabilities in order to understand customers' needs and problems, to assess competitors' strategies and competitive environments, and to obtain marketplace success (Dutta *et al*., 1999; Baker and Sinkula, 2005; Mohr and Sarin, 2008).

In this vein, we posit that ASOs should rethink their philosophy of doing business, assuming a market orientation that is expected to having a positive impact on business performance. Based on this argument, this study aims to analyse the impact of market orientation on business performance of academic spin-offs. We focus on two main research questions: (i) what is the effect of market orientation on economic and innovation performance of spin-off firms? (ii) how do technological turbulence and other environmental variables affect such a relationship?

The basic idea developed in this study is that an efficient market orientation may contribute to improving business performance, especially for high-tech firms that experience constant changes in their competitive environment and must be able to combine their resources in different ways in order to meet customers' needs more effectively than competitors. Although market orientation is expected to positively affect business performance of any firm, it should affect ASOs even more, since the capability to implement a market orientation is less diffused among this category of firms. As such, the capability to adopt and implement a market orientation should confer to ASOs a sustainable competitive advantage (Barney, 1991; Peteraf, 1993; Teece *et al*., 1997; Dutta *et al*., 1999; Ortin-Angel and Vendrell-Herrero, 2013).

In order to test our research framework, we firstly performed a regression analysis on original primary data collected on a sample of Italian and Spanish ASOs. Then, we complemented the results of the quantitative analysis with a few in-depth interviews with ASOs' managers in order to assess which obstacles impede a wider implementation of the market orientation among such a category of firms.

2. Theoretical background

2.1 Academic spin-off companies

Academic spin-offs constitute a complex phenomenon that involve the transfer of technological knowledge from universities (or higher education institutions, in general) into new companies (Nicolaou and Birley, 2003; O'Shea *et al*., 2005; Powers and McDougall, 2005; Wright *et al*., 2004). By promoting programs that stimulate the creation of ASOs, academic institutions thus contribute to the economic and social welfare, and to regional development (Etzkowitz and

Leydesdorff, 2000; Heydebreck *et al*., 2000; Lockett *et al.,* 2003). ASOs therefore represent the mechanism by which scientific discoveries of universities are converted into entrepreneurial opportunities (Etzkowitz *et al*., 2000; O'Shea *et al*., 2005).

Albeit their growing relevance, in economic and management studies there is no common and unique definition of what constitutes an academic spin-off firm (Degroof and Roberts, 2004; Roberts and Malone, 1996; Carayannis *et al.*, 1998; Steffensen *et al*., 1999; Rogers *et al*., 2001; Shane, 2004; Pirnay *et al.*, 2003). In general terms, ASOs can be considered new ventures promoted by academic institutions through the exploitation of their intellectual properties (Autio *et al*., 1989; Etzkowitz *et al*., 2000; Lockett *et al*., 2003) and the transfer of technological innovation emerging from the application of knowledge within their organizational boundaries (Birley, 2002; Pirnay *et al.*, 2003; Wright *et al*., 2006; Shane, 2004). Spin-off firms are characterized by the following peculiarities: 1) the start-up of a new company, 2) the transfer to this company of technological knowledge developed in universities, 3) the involvement of staff from the research organization in the ownership and management of the new entrepreneurial initiative (O'Shea *et al*., 2007).

ASOs are a heterogeneous category of firms, ranging from services organizations to real high technology developers (Mustar *et al*., 2006), which operate in different sectors, such as biotechnology, telecommunications, information technology, etc. The managerial literature focusing on ASOs has explored several dimensions related to their activity: motivation, abilities, attributes and personality characteristics of academic entrepreneurs and/or team formation (Franklin *et al*., 2001; Clarysse and Moray, 2004; O'Shea *et al*., 2005; Shane, 2004); spin-offs' activities and the level and nature of funding for R&D within universities (Lockett and Wright, 2005); external factors that influence both university's and spin-off's activities (Wright *et al*., 2006; O'Shea *et al*, 2007); development and performance of ASOs (Mustar *et al*., 2006; Ensley and Hmieleski, 2005). Relatively to the latter, scholars have highlighted that ASOs, similarly to other high-tech companies, show a low rate of growth in terms of sales, cash flows, and employees. They also show a lower likelihood to obtain profits (Zhang, 2009; Ortin-Angel and Vendrell-Herrero, 2013). One of the possible causes can be identified in the difficulty of assuming, defining and implementing the efficient marketing strategies, that is, appropriate policies and tools that are necessary to identify profitable market segments, to commercialize their innovative high-tech products/services, to outperform their competitors and, finally, to maximize success (Mohr *et al*., 2010).

Because ASOs mainly originate from scientific research projects, many university inventors (i.e., mostly engineers) are more focused on the technical aspects of their innovations than on commercial aspects (Lockett *et al*., 2003; Wright *et al.*, 2004; Shane, 2004; Roberts, 1991). As a result, these inventors consider erroneously that the superiority and the quality of their high-tech products are sufficient to influence their clients to select and to adopt their new products/services, reducing in this way the importance of marketing for the identification and implementation of satisfactory value propositions. In this sense, it has been suggested that ASOs suffer of different types of marketing myopia due to the fact that they usually believe that: a) their technologies are radically new and do not face any competition; b) technologies commercialized by competitors do not represent a great threat; c) competitors operate in different sectors and their strategies do not have any relevant impact on their businesses (Mohr *et al*., 2010).

In this perspective, ASOs show many difficulties to define and, consequently, to implement useful marketing activities, which in some cases become a simple afterthought to product development, and which constitute mere tactical solutions to solve specific market problems. In addition, especially in high-tech firms (Drucker, 1985; Mohr *et al*., 2010), the collaboration and the inter-functional coordination between R&D and marketing are scarce and infrequent, albeit it is considered a fundamental determinant of successful new product development. Indeed, as Dutta *et al*. (1999, p. 547) suggest, firms operating in high-tech markets have to "excel at two things: the ability to come up with innovation constantly and the ability to commercialize these innovation into the kinds of products that capture consumer needs and preferences".

2.2 Market orientation

The concept of market orientation has received a great deal of attention from business and marketing scholars, who have debated its theoretical and practical implications (Shapiro, 1988; Narver and Slater, 1990; Kohli and Jaworsky, 1990; Kohli *et al.*, 1993; Deshpandè *et al.*, 1993; Day, 1994; Noble, Sinha and Kumar, 2002; Kirca *et al.*, 2005; Song and Parry, 2009; Kumar *et al.*, 2011). Among the many scientific contributions published since the 1990s, two different streams of research have mainly emerged and have dominated the literature on this field. Firstly, Narver and Slater (1990) have conceptualised market orientation as an organizational culture that pushes a firm to achieve sustainable competitive advantage by creating superior value for customers. They have highlighted that market orientation is "the organizational culture (…) that most effectively and efficiently creates the necessary behaviours for the creation of superior value for buyers and, thus, continuous superior performance for the business" (Narver and Slater, 1990, p. 21). This organizational culture is characterized by three different behavioural components: (1) customer orientation, which means "the sufficient understanding of one's target buyers to be able to create superior value for them continuously"; (2) competitor orientation, which intends "that a seller understands the short-term strengths and weaknesses and long-term capabilities and strategies of both the key current and key potential competitors"; and, finally, (3) inter-functional co-ordination, which indicates "the coordinated utilization of company resources in creating superior value for target customer" (Narver and Slater, 1990, pp.21-22).

Then, in their seminal study, Kohli and Jaworsky (1990) have provided a useful interpretation of the market orientation from a behavioural perspective, focusing on market intelligence as a critical component because "it includes consideration of exogenous market factors that affect customer needs and preferences and current as well as future needs of customers (Kohli and Jaworski, 1990, p.3). Kholi and Jaworsky (1990, p.131) have defined market orientation as the "organization-wide generation of market intelligence pertaining to customers, competitors, and forces affecting them, internal dissemination of the intelligence, and reactive as well as proactive responsiveness to the intelligence". Concentrating to three fundamental pillars of the marketing concept (customer focus, marketing coordination and profitability), they described market orientation as a whole that contains the following critical activities: a) generation of market intelligence related to current and future needs and wants of consumers and other exogenous factors (i.e., competitor strategies and actions, emergent technologies, the broader market environment, etc.) for the purpose of supporting firms' strategic/tactical/operational decisions; b) dissemination of market intelligence across the different departments and decision-makers, because it permits to have shared bases for concerted actions; c) intelligence integration within and across the organization's boundaries for creating knowledge assets; and, finally, d) responsiveness to this market intelligence (Kohli and Jaworski, 1990) in a more unpredictable environment. This last factor can imply heterogeneous activities, such as selection of market targets, design and offer of products/services, distribution and promotion of products in a way that determine favourable customer response. From this behavioural standpoint, a market orientation strategy could be designed through the collection, sharing and coordination of market intelligence, assuming that market orientation originates a cost and their consequences have to assessed and evaluated (Day, 1994).

The perspectives of Narver and Slater (1990) and of Kholi and Jaworsky (1990) are complementary and not reciprocally exclusive (Manzano *et al.*, 2005), because they present some commonalities, such as focus on the understanding market needs, wants and preferences, the necessity to realize a cross-functional integration, and the importance of acting in response to multiple market opportunities (Rodrıguez-Cano et al., 2004). Therefore, market orientation can be examined as a cultural and behavioural feature of an organization that puts the customer at the center of their strategies, including the acquisition of market information, its interdepartmental dissemination and processing to respond and adapt to market conditions (Kohli and Jaworski, 1990; Narver and Slater, 1990). However, it is also necessary to underline that the definition and the

implementation of market orientation require firms to possess dynamic capabilities (e.g., Teece *et al.*, 1997; Eisenhardt and Martin, 2000) that allow innovation capabilities to be combined with marketing capabilities (Morgan *et al.*, 2009). More specifically, these capabilities permit firms to deploy their resources in ways that match changing market conditions ahead of their competitors, to define new strategies, and to respond more effectively to the market intelligence that has been generated, disseminated throughout the company and integrated (Morgan *et al.*, 2009). From this viewpoint, market orientation and dynamic capabilities are considered valuable strategic sources helping organizations obtain a competitive advantage (Morgan *et al.*, 2009) and in turn achieve marketing objectives.

In the specific case of high-tech context, a market orientation may allow firms to develop greater creativity and enhance new product development (Subin and Workman, 2004), although high-tech companies must be able to identify market opportunities, to come up with products and processes innovation constantly, and to commercialize these innovative results (Dutta *et al*. 1999; Mohr *et al*., 2010).

2.2.1 The impact of market orientation on firm performance

The notion that market orientation impacts on business performance is a matter of widespread research (Langerak, 2003; Cano et al., 2004; Baker and Sinkula, 2005; Kirca *et al.*, 2005; Shoham *et al*., 2005; Ellis, 2006). The majority of empirical studies (Narver and Slater, 1990; Jaworski and Kholi, 1993; Despandé *et al*., 1993; Diamantopoulos and Hart, 1993; Slater and Narver, 2000) highlight that market orientation is associated positively with business performance over time, such as financial performance (e.g., growth in sales revenue, sales growth, profitability and cash-flow), market performance (e.g., market share, new product performance, customer satisfaction and customer loyalty), organizational learning (Slater and Narver, 1994), and firm innovativeness (e.g., patents, generation of new knowledge on target technology). Concerning this last aspect, the marketing literature has specifically underlined that market orientation has a positive impact on innovations and their success (Atuahene-Gima, 1995; Han *et al*., 1998; Hurley and Hult, 1998; Lukas and Ferrell, 2000; Aldas-Manzano *et al*., 2005). In this sense, Santos and Vazquez (1997) have emphasized that market-oriented high-tech firms achieve better innovation results, higher success and lower failure rates for commercialized innovations. This is because market orientation facilitates the firm's access to new ideas from the market and improves the motivation to respond to market demand (Lukas and Ferell, 2000; Jiménez-Jiménez *et al*., 2008), determines an organizational environment that encourages innovation and, finally, improves the chances of innovations to be better based on market requirements (Jiménez-Jiménez *et al*., 2008).

However, the relationship between market orientation and business performance may be moderated by environmental uncertainty referred to the unpredictability and instability of external environment (Song and Parry, 2009). Specifically, three types of environmental uncertainty may affect firms' performance: 1) market uncertainty (Han *et al*., 1998); 2) competitive intensity (Jaworski and Kholi, 1993; Kirca *et al*., 2005); and, 3) technological turbulence (Kohli and Jaworski, 1990; Slater and Narver, 1994). Market uncertainty refers to changes about the type and the composition of customers and their needs/preferences (Kohli and Jaworski, 1990; Jaworski and Kohli, 1993). Competitive intensity refers to the degree of change in the competitive scenario and the uncertainty concerning competitors and their strategies in order to gain competitive advantage (Kohli and Jaworski, 1990; Mohr et al., 2010). Finally, technological turbulence refers to changes in the "entire process of transforming inputs to outputs and the delivery of those outputs to the end customer" (Kohli and Jaworski, 1990, p.14).

Based on these considerations, we thus aim at testing the theoretical framework depicted in Figure 1, in which ASOs' performance is affected by the different dimensions of market orientation. The relationship between market orientation and firm performance is then expected to be mediated by the three environmental factors described above.

[Figure 1 about here]

3. Research methodology

The study's objectives were addressed in two different steps. The first one consisted of a quantitative analysis through an ad-hoc survey, while the second one consisted of a follow-up qualitative analysis through in-depth interviews.

Initially, we designed a questionnaire based on the elaboration that Mohr *et al*. (2010), made of both MKTOR and MARKOR scales (Narver and Slater, 1990; Jaworski and Kohli, 1993; Kholi *et al*., 1993) to adapt them to the specificities of high-tech firms. More specifically, the questionnaire consists of 38 items and contains three different sections. The first section asked the respondents to answer 28 questions to measure their firm's market orientation. The dimensions derived from the conceptualisations of market orientation are: intelligence generation (customer and competitor), intelligence dissemination, intelligence integration and inter-functional coordination. For each of the cited dimensions of market orientation, we used a list of items selected and developed by marketing literature (Narver and Slater, 1990; Kohli and Jaworski, 1993). The questionnaire items were rated on a seven-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree).

The second section of the questionnaire included questions related to environmental uncertainty: market uncertainty, competitive intensity and technological turbulence (Kohli and Jaworski, 1990; Jaworski and Kohli, 1993). These information were collected using a five-point Likert scale (1= very weak/aggressive, 2= moderate, 3= very strong/aggressive) in response to statements about the mentioned variables. In addition, this section contains questions about business performance, such as sales revenue growth, market share gain, profitability, successful innovation, customer satisfaction, new patents and generation of new knowledge on target technology/market domains (Kohli and Jaworski, 1990; Jaworski and Kohli, 1993; Han *et al*., 1998; Hurley and Hult, 1998; Lukas and Ferrell, 2000; Kirca *et al*., 2005). These questions asked respondents to rate the performance of their company relative to that of their direct competitors during the last three years. Information was collected using a 5-point Likert scale, ranging from 1 (much worse) to 5 (much better). Subjective measures of business performance have widely used in this study because managers are often reluctance to provide information, which they consider confidential. However, subjective measures, used by previous authors (Narver and Slater, 1990; Kohli and Jaworski, 1993; Deshpandé *et al*., 1993), have been presented to correlate with objective measures. Finally, the last section contained demographic information.

The questionnaire was pre-tested using three companies in order to insure that the survey content and measurement scales were clear, appropriate and valid. Based on their feedback, some items were opportunely adjusted, integrated and modified. English language was used for all the questionnaires with the agreements of respondents.

The sample for our empirical study consisted of ASOs in manufacturing and services industries, such as communications, automotive, life sciences, biotechnology, nanotechnology, etc. Companies operate in two different countries: Italy and Spain. They have been created between 2000 and 2010. Spin-off firms, that are established more recently, were excluded because some items included in the questionnaire are less relevant for these organizations.

Firms were randomly sampled from the complete list of academic spin-off firms existing in both countries. Random sampling the population for subjects is an appropriate option for obtaining a cross-section of the general population. However, it is necessary to highlight that the results of this study do not reflect a variation of industry conditions of each specific country, but sample firms from a variety of business areas.

The list of ASOs was also used as a basis for collecting the email addresses of entrepreneurs and marketing managers because in these companies they are a key informants and respondents to our questionnaire for the reason that they have detailed information about of companies' operations

and conditions (Deshpandè and Farley, 2004). More specifically, they were selected as the "qualifying" informants most likely to have specific knowledge on the key aspects of our analysis and could provide the most useful information regarding these aspects. Therefore, our survey approach targeted ASOs' entrepreneurs and/or marketing managers (were existing). Therefore, each spin-off received an email explaining issues like general purpose of the analysis, questionnaire salience and length, anonymity, lack of explicit deadline. Then, two follow-up emails were sent to non-respondents. The survey was conducted in the period from May 2011 to May 2012. A number of the questionnaires received from sampled companies had to be eliminated due to the fact that they were incomplete. The final sample consisted of 74 of university spin-off firms: Italian (18) and Spanish (56).

As far as the second step is concerned (qualitative study), in-depth face-to-face interviews were conducted to explore specific aspects related to the market orientation construct in the context of ASOs, such as the motivations that drove the implementation or not implementation of this orientation, and, principally, the main difficulties and constraints in doing so. Semi-structured interviews were run with 4 among managers and marketing managers of these companies. In this sense, such evaluative case studies (Thomas, 2011) complemented previous quantitative analysis. In particular, interviewed ASOs, operate in ICT services and materials engineering located in Italy and Spain. Although they have been created between 2002 and 2006, interviewed ASOs are still small firms with 5-15 employees.

Interviews were conducted from September to December 2012, following to the traditional methodological prescriptions on collecting data through personal interviews (Lee, 1999).

3.1 Estimation strategy

In order to estimate the relationships identified by the theoretical framework (Figure 1), we made use of responses to our questionnaire to build a set of numerical variables (Table 1). First, we measured ASOs' economic performance by computing the average of three different items: sales revenues' growth, market share gains, and profitability. As said above, respondents were expected to rate the economic performance of their company during the last three years relative to the economic performance of their direct competitors. In this sense, this variable measures ASOs' relative economic performance. Similarly, we measured ASOs' innovation performance relative to their direct competitors by computing the average of three other items: successful innovation, new patent applications, and generation of new knowledge on target technology/market domains.

[Table 1 about here]

Second, we assessed ASOs' market orientation by making use either of the MKTOR scale or of the MARKOR scale, according to Mohr *et al.*'s (2010) adaptation to high-tech companies. Components of each market orientation scale (Customers' Intelligence Generation, Competitors' Intelligence Generation and Interfunctional Coordination, for MKTOR, and Intelligence Generation, Intelligence Dissemination and Interfunctional Integration, for MARKOR) were computed as the average of respective questionnaire's items.

Third, we used responses to questions related to environmental uncertainty to measure the relevance of market uncertainty, competitive intensity and technological turbulence over the last three years for ASOs' reference markets.

Finally, we also employed a set of control variables that might affect business performance. Specifically, we considered ASOs' age (number of years since foundation) because we presume that, especially for small high-tech start-ups (as ASOs are) at the very beginning of their activity, the longer the number of years a firm operates in the market, the higher the firm's ability to face uncertainty and to respond to customers' needs. Also, especially in the case of ASOs, age is often directly correlated with size. Therefore, by including ASOs' age as control variable we also

controlled for size effects on firm performance. Second, we controlled for ASOs' main market by distinguishing between firms operating in the consumer market (B2C), business market (B2B) or in the specialized market for public administrations (B2A). A set of dummy variables were introduced accordingly. Third, we controlled for ASOs' main activity. We thus made a distinction between firms whose main activity was to provide R&D, consulting or other professional services, and firms involved in the development, manufacturing and commercialization of tangible products. Finally, we also controlled for the ASO's country of origin (Italy vs. Spain). As Table 1 shows, all measures meet the Cronbach's alpha cut off according to Bagozzi and Yi (1988). Table 2 reports descriptive statistics and pairwise correlations of the variables, respectively.

[Table 2 about here]

By using Ordinary Least Squares, we then estimated the following econometric model:

$$Y_i = \alpha + \beta\, X_i + \gamma\, Z_i + u_i$$

where

- Y_i is the performance indicator (either economic performance or innovation performance) for firm i,
- X_{it} represents our main explanatory variables (i.e., either components of MKTOR or MARKOR scales) for firm i,
- Z_{it} denotes the vector of control variables for firm i,
- α is constant term, β and γ are the vectors of parameters to be estimated,
- μ_i is the error term $i = 1\ldots N$.

Finally, in order to assess whether environmental conditions moderate the relationship between market orientation and business performance, we included one additional interaction variable in our model:

$$Y_i = \alpha + \beta\, X_i + \delta\, I_i + \gamma\, Z_i + u_i$$

where

- I_i is the vector of interaction variables (that is, each component of market orientation multiplied by each environmental factors) for firm i,
- δ is the parameters to be estimated for the interaction variables.

Given the specificities of the model, each key independent variable plays a double effect on business performance. On the one hand, direct effects capture the impact that the adoption and implementation of a market orientation has on ASOs' performance. On the other hand, the model expresses the idea that the impact of market orientation on business performance might be reinforced or reduced under specific environmental conditions (market uncertainty, competitive intensity and technological turbulence, respectively).

4. Results

Results of our regression estimates reveal that the MKTOR and MARKOR do show different abilities to capture the implementation of market orientation by academic spin-off companies. Specifically, while by applying the MARKOR scale we observed an effect of the different dimensions of market orientation on firm performance (Tables 3 and 4), especially under some environmental conditions, variables of the MKTOR scale do never show any statistically significant association with firm performance (Tables 5 and 6).

[Tables 3-6 about here]

In turn, this first outcome of our analysis seems to suggest that more than the adoption of a market orientation culture, what mostly affects ASOs' performance is the ability to transform a market orientation approach into an effective organizational behaviour, by setting-up coherent intelligence processes and routines.

Furthermore, tables 1 and 2 show that such an effect is especially pronounced under conditions of high technological turbulence, while market uncertainty and competitive intensity do not play any role in moderating the relationship between market orientation and performance.

The moderating role of technological turbulence, however, is not the same for all the dimensions of market orientation. As far as economic performance is concerned, only activities of Intelligence Dissemination and Intelligence Integration do play a role, while activities of Intelligence Generation do not. By summing up the direct and indirect effect of the former two variables, it is possible to show (Figures 2 and 3) that the higher the technological turbulence, the higher the positive effect of activities of Intelligence Dissemination on economic performance. By contrast, the effect of activities of Intelligence Integration on economic performance shifts from positive to negative, the higher the technological turbulence. Thus, in contexts characterized by high technological uncertainties and opportunities, the capability to let relevant information flow among organizational boundaries allows spin-off firms to generate higher profits. By moving from economic to innovation performance, however, the situation partly changes. First, activities of Intelligence Dissemination do not affect firm performance. Second, results confirm that activities of Intelligence Integration do negatively affect firm performance the higher the level of environmental technological turbulence. Third, activities of Intelligence Generation, albeit irrelevant in the case of economic performance, do allow firms to enhance their innovative ability, especially in contexts of high technological turbulence.

[Figures 2 and 3 about here]

Overall, our results show that, while the generation and dissemination of information on customers and competitors directly affects firms' ability to generate technological innovations and to gain profits, market orientation activities that require a deeper organizational change (e.g., by implementing a stricter inter-functional coordination between R&D and Marketing) represent a challenge to firms, and may eventually generate inefficiencies when external technological conditions require firms to respond quickly to environmental stimuli.

4.1 Qualitative analysis

In-depth interviews with academic spin-off companies confirm the findings obtained through quantitative analysis. Firstly, some of the university entrepreneurs interviewed recognize the relevance of defining and implementing a set of heterogeneous activities oriented to the examination of their customers, their main requests and their preferences. One of the respondents specifies that: "*Although in many high-tech environments needs and preferences of customers change rapidly, the necessity to analyse and understand them is critical for developing and commercializing products/services with the right set of features that satisfy customer needs in a fascinating way. We can create innovative products/services, characterized by high-quality and excellence in technologies, but the clients represent ineluctable premise and decree unscrupulously our destiny in order to survival and success*" (2011). And, high-tech markets are perceived by entrepreneurs as risky because they are fast-moving and expensive due to technological advances and intense competition.

In this perspective sampled ASOs are beginning to implement marketing activities that allow gathering and utilizing information about customers' current and future needs to discover, understand, and pursue market opportunities that are not evident to competitive rivals. On the other hand, they are increasingly realizing that nowadays firms with a strong technological base have to incorporate customers into their product development processes, because they can actively contribute to the creation of innovation and the commercialization of outcomes of innovative processes into the type of successful products/services that meet consumer needs and preferences, and delivery value. In this way, the customer's role changes, by moving from passive recipient of information flow concerning products and services developed principally by companies, to competent and suitable partner that firms can stimulate and involve in their innovation processes. Therefore, for high-tech firms a carefully examination not only of the needs, but also the competencies and capabilities of their clients appears a key condition to achieve marketplace success. In fact, the involvement and the collaboration of customers can be a strategic way of stimulating creativity and innovation, and designing synergic outputs (derived from a gradual and articulated process of interactions among the involved parties), able to realise several benefits and, primarily, to discover the best innovative solutions to different problems, which are often too easily expressed. In this respect, a university entrepreneur highlights that "*the type of clients that needs frequent contacts for developing alternative solutions to daily problems and configuring new prototypes fostering our creativity has stimulated advantageous forms of participation in our internal R&D processes and suitable collaborations* (2011). Also, he continues and stresses that "*some of our products and/or services are the results of intensive processes of exchange and collaboration between the firm and the client, which is involved from idea generation to test of prototype, permitting to eliminate defects and reduce the risk to failure*" (2011).

In these circumstances, customers can cover all stages of innovation processes and organizations work with these parties in order to anticipate the emerging market needs (which usually take a long time before the mass marketplace realizes their importance), to personalize solutions for their needs, , and, consequently, to face market uncertainty. Undoubtable, ASOs can acquire, integrate and absorb the know-how of customers, which is necessary to support different stages of innovation processes and, also, to explore the knowledge of potential customers. Thus, they acquire knowledge sources at low cost and accelerate the time-to-market of their products/technologies in turbulent and more competitive environments. In this way, they have access to the important social dimension of customer knowledge and gradually extend the reach and scope of customers to interact with, thus enhancing innovation and business performance.

Secondly, some ASOs are trying to have regular gathering, analysis and interpretation of information inherent to the adopted market strategies, the main strengths and the weaknesses of the key players that offer similar products or products with the same functionality and, thus, intend to capture market demand. One of the entrepreneurs highlights that "*we are focused on the competitor's features, their mechanisms and significant tactical activities, their innovation processes and, in particular, their innovation performance in terms to new patents, licenses, technological platforms/underpinnings (…). This is because they impact and change the rules and the logics of the game*" (2011). In this context characterized by high competitive volatility, the same interviewee stresses that: "*although size and dimensions of our companies do not allow us to assuming a significant role and influencing really the external competitive environment, we have only a strategic possibility consisting in the identification of different market spaces not explored and engaged by our competitors, by designing focused value propositions and obtaining positive business performance in long-term*" (2011).

Recognizing the relevance of these strategic questions, spin-off efforts are oriented to the gathering, analysing and disseminating of competitor information that regard the following aspects: characteristics of their offer proposals, focusing on the development and the applications of technological bases considered more relevant for upcoming technological innovations; to possess resources and specialized competencies that are valuable, difficult for competitors to imitate and,

then, explain the obtained advantage positions; cost structure; capabilities to develop continually technological innovation through which to maintain their leadership over time; patent portfolios that increase their contractual power among different companies.

Furthermore, an interesting aspect for this type of companies is represented by the underestimated opportunity of gathering, analysing sharing information about indirect rivals and key potential competitors because they often come outside existing industry boundaries and the competition will be concentrated on product classes. Thus, the lack of this focus on their goals, policies, resources and capabilities reduces the possibilities to design and elaborate all modifications that high-tech environment necessitates, moving from an attitude merely responsive to markets' evolutionary phenomena to an anticipatory attitude that requires sustained efforts of forecasting events in the competitive environment.

Finally, almost all the spin-off companies we have interviewed have strongly underlined that the heterogeneous activities related to market orientation require the availability of a set of different resources. More specifically, these resources, observed as the basis for the adoption of a market orientation are: human resources with relevant specialized competences and capabilities; economic and financial resources to support more appropriate investments (for example, investment on customer relationships); and technical/technological resources for the generation, dissemination and integration of customer intelligence and competitor intelligence within and across people and department of the organization's boundaries.

Generally speaking, interviewed ASOs highlight that marketing-specialized human resources should be mainly oriented to processes of gathering, analysing, interpreting and using market information to make appropriate strategic decisions, manage interactions and long-term relationships with customers to enhance the possibilities to offer them propositions that meet their current/future needs, develop high-quality technological innovations, and, finally, create and support R&D-marketing interactions. Therefore, while recognising the relevance of these aspects to their market position and their growth, interviewed ASOs stress that the availability of the cited resources is very limited and, also, the efforts are excessive.

On the other hand, technological resources are perceived to be relevant in organizational environments in which advanced technologies – corporate intranet and extranet, collaborative platforms – foster and support people to generate, share and integrate knowledge on specific fields, activating in this way efficient mechanisms used to transfer it. However, a large number of interviewed spin-off firms declares that the scarcity of mentioned resources poses several questions about the opportunity to sustain investments aimed at increasing their information assets (i.e., data and information on customers, competitors, other market forces) rather than use the same resources for other activities considered more profitable in short-term. Crucially for this last aspect, one of the respondents highlights that "*we often are obligated to choose projects of creation and development of technological innovation (i.e., incremental innovation), considered more coherent with our goals and more profitable especially for spin-off, rejecting other different projects related to marketing areas, although undoubtable are necessary to identify desirable customers and then keep them satisfied. This is because our economic and financial resources are limited and [the lack of resources] influences strongly our decisions, our directions of development and our main activities.*" (2011). In this condition, ASOs are strongly focused on an inevitable choice: to define research intensive projects and to explore new potential applications that allow integrating, improving and completing their technical knowledge (either with or without formal protection mechanisms). In summary, they continue to choose "*the natural way for university spin-off firms*" (X, 2011).

5. Conclusions

This study has examined the effect of market orientation on economic and innovation performance of academic spin-off firms, highlighting that two dimensions of the market orientation

construct affect firms' ability to generate technological innovation and economic results. Nevertheless, adopting and implementing a market orientation that confers to firms a competitive advantage and positively affects firms' performance also constitutes a challenge to firms, especially in the presence of specific environmental conditions (such as technological turbulence). In turn, the outcomes of our study offer interesting suggestions to ASOs' managers on how to overcome existing problems and undertake an effective and worthy implementation of a market orientation.

5.1 Managerial implications

The first and foremost implication arising from our analysis concerns the importance of adopting and developing a market orientation for ASOs, because such an orientation allows firms' technological capabilities to be coupled with proper marketing capabilities, thus allowing the full exploitation of the potentialities of the former. Indeed, technological capabilities alone are insufficient to maximize market success and to sustain over time a competitive advantage based upon some innovative offerings. By contrast, a company that is strongly innovative and is endowed with remarkable technological resources and competences may be unable to enjoy a long-term competitive success, because the lack of a market orientation may hurt the firm's ability to identify and satisfy the needs of targeted customers better than direct competitors. At the same time, our study shows that, in order to be effective, such a market orientation has to be practically implemented and converted in a set of practices, processes and routines that permit the proper generation, dissemination and integration of customers' and competitors' information within the firm's boundaries. The simple adoption of the culture of market orientation might not be so effective in generating positive effects on business performance.

Generally speaking, the implementation of a market orientation implies interesting consequences linked to the possibility to identify market opportunities not explored by competitive rivals, and to design innovative products/technologies/solutions that better meet customers' needs. The importance of adopting a market orientation is particularly crucial for ASOs since, being high-tech start-up companies, they operate in an environment characterized by rapid dynamics (i.e., high level of technology turbulence, market uncertainty, and competitive intensity). As highlighted above, in the presence of these external conditions, firms should be able to correctly identify and understand the main characteristics, behaviours and actions of key market forces and players, in order to pursue strategic decisions that allow them to sustain their business performance over time. In turn, it is exactly by collecting and analysing market intelligence about customers, competitors and other relevant entities in the environment, and appropriately integrating them within their strategic decision-making processes, that ASOs might improve their ability to gain returns from innovative activity and competences, by being able to generate a constant flow of innovations, by stimulating the interactions with profitable customers, and by correctly anticipate the moves of main competitive rivals.

Second, our analysis stresses the need to distinguish and evaluate the different impact that individual market orientation dimensions (if opportunely incorporated into ASOs' organizations) have on economic and innovation performance. In this sense, our study reveals that activities of Intelligence Generation, Intelligence Dissemination and Intelligence Integration produce different impacts on economic and innovative performance, depending on the degree of technological turbulence that firms face. Keeping in mind this distinction might become fundamental to address firms' efforts and investments. Indeed, ASOs are often confronted with a limited availability of human, economic, financial and technological resources that are needed to adopt a market orientation approach and implement adequate activities. Deciding on which specific activity/process related to market orientation firms should focus thus becomes key for success. Such decisions should then be modulated according to the level of technological turbulence a firm is facing.

Finally, our analysis highlights another interesting aspect that deserves closer attention as well. The process of implementing a market orientation within an organization is not neither simple nor

costless, but it implies significant organizational challenges. Academic spin-off firms need to assume coherent behaviours and, primarily, reinforce continuously their commitment to the heterogeneous related activities, by allocating (as much as possible) adequate resources to different initiatives that might ensure the benefits expected from a market oriented entity. However, if organizations aim at becoming market oriented, they should focus not only on internal market oriented activities/processes (i.e., information gathering/analysing processes, marketing communication within and across diverse organizational departments). They should also observe, assess and control the expected impact of external environment variables, in order to proactively respond to changes in the marketplace.

5.2 Limitations and future research

The results and the conclusions of this study need to be considered in the light of the following limitations. First, they have to be read in the context of the small sample of companies that we have been able to analyse. Consequently, the results may not be generalized to the universe of ASOs, especially when such companies operate in countries characterized by very different environmental conditions. In turn, our research should be intended as an exploratory study to examine the relationship between the market orientation construct and business performance. Secondly, other measurement scales for both market orientation and innovation could be considered to better integrate the characteristics and peculiarities of academic spin-off companies. With this in mind, we expect to expand and improve the empirical analysis in future research steps.

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Table 1 – Variables' definition

Variable	Definition	No. of items	Cronbach's alpha
Independent variables			
Innov_Perf	Innovation Performance	3	0.750
Econ_Perf	Economic Performance	3	0.781
Main explanatory variables			
Custom_Intel_Gen	Customer Intelligence Generation	8	0.931
Compet_Intel_Gen	Competitor Intelligence Generation	8	0.915
Interf_Coord	Interfuctional Coordination (Coordinated Action)	4	0.929
Intel_Gen	Intelligence Generation	16	0.951
Intel_Dis	Intelligence Dissemination	4	0.886
Intel_Int	Intelligence Integration	4	0.904
Moderating variables			
Mkt_Uncert	Relative market uncertainty		
Competition	Relative competitive intensity		
Tech_Turbol	Relative technological turbulence		
Control variables			
Firm_Age	Firm's age (No of years since foundation)		
Spain	Firm's country (1 = ES; 0 = IT)		
Product_Manuf	Firm's activity including manufacturing of products		
Service_Provider	Firm's activity including provision of R&D-related services		
B2B	Firm's main market = B2B		
B2C	Firm's main market = B2C		
B2PA	Firm's main market = B2PA		

Table 2 – Variables' descriptive statistics and pairwise correlations

Variable	Obs	Mean	Std. Dev.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 Econ_Perf	74	3.023	0.815	1.00																	
2 Innov_Perf	74	3.482	0.734	0.38 ***	1.00																
3 Custom_Intel_Gen	74	5.432	1.443	0.13	0.09	1.00															
4 Compet_Intel_Gen	74	4.742	1.399	0.17	0.21 *	0.77 ***	1.00														
5 Interf_Coord	74	5.368	1.481	0.04	0.14	0.76 ***	0.71 ***	1.00													
6 Intel_Gen	74	5.087	1.337	0.16	0.16	0.94 ***	0.94 ***	0.78 ***	1.00												
7 Intel_Dis	74	4.882	1.485	0.20 *	0.03	0.75 ***	0.74 ***	0.77 ***	0.79 ***	1.00											
8 Intel_Int	74	5.223	1.580	0.07	0.05	0.75 ***	0.75 ***	0.86 ***	0.79 ***	0.81 ***	1.00										
9 Mkt_Uncert	74	3.838	1.205	-0.07	-0.11	0.13	0.03	0.09	0.09	0.01	0 11	1.00									
10 Competition	74	3.716	1.188	-0.14	-0.26 **	0.03	0.07	-0.02	0.06	0.01	0.06	0.30 ***	1.00								
11 Tech_Turbol	74	3.797	1.216	-0.02	0.00	-0.04	0.02	-0.01	-0.01	-0.09	0.05	0.15	0.33 ***	1.00							
12 Firm_Age	71	5.901	5.083	0.02	0.00	-0.06	-0.05	-0.09	-0.06	-0.05	-0 12	0.02	0.09	0.02	1.00						
13 B2B	74	0.622	0.488	0.00	-0.01	0.19 *	0.16	0.11	0.19	0.10	0 27 **	-0.15	0.36 ***	0.12	-0.03	1.00					
14 B2C	74	0.108	0.313	0.12	0.17	-0.09	0.02	0.00	-0.04	0.08	-0.04	0.05	-0.21 *	-0.16	-0.05	-0.45 ***	1.00				
15 B2PA	74	0.230	0.424	0.00	0.02	-0.06	-0.07	-0.05	-0.07	-0.04	-0 13	0.18	-0.25 **	-0.01	0.08	-0.70 ***	-0.19	1.00			
16 Service_Provider	74	0.676	0.346	0.23 **	0.22 *	0.02	0.09	0.01	0.06	0.07	0 12	0.18	0.07	0.02	-0 11	0.12	0.27 **	-0 14	1.00		
17 Product_Manuf	74	0.595	0.411	0.27 **	0.28 **	0.17	0.09	0.18	0.14	0.16	0 14	0.09	0.03	-0.11	-0 18	0.04	0.13	-0.01	0 36 ***	1.00	
18 Spain	74	0.757	0.432	0.03	0.10	0.15	0.21 *	0.12	0.19	0.11	0 31 ***	0.13	0.10	0.09	-0 28 **	0.14	0.20 *	-0 14	0.47 ***	0 36 ***	1.00

*p<0.10, **p<0.05, ***p<0.01.

Table 3 – Impact of MKTOR on economic performance (OLS estimations)

	Coef.	Robust Std. Err.		Coef.	Robust Std. Err.		Coef.	Robust Std. Err.		Coef.	Robust Std. Err.		Coef.	Robust Std. Err.	
Const.	2.787	0.529	***	2.481	0.671	***	2.458	0.742	***	2.388	0.675	***	2.517	0.672	***
Firm_Age	-0.001	0.015		-0.003	0.015		0.002	0.017		0.002	0.018		-0.003	0.016	
B2B	0.023	0.248		-0.016	0.240		-0.045	0.246		0.012	0.278		0.014	0.244	
B2C	0.298	0.260		0.326	0.304		0.234	0.328		0.246	0.334		0.412	0.306	
Spain	-0.223	0.228		-0.273	0.237		-0.210	0.263		-0.222	0.262		-0.260	0.244	
Service_Provider	0.434	0.476		0.442	0.459		0.468	0.513		0.417	0.494		0.392	0.468	
Custom_Intel_Gen				0.117	0.119		-0.012	0.373		-0.179	0.577		-0.057	0.315	
Compet_Intel_Gen				0.120	0.113		-0.241	0.279		0.286	0.365		-0.118	0.339	
Interf_Coord				-0.158	0.101		0.344	0.376		0.051	0.467		0.214	0.221	
Mkt_Uncert * Custom_Intel_Gen							0.026	0.107							
Mkt_Uncert * Compet_Intel_Gen							0.085	0.081							
Mkt_Uncert * Interf_Coord							-0.117	0.094							
Competition * Custom_Intel_Gen										0.082	0.177				
Competition * Compet_Intel_Gen										-0.040	0.100				
Competition * Interf_Coord										-0.062	0.145				
Tech_Turbol * Custom_Intel_Gen													0.052	0.094	
Tech_Turbol * Compet_Intel_Gen													0.057	0.092	
Tech_Turbol * Interf_Coord													-0.101	0.068	
	No. obs. = 71			No. obs. = 71			No. obs. = 71			No. obs. = 71			No. obs. = 71		
	$F_{(5, 65)} = 0.65$			$F_{(8, 62)} = 0.79$			$F_{(11, 59)} = 0.82$			$F_{(11, 59)} = 0.87$			$F_{(11, 59)} = 0.70$		
	R-squared = 0.034			R-squared = 0.086			R-squared = 0.119			R-squared = 0.103			R-squared = 0.112		

$*p<0.10, **p<0.05, ***p<0.01.$

Table 4 – Impact of MKTOR on innovation performance (OLS estimations)

	Coef.	Robust Std. Err.		Coef.	Robust Std. Err.		Coef.	Robust Std. Err.		Coef.	Robust Std. Err.		Coef.	Robust Std. Err.	
Const.	3.344	0.340	***	3.004	0.523	***	2.979	0.552	***	2.828	0.503	***	3.064	0.526	***
Firm_Age	-0.001	0.013		-0.002	0.013		-0.003	0.014		0.005	0.015		-0.002	0.013	
B2B	-0.022	0.229		-0.039	0.226		-0.102	0.232		0.032	0.222		-0.004	0.232	
B2C	0.332	0.261		0.290	0.281		0.325	0.277		0.219	0.275		0.350	0.297	
Spain	-0.128	0.250		-0.175	0.247		-0.159	0.264		-0.109	0.274		-0.152	0.250	
Service_Provider	0.293	0.257		0.369	0.260		0.442	0.295		0.308	0.257		0.311	0.292	
Custom_Intel_Gen				-0.070	0.106		0.422	0.379		-0.216	0.469		-0.425	0.299	
Compet_Intel_Gen				0.136	0.105		0.081	0.313		-0.060	0.373		0.085	0.342	
Interf_Coord				0.010	0.100		-0.371	0.367		0.445	0.410		0.422	0.246	*
Mkt_Uncert * Custom_Intel_Gen							-0.117	0.095							
Mkt_Uncert * Compet_Intel_Gen							0.014	0.080							
Mkt_Uncert * Interf_Coord							0.088	0.086							
Competition * Custom_Intel_Gen										0.048	0.139				
Competition * Compet_Intel_Gen										0.055	0.094				
Competition * Interf_Coord										-0.124	0.125				
Tech_Turbol * Custom_Intel_Gen													0.096	0.081	
Tech_Turbol * Compet_Intel_Gen													0.013	0.087	
Tech_Turbol * Interf_Coord													-0.113	0.072	
	No. obs. = 71			No. obs. = 71			No. obs. = 71			No. obs. = 71			No. obs. = 71		
	$F(5, 65) = 1.18$			$F(8, 62) = 1.12$			$F(11, 59) = 1.01$			$F(11, 59) = 1.73$			$F(11, 59) = 1.11$		
	R-squared = 0.037			R-squared = 0.071			R-squared = 0.118			R-squared = 0.154			R-squared = 0.110		

$*p<0.10, **p<0.05, ***p<0.01.$

Table 5 – Impact of MARKOR on economic performance (OLS estimations)

	Coef.	Robust Std. Err.		Coef.	Robust Std. Err.		Coef.	Robust Std. Err.		Coef.	Robust Std. Err.		Coef.	Robust Std. Err.	
Const.	2.787	0.529	***	2.227	0.669	***	2.308	0.745	***	2.126	0.691	***	2.585	0.657	***
Firm_Age	-0.001	0.015		-0.001	0.014		0.000	0.015		0.001	0.015		-0.002	0.013	
B2B	0.023	0.248		0.075	0.254		0.033	0.264		0.089	0.265		0.062	0.244	
B2C	0.298	0.260		0.185	0.316		0.059	0.344		0.108	0.333		0.260	0.312	
Spain	-0.223	0.228		-0.061	0.230		-0.084	0.240		-0.028	0.241		-0.010	0.211	
Service_Provider	0.434	0.476		0.426	0.421		0.456	0.490		0.462	0.453		0.251	0.393	
Intel_Gen				0.121	0.118		0.094	0.379		0.050	0.293		-0.114	0.261	
Intel_Dis				0.218	0.118	*	-0.111	0.299		0.035	0.410		-0.518	0.334	
Intel_Int				-0.242	0.117	**	0.131	0.413		0.046	0.370		0.603	0.302	*
Mkt_Uncert * Intel_Gen							0.002	0.100							
Mkt_Uncert * Intel_Dis							0.091	0.084							
Mkt_Uncert * Intel_Int							-0.099	0.108							
Competition * Intel_Gen										0.021	0.082				
Competition * Intel_Dis										0.053	0.128				
Competition * Intel_Int										-0.081	0.111				
Tech_Turbol * Intel_Gen													0.061	0.073	
Tech_Turbol * Intel_Dis													0.197	0.098	*
Tech_Turbol * Intel_Int													-0.233	0.087	**
	No. obs. = 71			No. obs. = 71			No. obs. = 71			No. obs. = 71			No. obs. = 71		
	F(5, 65) = 0.65			F(8, 62) = 1.04			F(11, 59) = 0.84			F(11, 59) = 0.83			F(11, 59) = 1.62		
	R-squared = 0.034			R-squared = 0.112			R-squared = 0.132			R-squared = 0.129			R-squared = 0.202		

*p<0.10, **p<0.05, ***p<0.01.

Table 6 – Impact of MARKOR on innovation performance (OLS estimations)

	Coef.	Robust Std. Err.		Coef.	Robust Std. Err.		Coef.	Robust Std. Err.		Coef.	Robust Std. Err.		Coef.	Robust Std. Err.	
Const.	3.344	0.340	***	3.209	0.537	***	3.108	0.595	***	3.039	0.532	***	3.315	0.582	***
Firm_Age	-0.001	0.013		-0.003	0.012		-0.001	0.013		0.003	0.013		0.003	0.012	
B2B	-0.022	0.229		-0.029	0.221		-0.110	0.228		0.047	0.213		-0.008	0.225	
B2C	0.332	0.261		0.427	0.284		0.405	0.281		0.349	0.295		0.518	0.302	*
Spain	-0.128	0.250		-0.155	0.273		-0.154	0.296		-0.103	0.293		-0.113	0.280	
Service_Provider	0.293	0.257		0.231	0.265		0.331	0.311		0.226	0.287		0.111	0.318	
Intel_Gen				0.293	0.112	**	0.354	0.359		-0.018	0.384		-0.356	0.305	
Intel_Dis				-0.173	0.099	*	-0.137	0.284		-0.020	0.399		-0.114	0.349	
Intel_Int				-0.081	0.111		-0.079	0.345		0.178	0.436		0.477	0.275	*
Mkt_Uncert * Intel_Gen							-0.013	0.098							
Mkt_Uncert * Intel_Dis							-0.020	0.082							
Mkt_Uncert * Intel_Int							0.008	0.096							
Competition * Intel_Gen										0.087	0.102				
Competition * Intel_Dis										-0.040	0.110				
Competition * Intel_Int										-0.071	0.125				
Tech_Turbol * Intel_Gen													0.171	0.078	**
Tech_Turbol * Intel_Dis													-0.015	0.089	
Tech_Turbol * Intel_Int													-0.151	0.075	**
	No. obs. = 71			No. obs. = 71			No. obs. = 71			No. obs. = 71			No. obs. = 71		
	F(5, 65) = 1.18			F(8, 62) = 1.96			F(11, 59) = 1.73			F(11, 59) = 2.42			F(11, 59) = 1.64		
	R-squared = 0.037			R-squared = 0.132			R-squared = 0.174			R-squared = 0.204			R-squared = 0.204		

*p<0.10, **p<0.05, ***p<0.01.
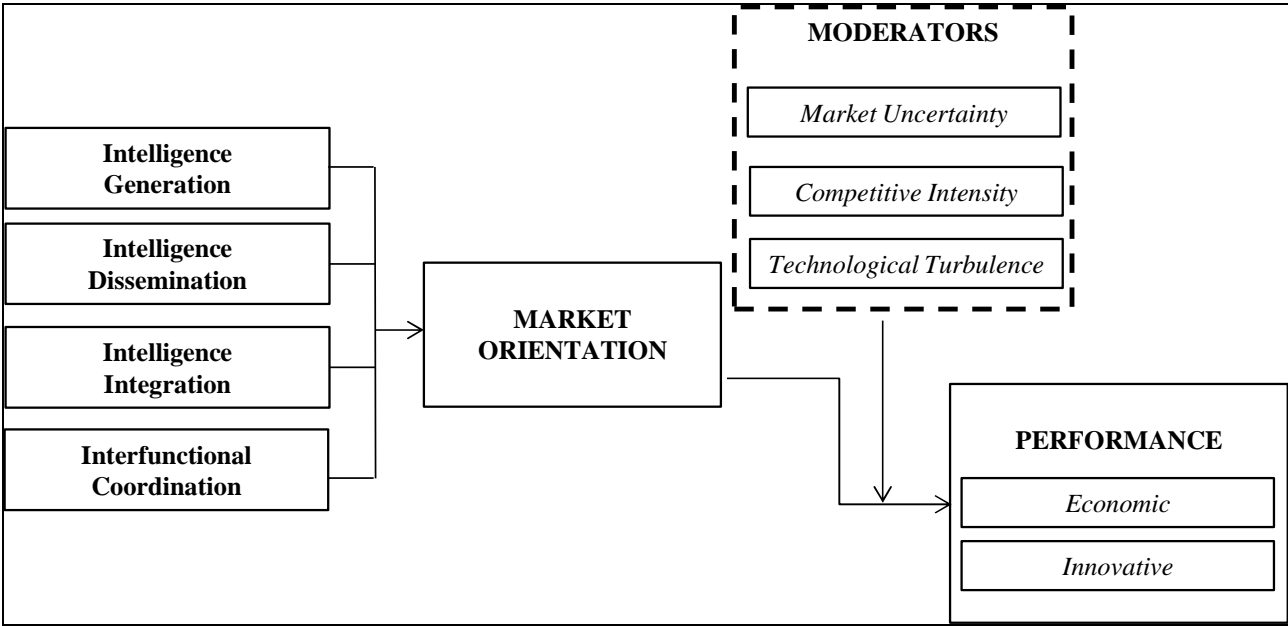
Figure 1 – Theoretical framework
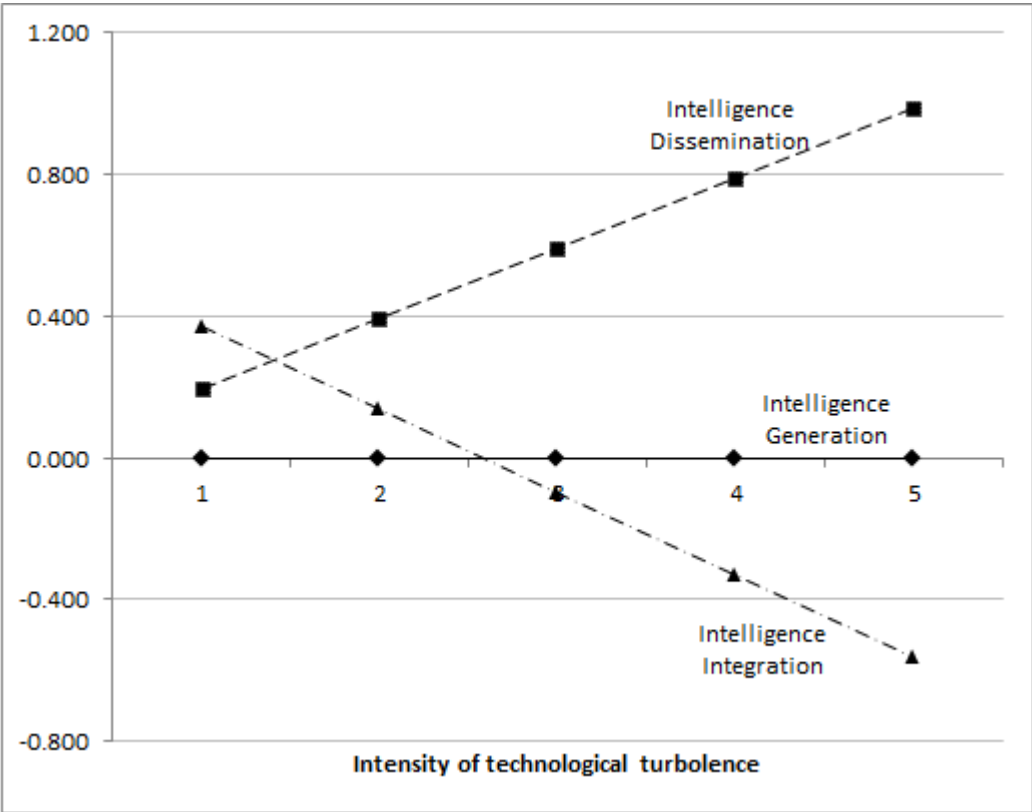
Figure 2 – Impact of MARKOR on ASOs' economic performance

Figure 3 - Impact of MARKOR on ASOs' innovation performance