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**Journal of International
Entrepreneurship**

ISSN 1570-7385

J Int Entrep
DOI 10.1007/s10843-020-00282-4



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The impact of market orientation on university spin-off business performance

Nicoletta Buratti¹  · Giorgia Profumo¹  · Luca Persico¹

Published online: 20 August 2020
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Abstract

Extant literature on the antecedents of university spin-off (USO) business performance has developed with the aim of highlighting those drivers that could foster the performance of such firms, focusing on a variety of factors. Less interest has been devoted to the market orientation–performance relationship, despite the positive link frequently found in the marketing literature. The aim of the present paper is therefore to fill this gap and investigate the relationship between market orientation (MO) and USO performance using the Netval database of Italian research spin-offs. To measure MO, we adopted an ad hoc questionnaire, and after testing its validity with a factor analysis, we performed a regression model. The results show that MO, particularly some of its components (customer intelligence generation, intelligence dissemination, integration and inter-functional coordination), has an impact on business performance. This contribution presents some valuable research implications useful for academics, but professionals from new high-tech ventures and technology transfer offices may also benefit from this knowledge.

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Résumé

Une importante bibliographie sur les antécédents de la performance des spin-off universitaires a déjà été développée, dans le but de mettre en évidence les éléments qui pourraient favoriser la performance de ces entreprises, et en mettant l'accent sur divers facteurs. Malgré le lien positif qui est généralement observé dans la littérature marketing, la relation entre l'Orientation Marché (OM) et la performance a été moins approfondie. L'objectif de cet article est donc de combler cette lacune en examinant la relation entre l'orientation marché et les performances des SOU (Spin-Off Universitaires) de la base de données Netval, dédiée aux spin-off de la recherche italienne. Afin de mesurer l'OM, nous avons adopté un questionnaire ad hoc et, après avoir testé sa validité avec une analyse factorielle, nous avons réalisé un modèle de régression. Les résultats montrent que l'OM a effectivement un impact sur la performance de l'entreprise, en particulier sur certaines de ses dimensions (production de renseignements sur les clients, diffusion de renseignements, intégration et coordination inter-fonctionnelle). Cette étude présente des perspectives de recherche utiles pour les universitaires, mais aussi pour les professionnels des nouvelles entreprises haute technologie et les bureaux de transfert de technologie, qui pourraient bénéficier de ces connaissances.

Keywords University spin-off · Market orientation · Business performance · Academic entrepreneurship · Factor analysis

Mots clés Spin-off universitaire · Orientation Marché · Performance des entreprises · Entrepreneuriat universitaire · Analyse factorielle

JEL classification M13 · M31

Summary highlights

Contributions: The study offers a better understanding of the span of applicability of Market Orientation (MO) concept. While most of the previous studies examined larger companies, our study focuses on university spin-offs (USOs), offering empirical evidence of the positive relationship between MO and business performance in the context of new ventures stemming from academic departments and research laboratories. Moreover, by testing a scale for measuring the level of MO in USOs, it offers a research tool that might be used in future studies on other countries or comparative analyses.

Research Questions: Which dimensions of MO are relevant for USOs? How do the different dimensions of MO affect USO business performance?

Data: Data were collected through a structured questionnaire, built using both MKTOR and MARKOR scales, submitted on-line, via Google Forms, to the population of the Italian University spin-offs surveyed in the Netval database in 2015. A total of 115 USOs completed the survey.

Methods: After the validation of the MO scale through a factor analysis (EFA and CFA), the extracted MO factors have been used in an OLS regression to investigate the impact of MO dimensions on business performance.

Results/Findings: The results show that the MO construct in USOs may be split into four dimensions, but not all the dimensions of the MO construct present the same effect on business performance. In particular, responsive customer intelligence generation (RCIG) and dissemination, integration and inter-functional coordination (DIIC) seem to positively affect business performance; proactive customer intelligence generation (PCIG) reveals a negative impact, while competitor intelligence generation (CIGE) presents a non-significant effect on business performance.

Limitations: The study takes into account only one financial year. Further studies would benefit from using longitudinal analyses. Another limitation is related to the measurement of firms' business performance. Sales revenues to number of employees is a good measure, but in the future, new measures of business performance should be used, not necessarily linked to financial results.

Theoretical Implications: The study adds some reflections within the academic entrepreneurship literature, highlighting the relevance of being market oriented in order to attain better results when exploiting research for commercial purpose. Within the market orientation literature, the study confirms the importance of examining MO in a disaggregated manner and improves the knowledge on its application and measurement in the context of new ventures, such as USOs.

Practical Implications: Results may be useful for both entrepreneurial teams of USOs and technology transfer offices, as they highlight the relevance of being market oriented in order to improve the business performance of this kind of firms.

Public Policy Implications and Recommendations: Support programs aimed at fostering the setting up and development of USOs should provide guidance and assistance to these firms in order to facilitate their adoption of market-oriented attitudes and behaviours.

Introduction

University spin-offs (USOs), which are created with the purpose of commercializing knowledge, technology or research results stemming from a university, are an important subset of start-up firms that are capable of becoming an economically powerful group of high technology companies and therefore attract the attention of policy makers and technology transfer institutions (Shane and Stuart 2002; Heirman and Clarysse 2004; Lerner 2004; O'Shea et al. 2005).

Despite the importance national and local governments attribute to university spin-offs as a driver of local economic development, the analysis of their performance shows high survival rates but slow growth, especially for companies based in the EU, compared with US new technology ventures.

Moreover, difficulties developing and maintaining a sustainable competitive advantage over time appear to be widespread (Di Gregorio and Shane 2003; Mustar et al. 2008; Yagüe-Perales and March-Chordà 2012; Buratti et al. 2014a, b, 2015).

Based on this evidence, some studies have tried to highlight the possible causes of such performance limitations (among others: O'Shea et al. 2005; Wu 2007; Fitza et al. 2009; Helm et al. 2010; Hesse and Sternberg 2017), pointing out, among their weaknesses, the way such firms are run. Often, new tech ventures, especially USOs, are managed more as research laboratories than as real companies, and in particular, scarce attention is given to potential markets and primary actors (customers and competitors), especially in the first years of activity. As some have emphasized, academics may be skilled at innovating within the research domain; yet, this may be of little use for identifying opportunities within the commercial context (Lockett et al. 2005; Rasmussen et al. 2011).

For these reasons, one could argue that to obtain better results, these new ventures should develop a market-oriented perspective towards doing business from the very first years of their lives, which in turn should have a positive impact on business performance.

It is already widely accepted that market orientation (MO) has a positive influence on firm performance (Narver and Slater 1990; Jaworski and Kohli 1993; Pitt et al. 1996; Chang and Chen 1998; Deshpandé 1999; Matsuno and Mentzer 2000; Raju et al. 2000; De Luca et al. 2010).

Unfortunately, although this relationship has been the focus of many studies, little research to date has concentrated on the context of smaller organizations, even though they are important for many European economies (Appiah-Adu 1998; Pelham 2000; Verhees and Meulenbergh 2004; Kara et al. 2005; Keskin 2006; Raju et al. 2011; Polo Peña et al. 2011). Even fewer studies have focused on new tech ventures, such as USOs (Roskos and Klandt 2007; Abbate and Cesaroni 2014; Abbate and Cesaroni 2017; Migliori et al. 2019).

Based on these assumptions, our work aims to address the relationship between MO and business performance using a sample of Italian USOs present in the Netval (Italian Network of Technology Transfer Offices of Universities and Public Research Organizations) database.

We first measured the level of MO through a questionnaire mainly based on scales used in previous studies (Narver and Slater 1990; Narver et al. 2004; Kohli et al. 1993; Mohr et al. 2010; Abbate and Cesaroni 2014). We then tested its validity through an exploratory factor analysis (EFA) followed by a confirmatory factor analysis (CFA), in which the principal dimensions of MO were highlighted. Finally, we controlled the effect of MO on firms' business performance. In particular, as the construct of market orientation has been conceptualized into distinctive components, we inspected the relationship with firms' business performance at the single component level, as has been done in other studies (Han et al. 1998).

The present study contributes to the extant literature on USOs in several ways. First, it offers empirical evidence of the positive relationship between MO and business performance in the context of new ventures stemming from academic departments and research laboratories. This result is not as trivial as one might expect, so we presume that it might be useful for both university-based entrepreneurs and policy makers looking for best practices.

Second, testing a scale for measuring the level of MO in USOs offers insights into a quite unexplored subject and a research tool that might be used in future studies on other countries or in comparative analyses.

Finally, one could argue that our study offers a better understanding of the span of applicability of the MO concept. Most of the previous studies examined larger companies (Narver and Slater 1990; Jaworski and Kohli 1993), and only a few have assessed the level of MO in young tech ventures and academic spin-offs (Roskos and Klandt 2007; Abbate and Cesaroni 2014). Since such types of firms usually work in dynamic and uncertain environments that force them to adopt an outward approach to business management, it is worthwhile studying how MO is conceptualized by such new ventures and its relationship with their business performance.

The remainder of the paper is organized as follows. First, prior studies on USOs and on the relationship between market orientation and firms' business performance are reviewed to develop the research questions. Second, the adopted methodology is specified, and the sample is described: university spin-offs in Italy surveyed by Netval. Third, the results of the analysis, together with a formal discussion of practical implications, are developed. Finally, the limitations of the study and suggestions for further research are summarized.

Conceptual framework

University spin-offs and market orientation

University spin-offs are business ventures (1) that originate from university research laboratories, (2) whose founder(s) choose to work in the private sector (at least partially) and (3) whose primary asset is a core technology transferred from the parent university.

These firms present some distinctive features stemming from the fact that the founders are most often engineers and scientists and that their orientation in running a business is very often influenced by their original motivations and personal status (Perez and Sánchez 2003; Walter et al. 2006). Sometimes, founders manage their business without much assurance of successful commercialization of the technology, as they may be driven by the desire to prove the new technology (technological obsession), and only a few may actually be motivated by the prospect of meeting market needs.

Moreover, university spin-offs based in European countries (and especially in Italy, due to specific legislation regarding the engagement of academics in start-up ventures) may be established to provide employment opportunities to young researchers and collaborators, while professors maintain their academic position at university (opportunistic motivation). For these reasons, the engagement of academic founders in the new start-up is limited, giving rise to so-called "hybrid entrepreneurship" (Nicolaou and Birley 2003), a form of entrepreneurship characterized by a low degree of risk taking and proactiveness.¹

¹ Entrepreneurial orientation (EO) has been traditionally considered a basic component required to obtain superior performance, especially in dynamic and turbulent environments. The literature offers different perspectives and defines the characterizing dimensions of EO (Miller 1983; Covin and Covin 1990; Lumpkin and Dess 1996); following Miller's approach (1983), we can consider EO to be the expression of three basic features: willingness to take risks, innovativeness (focus on innovation as a source of competitive advantage) and proactivity (propensity to beat competitors and actively seek business opportunities). USOs are very often expression of hybrid entrepreneurship characterized by innovativeness but lacking willingness to take risks and proactive business management.

University spin-offs with a technological “obsession” may be tempted to avoid the process of market learning, while those with an “opportunistic” motivation may tend to overlook the relevance of investing in intelligence generation and dissemination activities, as their business is primarily focused on financed R&D projects and research contracts. One of the major consequences is a generalized failure to consider the strategic value of the resources and competencies necessary to commercialize technological innovations (Würmseher 2017) or, even worse, a failure to direct attention towards potential customer needs, market attractiveness and competitive threats.

This is quite surprising, as successful USOs require a mix of technological and marketing competencies. They are set up to market R&D outcomes from university labs, find appropriate applications or even build entire markets *ex novo* (Migliori et al. 2019); they are therefore forced to implement specific activities based on integrating technical and market knowledge (Walsh et al. 2002; Walsh and Linton 2011).

For these firms, being market oriented might be a key driver for surviving in a hostile environment and a source of competitive advantage over time. Such orientation can also be seen as a corporate capability that may facilitate the development of a company’s internationalization strategy, especially in its earlier stages (Armario et al. 2008). This could be particularly important for USOs: companies with such advanced technologies are natural candidates to become born global firms (Pettersen and Tobiassen 2012). By promoting market orientation, managers will facilitate the development of core capabilities that can increase international competitiveness, such as market sensing and customer linking.

Studies on USOs’ success factors have identified, among others, government policies (Liu and Jiang 2001; Budyldina 2018); the characteristics of spin-off processes (Roberts and Malone 1996; Jones-Evans et al. 1998); specific founder qualities (Klofsten and Jones-Evans 2000; Huynh et al. 2017; Hesse and Sternberg 2017); entrepreneurial team formation (Clarysse and Moray 2004); ownership and board composition (Ferretti et al. 2020) and characteristics of technologies, industries and markets (Shane 2001; Nerkar and Shane 2003). The importance of the founder(s) holding an outward-looking attitude, the development of marketing capabilities in the early stage of the new venture’s lifecycle and the importance of absorptive capacity to internalize customer knowledge have been widely emphasized (Vohora et al. 2004; Scaringella et al. 2017), but only a few studies have explicitly addressed market orientation (Table 1).

Among others, we recall Roberts’ studies (1990 and 1992) on new tech-based firms within the Greater Boston area (spin-offs from MIT laboratories), which described their evolution over the first years after foundation, from consulting and R&D contracting towards more product (first) and market (last) oriented businesses. In general, Roberts found a generalized lack of market orientation at the time the company was established. For example, numerous companies in the sample, founded by sophisticated technological entrepreneurs, “presumed” market needs based on their own prejudices or feelings rather than on probes of potential customers. In addition, the majority of founders, in the first 6 months of company life, did not reveal awareness of competition (another important component of market orientation): the entrepreneurs frequently claimed they had no competitors, opining that their own products and services were so unique that no other firms’ products were relevant.

By collecting data about market orientation during three different periods (founding, year 2 and years 5 to 7), Roberts mapped an evolutionary path towards market

Table 1 Overview of the studies on market orientation-related issues in university spin-offs

Market orientation-related issues	Study	Aim	Sample and measures	Results
MO as a characteristic of the new venture's founder(s) leading to strategic actions taken after company formation oriented towards serving customer needs	Roberts (1990)	To explore success and failure determinants of research-based spin-off companies	114 MIT-based spin-offs Time allocation by founders' team towards efforts to sell company products and formal market-related activities	<p>a. A small percentage of technological enterprises begin with an orientation towards their markets and towards serving their customers' needs.</p> <p>b. Many of the companies gradually evolve in this direction, manifesting a shift in both time allocation and formal market-related activities</p> <p>c. As the size of the founding team increases, a greater proportion of their time is spent in efforts to sell the company's products.</p>
MO as an outwards-directed sensitivity of the spin-off founder(s)	Grandi and Grimaldi (2005)	To investigate organizational factors influencing the process by which academics form new ventures that are likely to affect their performance	42 Italian Academic spin-offs Variables refer to the extent to which academic founders were open to new stimuli from the outside before starting the new venture (four items, reflecting their attitudes towards 1. consulting for companies; 2. collaborating with industrial partners; 3. transferring academic knowledge to companies; 4. patenting)	<p>The market orientation of the academic founders and the frequency of their interaction with external agents positively affect business idea market attractiveness at the time of establishing the new venture.</p>
MO in young technology ventures and its interrelationship with entrepreneurial orientation (EO)	Roskos and Klandt (2007)	To explore the construct of MO for new tech ventures, thereby contributing to the overall research in MO by verifying former studies and measures	Survey of 282 wireless application developers in Europe and Israel Reviewed measures from previous works on MO and EO	<p>MO is a one-dimensional construct comprising five distinct dimensions. MO is related to EO, inasmuch as the more entrepreneurial a new venture is, the more emphasis it puts on understanding the market and responding to those insights.</p>

Table 1 (continued)

Market orientation-related issues	Study	Aim	Sample and measures	Results
Commercial knowledge as one of key competencies for obtaining a sustainable competitive advantage	Colombo and Piva (2008)	To deepen our knowledge of the relative strengths and weaknesses of academic start-ups (ASUs) compared with other new technology-based firms (NTBFs)	4 theory-building case studies of Italian academic start-ups	Initial gaps in commercial knowledge and related difficulties in implementing effective strategies to close them may have negative consequences on firm growth
Marketing knowledge and sales skills as key resources/competencies for sustainable growth	Van	Geenhuizen and Soetanto (2009)	To explore the incidence and nature of obstacles to growth in a cross-sectional and longitudinal approach	78 academic spin-offs incubated by Delft University of Technology (the Netherlands) Nature of the obstacles to growth collected by an ad hoc questionnaire
Lack of marketing knowledge and shortage of sales skills represent key obstacles to growth				
MO in academic spin-offs measured by a scale based on mixed building blocks from previous marketing studies	Abbate and Cesaroni (2014)	To analyse whether academic spin-off firms adopt a market orientation and the effect it produces on their economic and innovative performance	74 university spin-off firms (Italian and Spanish) Ad hoc measuring scale	The generation and dissemination of information (on customers and competitors) directly affect firms' ability to gain profits
MO as mediator and moderator in the relationship between an entrepreneurial orientation and performance in university spin-offs	Migliori et al. (2019)	To examine the relationship between entrepreneurial orientation, MO and performance in USOs	162 Italian USOs Ad hoc measuring scale	EO and MO in USOs occur within the same learning process Both support USO performance, but MO cannot occur without EO as an antecedent condition A significant portion of EO's contribution to performance occurs through MO

orientation, manifested in several ways. Firms' use of a direct sales force and sales representatives grew over time, as did their adoption of more formal mechanisms such as marketing departments, sales forecasting and analysis of potential markets. Finally, a greater orientation towards marketing in all its dimensions is especially observable in multi-founder firms, where founders may devote a larger part of their time and efforts in activities other than engineering and technical development. The single founder company instead evolves slowly towards developing the cited characteristics.

More specifically examining the relationship between MO and performance in university spin-offs, an empirical study of 125 major MIT laboratories and academic departments showed that 'more successful companies more often use market connected sources, such as customer requests or suggestion for new product ideas, rather than relying on founder ideas alone'...and... '...companies aware of their competition significantly outperformed their less aware cohorts' (Roberts 1992, 10). In sum, establishing a market orientation early in a firm's life bodes well for its future performance, and companies that attain positive results generally tend to establish separate marketing departments as they grow and prosper.

Thus, empirical research confirms that many marketing-related factors are associated with the later success of emerging technology-based companies, beginning with elements present at the time of company formation and later evidenced by organizational developments and practices post-founding. Therefore, Roberts (1992) considers the strategic transformation towards a marketing orientation essential for the long-lasting success of the new tech-based company.

Useful insights into the relationship between MO and performance in university spin-offs also come from an empirical study conducted by Grandi and Grimaldi (2005) on 42 Italian academic spin-off companies. In this study, the authors consider MO as a behavioural attitude of the new venture's founder, i.e. his (her) habits of being open to new stimuli from the outside, transferring knowledge to the marketplace and collaborating and communicating with companies before starting up the new venture.

In particular, they show the importance of the academic founder holding an outward-looking attitude, so that once acquainted with market requirements, he or she may be able to transfer them into research activities oriented at developing new technologies with higher potential market development, thus defining more attractive business ideas (for investors).

Roskos and Klandt (2007) explored the construct of the MO for new tech ventures using reviewed measures from the work of Kohli et al. (1993) with the aim of pinpointing the interrelationships (if any) with the construct of entrepreneurial orientation (EO). The results defined MO as a one-dimensional construct composed of five distinct dimensions ("intelligence generation on macro environments", "intelligence generation on micro environments", "intelligence generation on customers", "intelligence dissemination" and "responsiveness"). Their research showed that the more entrepreneurial a new tech venture is, the more important it is for the firm to consider its understanding of the market and ability to respond promptly to its dynamics.

In the following years, great attention was given specifically to academic spin-off companies, with the aim of understanding the factors affecting their ability to survive and grow; among others, we review the works conducted by Colombo and Piva (2008) and Van Geenhuizen and Soetanto (2009).

The former study, by focusing on the relative strengths and weaknesses of academic spin-offs compared with other new technology-based firms, showed that their major

weakness consists of the lack of commercial knowledge. As academic spin-offs suffer from greater initial gaps in this area and encounter serious obstacles in implementing effective strategies to close these gaps, they have a kind of relative disadvantage on the market, which could hinder their ability to grow. From this perspective, commercial knowledge is a mix of information about potential customers and competitors, whereas technical knowledge considers the appropriate way to go to market.

The latter study, by exploring the incidence and nature of obstacles to growth in a cross-sectional and longitudinal approach applied to 78 academic spin-offs incubated by Delft University of Technology (the Netherlands), found evidence that market-related obstacles occur most often, with financial and management obstacles in second and third place, respectively. In more detail, a lack of marketing knowledge is the most frequently experienced obstacle, followed by a shortage of sales skills; once again, we found evidence of the importance of adopting an outward-looking approach in managing these firms.

More recently, Abbate and Cesaroni (2014) analysed 74 Italian and Spanish academic spin-offs with the aim of highlighting whether they adopted an MO perspective in running their businesses and the effect it had on their economic and innovation performance. Their study revealed that some components of MO (namely, the generation and dissemination of information about customers and competitors) directly affect firms' ability to develop technological innovations and gain profits; the concept may indeed represent a challenge for spin-off companies and even generate inefficiencies under specific circumstances, particularly when external stimuli require firms to respond quickly.

Finally, Migliori et al. (2019), by examining the relationship between entrepreneurial orientation, market orientation and firms' performance for a cross-sectional sample of 162 Italian USOs, showed that EO and MO occur within the same learning process. Both strategic postures support USO performance, but MO cannot occur without EO as an antecedent condition. At the same time, a significant portion of EO's contribution to performance occurs through MO: the market orientation, in fact, serves a mediating role in the relationship between EO and performance.

To summarize, previous studies on USOs and MO are few and indicate that, in this specific kind of firm, there is a general underestimation of the value of being market oriented when running a business.

However, because university spin-offs operate, by definition, in markets characterized by volatility and uncertainty, we believe that attempting to manage risk by learning the market and responding promptly to market changes to stay ahead of competitors may increase potential rewards. Therefore, higher levels of market orientation should lead university spin-offs to higher performance.

MO and business performance in university spin-offs

The aforementioned studies related to university spin-offs assessed the MO concept mainly through indirect measures and not based on the conventional scales developed by previous literature on market orientation, such as the MKTOR and MARKOR scales (Narver and Slater 1990; Jaworski and Kohli 1993; Kohli et al. 1993). Such scales, although developed in the 1990s, are still widely diffused among scholars studying the concept of market orientation in small firms, who usually integrate the two scales (Ledwith and O'Dwyer 2009; Raju et al. 2011; Kajalo and Lindblom 2015; Leal-Rodríguez and Albort-Morant 2016).

To the best of our knowledge, only Roskos and Klandt (2007), Abbate and Cesaroni (2014, 2017) and Migliori et al. (2019) used a scale to examine the MO concept in new tech ventures, academic spin-offs and USOs, respectively, although only the latter two studies analysed the relationship with business performance.

To justify our approach, it may be useful to briefly recall the mainstream results on MO and performance within marketing studies.

The marketing literature has extensively examined the concept of market orientation, highlighting the effect of MO on business performance and generally showing a positive link. Most of the studies focus on large firms, while less attention has been paid to small- and medium-sized enterprises (SMEs) and even less to new high-tech ventures stemming from universities and public research laboratories. Narver and Slater (1990) defined market orientation as an organizational culture leading to organizational behaviours coherent with the creation of superior value for customers. In their conceptualization of market orientation, three components have been considered: (1) customer orientation, (2) competitor orientation and (3) inter-functional coordination.

Customer orientation expresses the firm's ability to understand its target customer, with the aim of creating superior value for that customer. Competitor orientation refers to the generation of information on competitor strategies and its internal dissemination. Inter-functional coordination indicates the alignment of organizational subunits with market-oriented goals, with a strong focus on effective interaction between marketing and R&D (Narver and Slater 1990; Li and Calantone 1998).

Kohli and Jaworski (1990) instead defined MO by adopting a behavioural approach based on the activities related to its implementation, namely (1) generation of marketing intelligence; (2) dissemination of intelligence across departments and integration into a unified and shared vision of the future and (3) organization-wide responsiveness to intelligence (Kohli and Jaworski 1990; Jaworski and Kohli 1996).

From both perspectives, the operational measures of MO have been developed with the aim of demonstrating the (expected) positive relationship between MO and business profitability, giving birth to a substantial stream of research in the 1990s that explored the antecedents and consequences of market orientation. Generally, the adoption of MO seems to generate higher performance as measured through profitability, sales growth or new product success (Narver and Slater 1990; Ruekert 1992; Deshpandé et al. 1993; Jaworski and Kohli 1993; Slater and Narver 1994b; Atuahene-Gima 1996; Pitt et al. 1996; Deshpandé and Farley 1998; Cano et al. 2004; Liao et al. 2011).

In particular, the relationship between MO and new product success (or, more generally, between MO and firm innovativeness) has been rather controversial: based on empirical studies, some scholars have suggested that being market oriented may lead to R&D strategies focused on minor improvements in existing technologies/products (Christensen and Bower 1996). The answer to this criticism was the development of a valid measure of MO, which consists of two essential sets of behaviours (Narver et al. 2004). The first is a "responsive" market orientation, in which 'a business attempts to discover, to understand and to satisfy the expressed needs of customers'. The second is a "proactive" market orientation, in which 'a business attempts to discover, to understand and to satisfy the latent needs of customers' (Narver et al. 2004, 335). It is the latter, in particular, that tends to be positively related to innovativeness and, ultimately, to better business performance.

It is worthwhile to note that the market orientation–innovation–business performance linkage may be moderated by environmental variables, such as technological turbulence (Kohli and Jaworski 1990), level of market uncertainty (Han et al. 1998) and competitive intensity (Jaworski and Kohli 1993; Slater and Narver 1994a).

Research questions

The above literature review revealed a lack of studies focused on the concept of MO in university spin-offs. In particular, in this specific context, little research exists on the creation and validation of an appropriate scale for measuring MO based on a clear comprehension of the principal dimensions of the MO construct and on the relationship between the different components of MO and business performance.

The entrepreneurship and business venturing literature, which include USOs, rarely use the MO concept, and when these studies do include it, they treat it as an unusual skill of the founder or as a mix of capabilities critical for survival and growth. Marketing management studies focused on these specific firms are nearly absent.

The present study, therefore, tries to advance the extant literature on this theme by exploring the relationship between MO and business performance in university spin-offs. In particular, assuming an interaction between MO and business performance, our aim is to answer the following research questions:

RQ₁: *Which dimensions of MO are relevant for USOs?*

RQ₂: *How do the different dimensions of MO affect USO business performance?*

Research design

The empirical research was based on a structured questionnaire conducted on-line, via Google Forms, to a sample of 919 Italian university spin-offs to evaluate their MO from different points of view. The questionnaire, containing a battery of seven-point Likert scales, was built using both the MKTOR and MARKOR scales (Narver and Slater 1990; Jaworski and Kohli 1993; Kohli et al. 1993), following the previous work of Abbate and Cesaroni (2014) that re-elaborated the scale proposed by Mohr et al. (2010) to adapt it to the specificities of academic spin-offs. Such scales have also been extensively used and integrated for measuring MO in smaller firms (Raju et al. 2011; Kajalo and Lindblom 2015; Leal-Rodríguez and Albort-Morant 2016). In particular, five components of market orientation have been identified: customer intelligence generation (both proactive and reactive), competitor intelligence generation, intelligence dissemination, intelligence integration and inter-functional coordination.

A preliminary version of this MO scale was pretested with the founders of three university spin-offs based in Genoa (Italy) to obtain their perceptions and interpretation of the different items; we were interested, in particular, in understanding the applicability of the items to these unique types of new ventures. Based on their comments, we refined some items and approved the first part of the questionnaire containing the final version of the MO scale and comprising 26 items divided into five sections (see Table 2).

Each section of the MO scale measures a particular dimension of the previously identified concept of MO. In particular, we used eight items for measuring customer

Table 2 Market orientation scale contained in the first part of the questionnaire

Section 1—Customer Intelligence Generation

- Item* 1.1 We continuously work to better understand our customers' needs for new products.
- Item* 1.2 We give close attention to after-sales service.
- Item* 1.3 We want the customer to think of us allies.
- Item* 1.4 We measure customer satisfaction systematically and frequently.
- Item* 1.5 We continuously try to discover additional needs of our customers that they might be unaware of.
- Item* 1.6 We incorporate solutions to unconscious customer needs in our new products and services.
- Item* 1.7 We brainstorm about how customer's needs and preferences will evolve.
- Item* 1.8 We work with lead users-customers who face needs that eventually will be in the market – but do this months or years before the majority of the market.

Section 2—Competitor Intelligence Generation

- Item* 2.1 Employees throughout the organization share information concerning competitor's activities.
- Item* 2.2 Top managers regularly discuss competitor's strengths and weaknesses.
- Item* 2.3 We rapidly respond to competitive actions that threaten us.
- Item* 2.4 We try to anticipate the future moves of our competitors.
- Item* 2.5 We monitor firms competing in related products/markets.
- Item* 2.6 We monitor firms using related technologies.
- Item* 2.7 We monitor firms already targeting our prime market segment but with unrelated products.

Section 3—Intelligence Dissemination

- Item* 3.1 We have interdepartmental meetings to discuss market trends and developments.
- Item* 3.2 Marketing personnel spend time discussing customers' needs with other functional departments.
- Item* 3.3 We share information about major market developments.
- Item* 3.4 When one function acquires important information about customers or competitors it shares that information with other functions.

Section 4—Intelligence Integration

- Item* 4.1 We have cross-functional meetings for the purpose of intelligence integration.
- Item* 4.2 We have cross-functional teams for important initiatives to ensure that all points of view are considered before decisions.
- Item* 4.3 We value collaboration in this business.

Table 2 (continued)**Section 5—Inter-functional Coordination**

<i>Item</i> 5.1	The activities of the different functions in this business are well-coordinated.
<i>Item</i> 5.2	There is a high level of cooperation and coordination among functions in setting the goals for the organization to ensure response to market conditions.
<i>Item</i> 5.3	R&D and business development/marketing personnel frequently interact and communicate.
<i>Item</i> 5.4	R&D and business development/marketing personnel fully collaborate in establishing innovation projects' goals and priorities.

intelligence generation, seven items for competitive intelligence generation, four items for intelligence dissemination, three for intelligence integration and four for inter-functional coordination. The questionnaire items were rated by respondents on a seven-point Likert scale, ranging from one (strongly disagree) to seven (strongly agree).

The second part of the questionnaire asked the respondents to answer three questions related to firm innovativeness, such as, in particular, the number of new products launched on the market in the last 5 years, the number of registered patents and the number of pending patents. Together with this information, we included three questions related to market uncertainty (rate of change in the composition of customers and their preference), competitive intensity and technological turbulence (Kohli and Jaworski 1990; Jaworski and Kohli 1993), as done by Abbate and Cesaroni (2014), to control for environmental uncertainty. The third part included firm-specific information such as industry, firm size (number of employees) and company age (number of years since foundation).

The final version of the questionnaire was published on-line in November 2015 using Google Forms as a website for the on-line survey.

The population for our empirical study consisted of Italian university spin-offs surveyed in the Netval database in 2015 (1330 firms). Based on the existence of the selected firms in the month of November 2015 and the availability of an e-mail address, we selected a list of 919 firms and electronically sent them the questionnaire on November 12, 2015. The survey remained open for 1 month. At the closing date, we collected 115 questionnaires (12.51% response rate).

To assess the relationship between market orientation and business performance, we integrated the dataset originating from the on-line survey with information on business performance gathered from the AIDA Bureau Van Dijk Database; based on the availability of financial data on the AIDA database, the sample was finally composed of 90 university spin-offs.

Analysis and results

Sample profiles

From the geographical point of view, almost all Italian regions are included in our sample (with the exception of Basilicata, Sicilia and Valle d'Aosta). Regarding industry distribution, more than half of the sample belongs to “energy and environment”

(25.6%) and “ICT” (26.7%) industries, while the remaining half belongs to “industrial” (20.0%), “life science” (16.7%) and “social services” (11.0%).

In general, the university spin-offs in the sample have, on average, 4.26 employees and a longevity of 6.09 years; 61 out of 90 firms present a longevity of at least 3 years.

Validation of MO scale

To validate the MO scale and understand whether the MO dimensions stemming from the extant literature are also relevant for USOs, we performed an exploratory factor analysis (EFA) on the 26 items included in the first part of the questionnaire (Table 2). Factors were extracted using the principal component method. The total number of factors (four) was defined using the Keiser criterion, which recommends dropping all factors with eigenvalues under one. In this way, we guaranteed a percentage of cumulative explained variance greater than 64%. To measure the appropriateness of the factor analysis, Bartlett’s sphericity test (p value < 0.001) and the Keiser Meyer Olkin index (KMO = 0.887) were calculated; the results showed that correlations exist in the dataset and are appropriate for factor analysis, as well as that the sampling adequacy is very good.

To simplify the factor structure and make its interpretation more reliable, a Varimax rotation was performed. To check the reliability of the MO scale, we calculated the Cronbach’s alpha among items for each extracted factor.

As reported in Table 3, the factors did not load as predicted. In particular, factor 1 (dissemination, integration and inter-functional coordination—DIIC) included three dimensions of MO (i.e. intelligence dissemination, intelligence integration and inter-functional coordination) and 11 items in total. The internal consistency is excellent, as the Cronbach’s alpha for this factor is 0.936.

Factor 2 (competitor intelligence generation—CIGE) loaded as predicted and contained all the items of section 2 of the questionnaire (competitor intelligence generation). The internal consistency is very good (Cronbach’s alpha = 0.875).

Section 1 of the questionnaires (customer intelligence generation) was split into two different factors. Factor 3 (proactive customer intelligence generation—PCIG) included all items connected to the proactive customer intelligence generation. Its internal consistency is high (Cronbach’s alpha = 0.791). Factor 4 (responsive customer intelligence generation—RCIG) included all items connected to responsive customer intelligence generation. Its internal consistency is also high (Cronbach’s alpha = 0.723).

To confirm the dimensions of MO obtained from the EFA, a confirmatory factor analysis (CFA) was used to test whether the four-dimensional model suggested by the exploratory factor analysis is an acceptable representation of MO. The CFA results confirmed the four-dimensional structure of MO as suggested by EFA. The goodness of fit of the model is acceptable (RMSEA = 0.044, CFI = 0.972, TLI = 0.964).

Testing the impact of MO on business performance

After factor analysis (EFA and CFA), the extracted MO factors were used to investigate the impact of MO on business performance. Thus, an OLS regression was performed to test the impact of MO dimensions (DIIC, CIGE, PCIG, RCIG) on the business performance (REVE) of USOs. In relation to the dependent variable, firm business

Table 3 Results of EFA on the 26 MO scale items

Market orientation measures		Explained variance (%)	Cronbach's alpha	Factor loadings	Mean	SD
Factor 1. Dissemination, integration and inter-functional coordination (DIIC)						
<i>Section 3</i>	Item 3.1	43.60	0.936	0.805	4.643	0.159
	Item 3.2			0.671	4.443	0.150
	Item 3.3			0.574	4.983	0.131
	Item 3.4			0.521	5.461	0.138
<i>Section 4</i>	Item 4.1			0.761	4.252	0.162
	Item 4.2			0.703	4.904	0.166
	Item 4.3			0.731	5.435	0.138
<i>Section 5</i>	Item 5.1			0.743	4.939	0.140
	Item 5.2			0.776	4.974	0.136
	Item 5.3			0.613	5.217	0.148
	Item 5.4			0.584	5.165	0.145
Factor 2. Competitor intelligence generation (CIGE)						
<i>Section 2</i>	Item 2.1	9.10	0.875	0.646	4.70	0.141
	Item 2.2			0.811	4.478	0.140
	Item 2.3			0.650	4.139	0.134
	Item 2.4			0.684	4.539	0.143
	Item 2.5			0.809	4.974	0.142
	Item 2.6			0.730	5.017	0.141
	Item 2.7			0.687	4.487	0.155
Factor 3. Proactive customer intelligence generation (PCIG)						
<i>Section 1b</i>	Item 1.5	7.00	0.791	0.740	5.591	0.122
	Item 1.6			0.674	5.426	0.129
	Item 1.7			0.752	5.296	0.145
	Item 1.8			0.555	5.139	0.138
Factor 4. Responsive customer intelligence generation (RCIG)						
<i>Section 1a</i>	Item 1.1	4.60	0.723	0.695	5.800	0.136
	Item 1.2			0.772	5.417	0.139
	Item 1.3			0.636	6.209	0.117
	Item 1.4			0.445	4.470	0.164

performance, data were obtained from AIDA Bureau Van Dijk Database; it was measured using sales revenues to number of employees, following previous studies (Kirca et al. 2005). As Italian university spin-offs usually present very limited profitability (Iacobucci et al. 2011), we preferred to avoid profitability indexes that could be highly volatile.

Six additional control variables (firm-specific and environmental variables) have been included in the regression analysis, as they have been identified in the extant literature as relevant drivers for USOs' business performance. Some of them are based on firm characteristics, such as industry (INDU) and company longevity (LONG). In

particular, we included five different industry categories (INDU) that enabled us to cluster spin-off companies based on their technological base and prevailing business: energy and environment, ICT, life science, industrial (B2B innovative product and services) and social services. The other set of variables measures environmental uncertainty: market uncertainty (UNCE), competitive intensity (COMP) and technological turbulence (TURB) (Kohli and Jaworski 1990; Jaworski and Kohli 1993; Kirca et al. 2005). Last, we added a measure of innovation (INNO) based on the number of patents (registered and pending) of the companies. Some differences in firms' business performance may result from these variables, so we controlled for each driver to isolate the unique contribution of the market orientation dimensions. All variables have been operationalized as reported in Table 4.

The results of the regression model, reported in Table 5, show an overall high significance (F-statistic = 5.786, p value < 0.001) and good explanatory power (adjusted $R^2 = 0.4114$).

Discussion and practical implications

Regarding the first research question, our study highlights the existence of four MO dimensions relevant for USOs: dissemination, integration and inter-functional coordination (DIIC), competitor intelligence generation (CIGE), proactive customer intelligence generation (PCIG) and responsive customer intelligence generation (RCIG).

In particular, the DIIC dimension combined three previous MO dimensions (i.e. intelligence dissemination, intelligence integration and inter-functional coordination); in effect, university spin-offs could see such dimensions as one, as they usually have, at least in the first years, very simple organizational structures and management functions, with informal methods of communications. Thus, the many dissemination activities and the integration between the different functions of the firm may appear to be less critical among such small companies.

Customer intelligence generation, instead, is split into two different dimensions: PCIG and RCIG. The separation of the two factors is, however, coherent with the results of Narver et al. (2004), which highlighted the bi-dimensional nature of the MO construct. This structure may also derive from the specific features of the business environment, as these firms often operate in very dynamic industries, where the anticipation of customer needs is extremely important and the mere satisfaction of customers' expressed needs may be insufficient to obtain a competitive advantage. Respondents seem aware of the difference between the two and are oriented toward exploring customers' latent needs in a proactive manner.

Regarding the second research question, regression results show that three of the four components, responsive customer intelligence generation (RCIG), proactive customer intelligence generation (PCIG) and dissemination, integration and inter-functional coordination (DIIC), present a significant impact on spin-offs' performance (sales revenues to number of employees).

In particular, RCIG and DIIC positively affect business performance, while PCIG reveals a negative impact. Regarding the positive relationship between DIIC and

Table 4 Definition and operationalization of dependent, independent and control variables

Code	Variable	Operationalization
Dependent variable (business performance measure)		
PERF	Performance indicator	Log transformed ratio of firms' sales revenues to number of employees
Independent variables (market orientation factors)		
DIIC	Dissemination, integration and inter-functional coordination	The operationalization of the four independent variables is based on factor analysis (FA) outcomes. Each variable is calculated as the mean of all items included in the corresponding factor
CIGE	Competitor intelligence generation	
PCIG	Proactive customer intelligence generation	
RCIG	Responsive customer intelligence generation	
Control variables (firm-specific and environmental variables)		
INDU	Firm industry	Categorical variable on five levels: energy and environment, ICT, industrial, life science and social services
LONG	Longevity	Number of years since foundation. Dummy variable: less or equal than 3 years (0), greater than 3 years (1)
UNCE	Market uncertainty	Five-point Likert scale based on question: "Please define the degree of uncertainty of your reference market in the last 3 years"
COMP	Competitive intensity	Five-point Likert scale based on question: "Please define the market competition level in the last 3 years"
TURB	Technological turbulence	Five-point Likert scale based on question: "Please define the degree of technological turbulence in the last 3 years"
INNO	Innovation measure	Number of patents (registered and pending). Dummy variable: no patent (0), more than one patent (1).

Table 5 Regression analysis results

	Estimate	SE	<i>t</i> value	
Intercept	3.358	0.887	3.784	***
Independent variables				
DIIC	0.027	0.013	2.138	*
CIGE	- 0.024	0.017	- 1.381	
PCIG	- 0.125	0.037	- 3.397	**
RCIG	0.132	0.036	3.636	***
Control variables				
INDU_ICT	-1.36325	0.32587	-4.183	***
INDU_Industrial	0.1184	0.37314	0.317	
INDU_life science	-0.89746	0.3769	-2.381	*
INDU_Social	-0.74834	0.43726	-1.711	.
LONG	1.08481	0.25292	4.289	***
UNCE	-0.1514	0.13376	-1.132	
COMP	-0.2999	0.12964	-2.313	*
TURB	0.14956	0.14985	0.998	
INNO	-0.44572	0.25632	-1.739	.
R^2		0.4974		
Adjusted R^2		0.4114		
F-statistic (dof: 13, 76)		5.7860		***

p values codes: $.p < 0.10$; $*p < 0.05$; $**p < 0.01$; $***p < 0.001$

business performance, our results provide evidence of the importance of creating a business environment where all the activities oriented toward creating customer value are coordinated, and collaboration among the different areas is developed. This research outcome follows the previous literature (Narver and Slater 1990; Kohli and Jaworski 1990; Kara et al. 2005) confirming that, again in firms with low levels of organizational complexity, the focus on knowledge dissemination and integration among different functions may be crucial for attaining good performance.

The result related to customer intelligence generation deserves more attention; while, in fact, the factor (RCIG) confirms previous MO studies (Narver et al. 2004), proactive customer intelligence generation seems to negatively affect business performance, which is contrary to the mainstream literature. In this respect, our study seems to reveal that to be successful, university spin-offs should develop new value propositions able to satisfy the needs of potential customers and not merely apply new technologies to existing products/services. At the same time, their proposition must not anticipate too many customers' expectations because more innovative products are more difficult for both existing customers and the market as a whole (potential customers) to appreciate. Moreover, one could argue that companies that are overly focused on anticipating customers' latent needs require significant investments in R&D activities that could hinder the attainment of profitable results in the short term. However, this proposition requires further investigation.

In our study, the acquisition of information relating to competitors' strategic moves, competitor intelligence generation (CIGE), presents a non-significant effect on business performance, with a negative trend. This result may sound quite unconventional, but it seems to be coherent with some previous studies on the topic.

Gatignon and Xuereb (1997), finding similar results in their research on the relationship between MO and innovation performance in different types of industry, suggest: '...a competitive orientation is recommended ...when demand is not too uncertain and in growing markets but should be de-emphasized in highly uncertain markets...'. Similarly, Van Riel et al. (2004), in their study on high-tech services, found that the acquisition of competitive information has a significant negative effect on the likelihood of short-term innovation success. Even if attempts to imitate competitors' successful value propositions are very common, particularly in high-tech services, past research demonstrates that products/services that are not unique and not evidently superior to competitive offerings are prone to failures (Dutta et al. 1999). Moreover, one could also argue that firms overly focused on generating intelligence on competitors may overlook customers' requirements, thereby losing opportunities to satisfy their actual expectations. Finally, underestimating the need to generate competitor intelligence may be connected on university spin-off strategic behaviour: the adoption of niche positioning strategies may protect them, at least temporarily, from direct competition. After all, this strategic behaviour has been highly documented (Roure and Maidique 1986; Roure and Keeley 1990; Arora et al. 2001). New companies in high-tech markets may indeed try to control their destinies by positioning themselves in market niches with low levels of competition, markets in which they anticipate a major role in shaping standards and customer expectations. In sum, we may conclude on this matter that the recommendations for which strategic orientation to emphasize are not unconditional.

The results of this study demonstrate that MO has an impact on the business performance of USOs. More precisely, the analysis conducted indicates that the dimensions of customer intelligence generation and intelligence dissemination, integration and inter-functional coordination influenced the MO of USOs, which, in turn, impacts firm performance as measured by operating variables (sales revenues to number of employees). Therefore, these factors may be considered critical to the success of USOs; their presence in this kind of firm may indicate that entrepreneurs (or the entrepreneurial team) should give attention to the evaluation of customers' needs and expectations and to the assessment of their satisfaction with the product/service delivery system. Seemingly, the analysis suggests that entrepreneurs value the dissemination of information among their staff and that this practice may lead to superior performance through the ability to respond to market change faster than competitors do.

Taking up the second research question, we may conclude that although the relationship between university spin-offs' MO and performance may be more complex than that analysed in this study, our research provides some empirical evidence suggesting that better performance may be achieved by USOs adopting a "market orientation" in running their business. This finding is noteworthy, taking into account that new firms stemming from research and technological development are very often born global, as their market is at least potentially at a global scale. From this perspective, being market oriented may be a key strategic posture for success because it may reduce the risk of strategic choices characterized by intrinsic uncertainty.

Conclusions

In this study, we tried to extend previous literature on university spin-offs with two principal aims: understanding the MO dimensions relevant for USOs, through the development of a valid measuring scale of the MO construct for these specific companies and examining the relationship between MO and business performance. The results show that the MO construct in USOs can be split into four dimensions, but not all dimensions present the same effect on business performance. In particular, responsive customer intelligence generation (RCIG) and dissemination, integration and inter-functional coordination (DIIC) seem to positively affect business performance; proactive customer intelligence generation (PCIG) reveals a negative impact, while competitor intelligence generation (CIGE) presents a non-significant effect on business performance, with a negative trend.

Our study has some limitations, which provide possible starting points for future research. First, our analysis takes into account only one financial year, 2015; future studies should instead consider conducting a longitudinal analysis for a deeper understanding of the relationship between MO and business performance (as in Noble et al. 2002).

The second limitation stems from the measurement of firms' business performance. Sales revenues to number of employees is indeed a better measure than profitability indexes, as university spin-offs usually present very limited profitability, and such indexes can be highly volatile, but in the future, new measures of business performance should be used that are not necessarily linked to financial results. Such results are, in fact, very difficult to reach in the first years following the firm's founding: perhaps the capacity for attracting capital investment from business angels, venture capitalists or private equity funds could constitute a valid alternative measure of business performance in such type of firms.

Finally, our sample is generated by a voluntary self-reporting process that might lead to the inclusion in the analysis of companies that are already biased towards a market orientation and who thus wish to report it.

Despite such limitations, we can draw from this study some insights into the nature and consequences of MO in USOs.

Within the market orientation literature, our study confirms the importance of examining the construct in a disaggregated manner: we are conscious that the components of MO are conceptually linked and should be considered as a whole, but a disaggregated approach enables us to pinpoint the relative value of each component. This is particularly important when analysing a specific kind of firm, such as USO, that shows some unique features from both an organizational and a strategic perspective. Regarding instead the relationship between MO components and USO business performance, our study confirms the importance of both customer intelligence generation and inter-functional coordination, while at the same time showing an unexpected result regarding proactive customer intelligence generation. We may speculate that the risk of over-aggressively anticipating customers' expectations by developing radical innovations is one of the biggest failures for USOs. At the same time, the lack of significance for the competitor orientation dimension is provocative and worthy of further research, but it is coherent with some previous studies on the topic.

Our analysis also adds some reflections within the academic entrepreneurship literature, highlighting the relevance of being market oriented to attain better results when exploiting research results for commercial purposes. Studies on this topic have reported either the hybrid nature of entrepreneurial posture in USOs or the lack of market knowledge and commercial resources as the main motivations for poor performance and slow growth. Our results show more precisely that the ability to identify market opportunities stemming from new technological applications through the satisfaction of actual or latent needs is of paramount importance for survival and growth.

In conclusion, we believe that these findings may be useful for researchers and academics engaged in entrepreneurial initiatives, as the approach adopted in our study lends itself to more precise insights for those who are interested in developing market-oriented organizations aiming at better performance.

Furthermore, we think that our results may also be useful for professionals from new high-tech venture and technology transfer offices, who may use these results to plan and design market-focused actions and support activities that will lead to the improved business performance of USOs.

Acknowledgments The authors want to express their gratitude to Editor-in-Chief Professor Hamid Etemad and to the two anonymous reviewers for comments and suggestions that much helped improving this manuscript.

Authors' contribution Authors equally contributed to this paper.

Funding Information Open access funding provided by Università degli Studi di Genova within the CRUI-CARE Agreement.

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