EDITORIAL ADVISORY BOARD

Guest editorial

Special issue on digital transformations and value creation in management

Introduction

The importance of innovation is manifest. Recently, a hotter issue is moving to global innovation. Global innovation is highly related to competitive advantage. For example, the ability of multinational corporations to leverage their innovation competencies across globally dispersed subsidiaries is a valuable source of competitive advantage (Mudambi *et al.*, 2007). Companies have managed to integrated a globally innovation chain. They have implemented innovation processes crossing borders that provide these companies new source of competitive advantages (Doz *et al.*, 2004). Many high-tech industries need global innovation to develop multiplying effects. For example, global innovation and markets has dramatically impacted software development (Damian and Moitra, 2006). From other perspective, the rise of smart cities in the globalization of innovation networks generate demand from global technology markets, global innovation, global technology transfer and new product co-development (Komninos, 2009).

On the other hand, a basic issue within the field of management concerns the generation, exploitation and sharing of company knowledge (Berry, 2014). A growing body of research addresses how firms can achieve sustainable advantages through using, reconfiguring and extending their knowledge (Cohen and Levinthal, 1990; Eisenhardt and Martin, 2000; Gran, 1996; Kogut and Zander, 1992). The process of innovation depends heavily on knowledge, and the management of knowledge should be a critical part of business operations (Gloet and Terziovski, 2004). Innovation relates to the process of creating and applying new knowledge. Hence, innovation itself is the very central of knowledge management (Gurteen, 1998).

Darroch (2005) states that a firm with a knowledge management capability can use resources more efficiently and so can be more innovative. This addresses the relationship between knowledge management and innovation. The nature of global economic growth has been changed by the speed of innovation. Meanwhile, the complexity of innovation has been increased by growth in the amount of knowledge available to organizations (Du Plessis, 2007). Study also shows that knowledge management capacity plays a mediating role between strategic human resource (HR) practices and innovation performance (Chen and Huang, 2009).

Following the literature, this special issue covers studies ranging from individual level that may affect company innovation and performance, such as soft skills and employee deviant behavior, to company level, such as how brand may attracts job applicants, and to region level, such as the relationship of entrepreneurship and firm creation with region performance, how additive manufacturing may change global business landscape, and the issue of innovations in intellectual property rights management (IPRM). The contributions of these studies are summarized below.

Contributions

The impact has been widely recognized of interpersonal skills and personal characteristics on employability (Heckman and Kautz, 2012; Succi, 2018; Wheeler, 2016). Succi and Wieandt conduct an exploratory study to describe the tools to assess soft skills during the recruitment process, and those to develop soft skills of graduates during their first years on the job. Two symmetrical online questionnaires have been sent to 500 HR managers and 240 graduates of a European business school in both Italy and Germany. The empirical results show that graduates and managers describe differently the use of tools to develop graduates' soft skills. The majority of HR managers state that they use formal training to graduates and that they are involved in the performance appraisal sessions. From the graduate side, only 22 percent agree that they receive formal training and only 26 percent in a performance appraisal process. Based on the finding, it is interesting to ask whose responsibility it is to develop soft skills for employees, graduates themselves, higher education or companies?

Deviant workplace behavior (DWB) violates significant organizational norms and is perceived as threatening to the well-being of an organization (Bennett and Robinson, 2000). Kalemci, Kalemci-Tuzun and Ozkan-Canbolat conduct a study to understand the organizational and supervisory support in the context of employee DWB by examining the employees' cultural value orientations. This study uses fuzzy set/qualitative comparative analysis (fsQCA) to analyze relationships between DWB and perceived organizational support, as well as perceived supervisory support and employees' cultural value orientations. Contrary to conventional statistical analysis, fsQCA can generate multiple relationships, consisting of various combinations of independent variables but leading to the same dependent variable. The multiple relationships can demonstrate different behaviors. This study shows that organizational and supervisory support influences employees' DWB.

The impact of branding activities has increased to include not only consumers but also stakeholders, in particular, employees (King and Grace, 2009; Jiang and Iles, 2011; Xie *et al.*, 2015; Jain and Bhatt, 2015). Santiago explores the relationship between the employer (organization) brand attractiveness and the intention of job hunters to submit a job application to that organization. This study used both quantitative (a questionnaire survey) and qualitative (in-depth interviews) data to investigate the perceptions of future and current employees. The millennial generation respondent supports the multi-dimensionality of employer brand attractiveness, highlighting the importance of economic factors, such as better salary or opportunities for promotion. These factors seem less important to millennials for them to consider future job prospects. However, the results of the qualitative research for current employees show that career progression appears to be crucial.

Huarng (2013) considers it is critical to lower the entrepreneurship risk. Innovations requires an entrepreneur willing to assume the risk involved in launching new products or processes onto the market (Braunerhjelm *et al.*, 2010). Rico and Cabrer intend to examine the factors for the divergences in the economic growth of the Spanish regions. The empirical results show that entrepreneurial capital, understood as both the creation of new firms and entrepreneurship activity, have a positive effect on productive efficiency and can explain the differences in the economic growth of the regions. In addition, human capital and the promotion of innovation act as catalysts for the productive efficiency of the regions.

Additive manufacturing is supposed to change supply chains from global to local (Zeleny, 2012), or disrupt operations of firms along the supply chain (Oettmeier and Hofmann, 2016, Rogers *et al.*, 2016). Öberg intends to explore the development of additive manufacturing from a power dependence perspective. The study is based on the data collected from 620 industry experts representing 102 companies. The result points out how the disruptive characteristics of the supply chain leads to exercised power. The power

struggle provides new insights into how an emerging technology is realized and the effect of protectionism on such attempts.

The global process of strengthening and harmonization of intellectual property rights (IPRs) systems has been intensified recently by the signing chapters with intellectual property provisions and other trade-related issues (Campi and Dueñas, 2019). Ana Modic, Hafner, Damij and Zajc evaluate innovations in IPR databases, techniques and software tools, with an emphasis on selected new developments and their contribution toward achieving advantages for IPRM and wider social benefits. Several industry buzzwords are addressed, such as IPR-linked open databases, blockchain and IPR-related techniques, acknowledged for their contribution in moving toward artificial intelligence in IPRM. The analysis is done by a literature review, web analysis and interviews carried out with some of the top experts from IPR-savvy multinational companies. An examination of existing IPR tools shows they are not yet fully developed, with limited usability for IPRM. After reviewing the techniques, it is clear that the current one is insufficient to fully address artificial intelligence in IPR. Uses of blockchain in IPR show they are yet to be fully exploited on a larger scale.

Kun-Huang Huarng
National Taipei University of Business, Taipei, Taiwan, and

Andrea Rey-Martí
University of Valencia, Valencia, Spain

References

Bennett, R.J. and Robinson, S.L. (2000), "Development of a measure of workplace deviance", *Journal of Applied Psychology*, Vol. 85, pp. 349-360.

Berry, H. (2014), "Global integration and innovation: multicountry knowledge generation within MNC's", *Strategic Management Journal*, Vol. 35 No. 6, pp. 869-890.

Braunerhjelm, P., Acs, Z.J., Audretsch, D.B. and Carlsson, B. (2010), "The missing link: knowledge diffusion and entrepreneurship in endogenous growth", *Small Business Economics*, Vol. 34 No. 2, pp. 105-125.

Campi, M. and Dueñas, M. (2019), "Intellectual property rights, trade agreements, and international trade", *Research Policy*, Vol. 48 No. 3, pp. 531-545.

Chen, C.J. and Huang, J.W. (2009), "Strategic human resource practices and innovation performance – the mediating role of knowledge management capacity", *Journal of Business Research*, Vol. 62 No. 1, pp. 104-114.

Cohen, W. and Levinthal, D. (1990), "Absorptive capacity: a new perspective on learning and innovation", *Administrative Science Quarterly*, Vol. 35, pp. 128-152.

Damian, D. and Moitra, D. (2006), "Guest editors' introduction: global software development: how far have we come?", *IEEE Software*, Vol. 23 No. 5, pp. 17-19.

Darroch, J. (2005), "Knowledge management, innovation and firm performance", *Journal of Knowledge Management*, Vol. 9 No. 3, pp. 101-115.

Doz, Y., Santos, J. and Williamson, P. (2004), "Is your innovation process global", *MIT Sloan Management Review*, Vol. 45 No. 4, pp. 31-37.

Du Plessis, M. (2007), "The role of knowledge management in innovation", *Journal of Knowledge Management*, Vol. 11 No. 4, pp. 20-29.

Eisenhardt, K. and Martin, J. (2000), "Dynamic capabilities: what are they?", *Strategic Management Journal*, Vol. 21 Nos 10–11, pp. 1105-1121.

Gloet, M. and Terziovski, M. (2004), "Exploring the relationship between knowledge management practices and innovation performance", *Journal of Manufacturing Technology Management*, Vol. 15 No. 5, pp. 402-409.

Gran, R. (1996), "Toward a knowledge-based theory of the firm", *Strategic Management Journal*, Vol. 17, pp. 109-122.

Gurteen, D. (1998), "Knowledge, creativity and innovation", *Journal of Knowledge Management*, Vol. 2 No. 1, pp. 5-13.

Heckman, J.J. and Kautz, T. (2012), "Hard evidence on soft skills", *Labour Economics*, Vol. 19 No. 4, pp. 451-464.

Huarng, K.H. (2013), "A two-tier business model and its realization for entrepreneurship", *Journal of Business Research*, Vol. 66 No. 10, pp. 2102-2105.

Jain, N. and Bhatt, P. (2015), "Employment preferences of job applicants: unfolding employer branding determinants", *Journal of Management Development*, Vol. 34 No. 6, pp. 634-652.

Jiang, T.T. and Iles, P. (2011), "Employer-brand equity, organisational attractiveness and talent management in the Zhejiang private sector, China", *Journal of Technology Management in China*, Vol. 6 No. 1, pp. 97-110.

King, C. and Grace, D. (2009), "Employee based brand equity: a third perspective", *Services Marketing Quarterly*, Vol. 30 No. 2, pp. 122-147.

Kogut, B. and Zander, U. (1992), "Knowledge of the firm, combinative capabilities and the replication of technology", *Organization Science*, Vol. 3 No. 3, pp. 383-397.

Komninos, N. (2009), "Intelligent cities: towards interactive and global innovation environments", *International Journal of Innovation and Regional Development*, Vol. 1 No. 4, pp. 337-355.

Mudambi, R., Mudambi, S.M. and Navarra, P. (2007), "Global innovation in MNCs: the effects of subsidiary self-determination and teamwork", *Journal of Product Innovation Management*, Vol. 24 No. 5, pp. 442-455.

Oettmeier, K. and Hofmann, E. (2016), "Impact of additive manufacturing technology adoption on supply chain management processes and components", *Journal of Manufacturing Technology Management*, Vol. 27 No. 7, pp. 944-968.

Rogers, H., Baricz, N. and Pawar, K.S. (2016), "3D printing services: classification, supply chain implications and research agenda", *International Journal of Physical Distribution & Logistics Management*, Vol. 46 No. 10, pp. 886-907.

Succi, C. (2018), "Are you ready to find a job? Ranking of a list of soft skills to enhance graduates' employability", *International Journal of Human Resources Management and Development*.

Wheeler, R.E. (2016), *Soft Skills. The Importance of Cultivating Emotional Intelligence*, Boston Univ. School of Law, Public Law Research No. 16-06, available at https://scholarship.law.bu.edu/cgi/viewcontent.cgi?article=1129&context=faculty_scholarship (accessed February 1, 2018).

Xie, Ch., Bagozzi, R.P. and Meland, K.V. (2015), "The impact of reputation and identity congruence on employer brand attractiveness", *Marketing Intelligence and Planning*, Vol. 33 No. 2, pp. 124-146.

Zeleny, M. (2012), "High technology and barriers to innovation: from globalization to relocalization", *International Journal of Information Technology & Decision Making*, Vol. 11 No. 2, pp. 441-456.

Walk the talk: soft skills' assessment of graduates

Chiara Succi
ESCP European – Torino Campus, Turin, Italy, and
Michaela Wieandt
ESCP Europe Wirtschaftshochschule Berlin, Berlin, Germany

Abstract

Purpose – A fast-changing environment entails several reflections about skills and attitudes required to face the increasing complexity brought by the "glocal, liquid and networked" world in which workers operate (Bauman, 2003; Clarke, 2017). In the literature, an increased attention has been devoted to the impact of interpersonal skills and personal characteristics on employability (Heckman and Kautz, 2012; Succi, 2019; Wheeler, 2016). In this context, the so-called soft skills become of crucial importance, but a lack of academic attention devoted to their development, and a deficit of companies in integrating soft skills in their selection, induction and training processes have been identified (Hurrell, 2016). The paper aims to discuss these issues.
Design/methodology/approach – An exploratory study has been designed to describe the tools in use to assess soft skills, during the recruitment process and those to develop soft skills of graduates, during their first years on the job. In January 2017, two symmetrical online questionnaires have been sent to 500 HR managers and 240 graduates of a European business school, in Italy and Germany.
Findings – Results show that graduates and managers describe differently the use of tools to develop graduates' soft skills. The large majority of HR managers indicate they offer formal training to young graduates and that they are involved in the performance appraisal sessions, while only 22 percent of students confirm they receive formal training and only 26 percent declare to be inserted in a performance appraisal process. Moreover, concerning the assessment of soft skills during the selection process, significant differences between Italian and German companies emerged.
Research limitations/implications – This research constitutes the first step to acknowledge the lack of initiatives devoted to soft skills development, despite their rising importance for the job market.
Practical implications – Findings allow initiating a discussion about a strategic topic in human resources management: whose responsibility is it to develop soft skills? Should graduates, higher education or companies fill the gap? The study can be extended to other types of higher education institutions, and a qualitative research could deepen the understanding of root causes of the differences identified.
Social implications – The impact on youth employment, reduction of labor skills mismatch and improvement of managerial practices could be interesting social implications of the study.
Originality/value – While previous research has predominantly focused on higher education executives and HR managers, this paper's contribution consists in involving young graduates in the reflection on employability.
Keywords Graduate employability, Soft skills, HRM practices, Assessment tools, Development methodologies
Paper type Research paper

1. Introduction

One of the most discussed and controversial debates within the current literature on graduate employability relates to the quality of students and their lack of soft/transferable skills, essential in today's labor market and necessary to increase individual employability (Clarke, 2017; Crossman and Clarke, 2010). The "blame game" has been going on for over three decades between employer groups and higher education with regards to the responsibility of

graduate employability. Employers have blamed and criticized higher education for not preparing students adequately for the current labor market, and thus continuously highlighting students' lack of transferable skills (Hurrell, 2016). Although, throughout the years, higher education institutions (HEIs) seem to have responded to this criticism and progressively addressed this issue, improvements in students' acquisition of transferable competences still seem to be missing. Accordingly, should the soft/transferable skills gap – identified by employers – be attributed to HEIs, graduates or employers themselves due to the adoption of inadequate recruitment and graduate development processes (Hurrell, 2016)? How can we measure soft skills effectively? Whose responsibility is it to develop soft skills? Should graduates, higher education or companies fill the gap?

This paper intends to describe the main practices of companies to assess and develop soft skills. Its main contribution consists in involving young graduates directly in the reflection on their employability and it constitutes a first step to acknowledge the lack of initiatives devoted to soft skills development, perceived by students, despite the rising importance for the job market.

The succeeding section provides a comprehensive definition of the so-called soft skills and shows the increased importance recorded in the literature and in the job market. Then, it describes the different practices, implemented by companies, to assess these "wicked competences" (Knight and Page, 2007). Finally, it outlines the methodologies adopted in organizational settings.

2. Soft skills importance for the job market

It has been argued that, in order to achieve a positional advantage, graduates need to develop and acquire a combination of skills, notably core/hard skills and transferable/soft skills (Clarke, 2017). It is important to note that, over the last decades, research has largely focused on the technical/hard skills and know-how required by the labor market (Balcar, 2016; Eshet, 2004), whereas only limited attention has been devoted to the investigation of soft/transferable competences (Ciappei and Cinque, 2014; Seligman, 2002). This is quite surprising, considering the importance of soft skills in relation to graduate employability. Archer and Davison (2008) pointed out that the International Employee Barometer survey confirmed the importance of soft skills amongst employers. They argue that employers attributed higher importance to soft skills compared to students' higher education qualifications. Similarly, the World Economic Forum identified 10 out of 16 "crucial proficiencies in the 21st century" to be related to employees' soft competencies (Deloitte Access Economics, 2017, p. 1). The following section will thus discuss the notion of soft skills, highlighting the inconsistency in scholars' attempts to define the concept.

There are different ways of defining and classifying "soft skills," notably as life skills (WHO, 1993), transversal skills, generic competences as well as key competencies for a successful life, a well-functioning society (OECD, 2003, 2012) and lifelong learning (European Union, 2006). Life skills, social skills, interpersonal skills, leadership skills, transversal competences, social competences, and meta-competences, are commonly used to refer to the "emotional side" of human beings, in opposition to the intelligent quotient component related to hard skills (Delamare-Le Deist and Winterton, 2005; Shalini, 2013). According to Heckman and Kautz (2012, p. 451), "soft skills [are] personality traits, goals, motivations, and preferences that are valued in the labor market, in school, and in many other domains […]." They are "a mix of dispositions, understandings, attributes and practices" (Yorke, 2006, p. 4). Knight and Page (2007) describe them as wicked competences, as it is very difficult to define them because they can assume different forms in different contexts and they keep developing along the entire lifetime (Ciappei and Cinque, 2014).

A working definition we propose for this paper is taken from Haselberger *et al.* (2012) within the ModEs project (p. 67): "Soft Skills represent a dynamic combination of cognitive and meta-cognitive skills, interpersonal, intellectual and practical skills. Soft skills help people to adapt and behave positively so that they can deal effectively with the challenges of their professional and everyday life." In this instance, soft skills relate to a vast range of interpersonal and social qualities and competences, transferable across economic sectors and industries (Hurrell, 2016; Deloitte Access Economics, 2017). These soft skills include communication, teamwork, problem solving, critical and innovative thinking, creativity, self-confidence, ethical understanding, capacity of lifelong learning, the ability to cope with uncertainty, as well as the willingness to accept responsibility (Andrews and Higson, 2008; Clarke, 2017; Harvey, 2000; Kalfa and Taksa, 2015; Moore and Morton, 2017). The empirical study presented in this paper adopted the list of soft skills defined and extensively described by the ModEs European Project (Table I; Haselberger *et al.*, 2012).

It is argued that the acquisition of these soft skills allows students to better adapt to the organizational culture, take initiative and contribute to organizational success (Harvey, 2000). Similarly, emotional intelligence studies support the hypothesis that interpersonal skills are more likely to predict successful careers (Claxton *et al.*, 2016; Goleman, 1995;

Category	Skill
Personal	1. Being committed to work – make a commitment to the organization and understand its specific characteristics
	2. Being professionally ethical – take actions while bearing in mind the principles and ethics of the profession in daily activities
	3. Being tolerant to stress – show endurance in complicated or stressful situations
	4. Creativity/innovation skills – contribute new ideas to develop improvements in the products or services of the organization as well as in the activities performed in the job
	5. Learning skills –provide a self-assessment of necessary knowledge (theoretical or practical) and take measures to acquire and implement this knowledge
	6. Life balance skills – manage successfully the frequent conflicts between life and work
	7. Self-awareness skills – grasp our real weaknesses and strengths
Social	8. Communication skills – transmit ideas, information and opinions clearly and convincingly, both verbally and in writing, while listening
	9. Conflict management and negotiation skills –conciliate different opinions to reach an agreement that satisfies everyone
	10. Contact network skills – develop, maintain and foster contacts
	11. Culture adaptability skills – carry out managerial and entrepreneurial processes in multicultural environments
	12. Leadership skills – motivate and guide others to get them to contribute effectively
	13. Team-work skills – to build relationships based on participation and cooperation with other people
Methodological	14. Adaptability to changes skills – redirect the course of action to meet goals in a new situation
	15. Analysis skills – draw conclusions and forecasts for the future by acquiring relevant information from different sources
	16. Continuous improvement skills – perform the activities, duties and responsibilities inherent to the job under quality standards and strive for excellence
	17. Customer/user orientation skills – identify, understand and satisfy efficiently the needs of customers
	18. Decision-making skills – make the decisions necessary to achieve objectives quickly and proactively+B18
	19. Management skills – set goals and priorities through the selection and distribution of tasks and resources
	20. Results orientation skills – make organizational efforts profitable while having always in mind the goals pursued

Sources: Haselberger *et al.* (2012); Succi (2019)

Table I.
List of the 20 soft skills utilized in the study

Goleman and Boyatzis, 2008) and are necessary for the development of teamwork, the rapid pace of globalization, the capacity to dialogue in a cross-cultural environment, and the growing need to retain talent in organizations.

Various documents issued by the European Commission (EC, 2012a, b, 2013) as well as a numerous human resources experts (Grugulis and Vincent, 2009; ISFOL, 2012) pointed out that "soft skills" are closely connected with employability, particularly for young graduates entering the labor market. According to these documents, companies need to learn how to assess them effectively during the selection process and more opportunities should be given to young people to develop soft skills.

3. Soft skills assessment

Soft skills became increasingly important in the work place. However, they are not only difficult to define but also complex to assess as selection methods can cover a wide range of different constructs related to soft skills (Cook, 2016). According to research, the most popular selection method related to social and behavioral dimensions of employees' skill sets is interviewing (Dipboye *et al.*, 2012). Looking at soft skill assessment practices, the vast majority of hiring managers use interviews in various forms (Cook, 2016; Hurrell, 2016; Ployhart *et al.*, 2006) despite the fact that the interview as a selection method has its shortcomings with regard to validity and to the many factors possibly influencing its course in a negative way (Barber *et al.*, 1994; Cook, 2016; Ployhart *et al.*, 2006; Johns *et al.*, 2007; Dipboye *et al.*, 2012). However, it is still "one of the most preferred and the most frequently used relative to all other selection procedures" (Dipboye *et al.*, 2012, p. 324). With regard to soft skill assessment, structured interviews correlate highly with applicants' social skills and situational judgement (Cook, 2016, p. 83), while achievement tests "do not adequately capture" soft skills (Heckman and Kautz, 2012, p. 451). Moreover, interviews are widely used when recruiting university graduates (Johns *et al.*, 2007; Keenan, 1995).

In graduate selection, group interactions, role plays and presentations are also frequently used selection methods, often applied in assessment centers for graduate selection (Cook, 2016; Johns *et al.*, 2007; Keenan, 1995). In addition, Johns *et al.* (2007) refer to personality tests as instrument for selecting graduates.

Another instrument that gained importance in graduate recruitment in the last years is video interviewing, especially for international companies who recruit worldwide. Recruiters widely use it in the initial stages of high volume recruitment campaigns to identify strong candidates for later stages of the selection process. Of course, video interviews enable companies to process larger scales of applications and help to save costs and time (Beagrie, 2015). An attractive industry for university graduates, especially from business schools is management consulting. Here, case study interviews are widely used for assessing important soft skills like problem solving, communication and customer orientation (Armbrüster, 2004).

Despite the vast and growing body of research about applicants' reactions to selection methods (Gilliland and Steiner, 2012), there is relatively small research on graduates' experience. Johns *et al.* (2007) report that graduates do not rate selection methods connected to soft skills like communication, team work and critical thinking as useful and important as employers when selecting graduates. These were interviews, personality tests, group discussion and presentation. This may be due to the fact that graduates still underestimate the meaning of soft skills or due to employers' and candidates' different perceptions of selection methods (Cook, 2016; Dipboye *et al.*, 2012).

4. Soft skills development

Now more than ever, individuals and organizations must continuously gain knowledge and develop a new set of skills to remain competitive (Sheikh, 2008). Thus, it is important to

identify the learning/training methodologies available to achieve the objective. "With the ever-changing technological advances of our time and the continual development of learning theories, there are now more options than ever before in how we train people" (Martin *et al.*, 2014, p. 12). Several classifications can be retrieved in the literature considering different learning goals, different content, different audiences or different settings (Bloom *et al.*, 1964; Hackathorna1 *et al.*, 2011; Lonergan, 1990; Merrill, 1994).

Here, the analysis is focused only on the development of soft skills, trying to outline a list of the most appropriate methodologies in use. It is important to distinguish between training/learning in organizations and teaching in K-12 grades or taking courses in postsecondary or continuing education (Martin *et al.*, 2014).

Soft skills are developed through formal and informal activities. Universities recognize formal skill development activities in the classroom and residence halls through ECTS academic credits. The informal skill development activities are non-academic and non-recognized, although the structure of the courses is similar to the previous ones. Soft skills development in the classroom can be performed using mini-curricula, programs, workshops, labs, training sessions, projects, company visits and study journey, and individual or group tasks. "Universities and higher education institutions, as part of the education system, should not educate students only in narrow, knowledge-based specializations, but must go further, seeking the integral education of the person. […] Efforts need to be concentrated on developing transversal skills, or soft skills […]. In order to develop these skills, teaching is not enough: an appropriate environment is also required. For example, extra-curricular activities, whether organized in a university/college/institute environment, ranging from volunteering, culture and the arts, to sports and leisure activities, help develop soft skills and nurture talents" (EC, 2013, p. 36).

Companies, on the other hand, are characterized by different needs (Martin *et al.*, 2014) and they experimented, over time, different mix of educational methodologies and development strategies (Conger and Xin, 2000, p. 96). Learning has to be part of every-day activities. It is important to set participants in a collaborative/competitive environment and they can learn from each other and through the exposure to authentic, complex and real-life problems. Soft skill learning is "meaningful," since it is a willful, intentional, active, conscious, constructive and socially mediated practice that includes reciprocal intention-action-reflection activities. Educational initiatives need to be seen not as a fake reality but as part of the wider culture and as an embodiment of a culture's way of life (Christensen *et al.*, 1992). It is widespread the 70:20:10 learning model, where it is considered that 70 percent is learned informally, on the job, experience based, and through stretch projects and international mobility; 20 percent occurs thanks to coaching and mentoring, and developing through others' feedbacks and performance appraisal processes; finally, 10 percent through formal learning interventions and structured courses (Kajewski and Madsen, 2013).

5. Methodology and research design

The literature review shows a growing interest in soft skills, a difficulty of academic programs to develop them, and the need of companies/employers to "measure" them and to equip graduates with the right skills to face a volatile and complex job market.

This research has thus been designed to comprehend how, on one side, employers perceive the importance of soft skills and structure their recruitment and development processes, and, on the other side, how students/recent graduates perceive the importance of soft skills in finding a job and for future career development. An exploratory study has been developed to achieve the research objectives, combining quantitative (i.e. surveys) and qualitative (i.e. focus groups and interviews) research methods. First, a pilot study has been conducted in Italy followed by the main empirical study conducted both in Italy and Germany. A business school

was selected for the data collection. The school is based in six European countries, counts more than 4,500 students a year in degree programs, and collaborates on a regular basis with a large number of multinational companies.

The first phase of the research was carried out in February 2016 and was intended to verify the interest of the corporate community on the topic and to create a common framework to build further analysis. A pilot survey was sent to a group of Italian HR managers on the occasion of the career day of the business school. Results of the pilot study confirmed that the development of soft skills is a top priority on the agenda of Italian HR managers and, in particular, teamwork, communication, results orientation and learning skills (see Table I) were considered primary skills when assessing and looking to employ young graduates. In their opinion, universities should encourage students to face a wider variety of situations (Succi, 2019). They need to be able to step out of their comfort zone, develop cognitive skills and ultimately apply what they have learned, to work with others and to solve problems.

Following the pilot study with Italian HR managers, the authors decided to investigate the topic more in details and on a larger scale. The second phase of the research was conducted in the period between January and June 2017, with the goal to describe main practices in soft skills assessment and development. Other countries, in which the school is present, in particular Germany, have been included in the study. The enlarged target group was now composed by two populations. On one side, it involved 1,200 currently enrolled masters' students and recent graduates (i.e. no more than two years of experience). On the other side, 800 HR managers were selected, within the network of the school. The e-mail questionnaire was sent out to the target groups for the first time in March 2017, followed by an intense recall phase during the months of April and May.

The questionnaire sent out to employers and students/graduates via e-mail was divided into four subsections: importance and ranking of soft skills; activities to assess soft skills during the recruitment process; learning methodologies to develop soft skills in the induction phase; and demographic information, in order to address the following research questions:

RQ1. Which are the main instruments, used by companies, to assess soft skills in the recruitment process?

RQ2. Which are the most common methodologies, used by companies, to develop soft skills in young graduates?

RQ3. Is there a difference between students/graduates experiences and HR managers' declared practices?

The first section of the questionnaire investigated the importance of soft skills compared to hard skills and proposed the list of 20 soft skills (Table I), divided in three categories, to measure the perceived importance of each of them.

Then, companies were asked to indicate the "assessment instruments" (e.g. observation of group interaction, personality tests, role play/simulation) used in the recruitment process, to test softs skills and the "type of activities" (e.g. coaching, performance appraisal, formal training) they offer to new hires to develop their soft skills in the first two years with the company. Students and graduates were also questioned about the "assessment instruments" in the application process, while only graduates were interrogated regarding the "type of activities" to develop soft skills.

The last section of the questionnaire focused on the collection of demographic data of employers and the companies in which they operate as well as of students' and graduates' work experience. In particular, researchers asked to indicate the area of business, the size and country of the headquarter of each company, plus their level of internationalization.

On the other side, students, and especially graduates, were required to describe in detail the companies of their previous work placement as well as their current job. The online questionnaire was distributed simultaneously to the two populations investigating the same issues. A response rate of 21 percent was obtained with 425 people participating in the study and 300 completing the questionnaire, among which 169 students/graduates and 131 employers.

Description of the sample
Employers participating in the survey were mainly Italian (50 percent) and German (35 percent), and equally distributed between women and men. The large majority (42 percent) is middle or senior managers, and 20 percent of respondents hold a CEO or executive position. In total, 35 percent of respondents were born in the seventies and 33 percent in the eighties (the others are born before 1970). The majority of employers are working for big companies 36 percent (more than 10.000 employees) with international activities (13 percent is headquartered in the USA). Sectors in which companies operate are mainly IT (26 percent), finance (23 percent), insurance and consulting (23 percent), industry and production (16 percent), and FMCG (12 percent).

The other sample is formed by 78 percent of students and by 22 percent of recent graduates. They come mainly from Italy (37 percent) and Germany (46 percent) and from other European countries (17 percent). There is a slight majority of male participants (59 percent). Furthermore, the majority of participating students undertook at least one internship and 44 percent of students have done more than three internships. Almost all participating students have international experience and they either worked in large companies (more than 10.000 employees) or in small ones (below 50 employees). Students mainly worked in industry and production (20 percent), consulting, insurance and finance (21 percent), FMCG (14 percent) or IT, media and digital (12 percent).

A descriptive statistical analysis of the data was conducted to answer the three research questions. First, the two data sets (i.e. companies and students/graduates) have been analyzed separately to calculate the frequency of answers on each component and to identify the most utilized assessment instrument and development activity. As the second step, a χ^2 test has been carried, looking for statistical significant differences between the two data sets. Comparisons have been run also gathering data based on the other variables, such as, country, gender, industry, sector, company size, etc.

6. Results
The large majority of respondents (85.5 percent) – both employers and students – indicated an increased emphasis on soft skills over the last five to ten years and the need for managers and academics to devote more attention to soft skills. It confirms the results of the pilot study and the relevance of the topic for practitioners.

Addressing the first research question (*RQ1*), companies were asked, through an open multiple choice question, to indicate which of the following assessment instruments they use in the recruitment process for "testing" soft skills (i.e. case study, observation of group interactions, one-to-one interview, personality test, presentation, role play simulation, video interviews, and the final option was we do not test for soft skills). Percentage of positive answers allows us to create a ranking of the most utilized tools by companies. One-to-one interview is the most common tool utilized during the selection process to evaluate candidates and their soft skills (92 percent), while video interviews do not seem to be replacing them at the moment (3.6 percent). Case study and observation of group interactions are also implemented by more than 40 percent of respondents to test soft skills (Figure 1).

Concerning development methodologies (*RQ2*), employers were asked to indicate which of the following activities were offered to young graduates by their company (i.e. coaching, feedback and performance appraisal session, formal training and/or workshop, induction seminar, international assignment, mentorship/tutorship activities, special training on the job, and the final option was we do not offer any formal support). A large majority of HR managers indicated feedback and performance appraisal session (80.4 percent) and formal training and/or workshop (78.6 percent) as the principal activity offered to the employee at the beginning of their career path (Figure 2).

Comparing the two samples (*RQ3*), results show that graduates and managers describe very differently the use of tools to develop graduates' soft skills. The large majority of HR managers indicated they offer formal training to young graduates and that they are involved in the performance appraisal sessions, while only 22 percent of students confirm they receive formal training and only 26 percent declare to be inserted in a performance
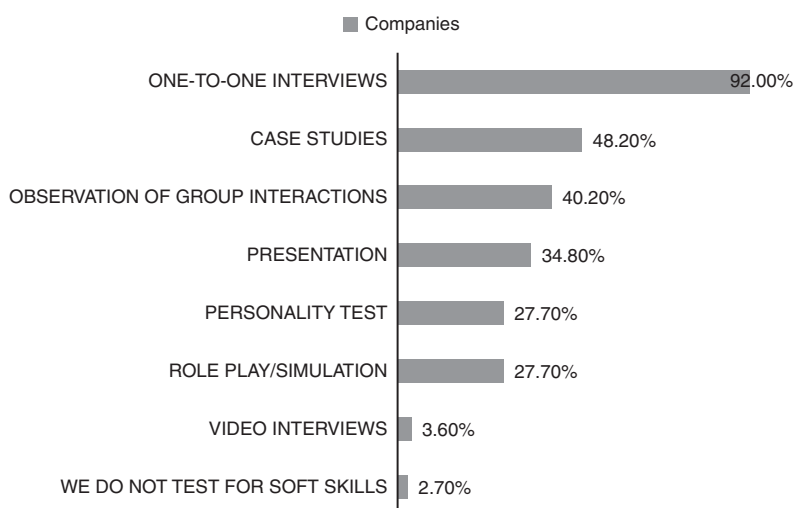

Figure 1.
Ranking of the different assessment instruments based of the percentage of use declared by companies
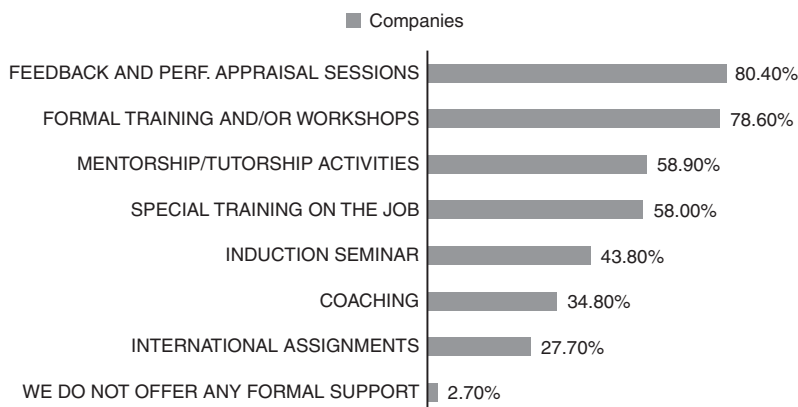

Figure 2.
Ranking of the different activities to develop soft skills based of the percentage of offer declared by companies

appraisal process. Significant differences have been documented on all the activities, providing interesting insights on a clear mismatch between graduates experiences and HR practices (Table II).

Moreover, concerning the assessment of soft skills during the selection process, some significant differences emerged between the two samples and between Italian and German companies. Personality test, for instance, is used by 39 percent of Italian employers and only by 13 percent of German ones.

7. Discussion and further development

This research constitutes the first step to acknowledge the lack of initiatives devoted to soft skills development, despite their rising importance for the job market. Tools and activities utilized to assess and develop soft skills have been deeply investigated, and a better understanding of main practices is offered by the study. Moreover, while previous research has predominantly focused on higher education executives and HR managers, this paper's contribution consists in involving young graduates in the reflection on employability.

Results show a clear difference between the practices declared by employers and the experiences of young graduates. On one side, companies state they propose to new employees a wide range of opportunities to be trained, to receive feedbacks and to be accompanied by mentors and coaches, while, on the other side, graduates indicate a much lower offer provided by companies. Are companies addressing inadequately the huge demand or even making "false promises"? Are graduates expecting too much from companies and not taking the responsibility of their own development?

Future research should investigate further these results in order to gain a better understanding of the reasons causing different perceptions of practices between employers and graduates. For instance, the two groups differ in the level of work experience and tend to belong to a different generation. Moreover, future studies could enlarge the sample through including other student groups, coming from different HEIs, to address the limitations brought by having respondents coming exclusively from one single business school. The point of strength of this study has been also the internationality of the sample, which could even further increased through extending this study to other European or non-European countries.

In conclusion, there are main implications for practitioners working in the field. On one side, employers have to actively participate in developing students', as well as graduates' soft skills; on the other side, academia needs to build stronger partnerships with the industry and work effectively together to guarantee ready-for-the-job graduates. Finally, students and young graduates need to be made aware of their individual responsibility in developing soft skills and in adopting a pro-active role in order to increase their employability.

	Students (%)	Companies (%)	Pearson χ^2	df	Asymp. Sig. (two sided)
Coaching***	17.40	34.80	10.243	1	0.001
Feedback and perf. appraisal sessions***	26.40	80.40	73.397	1	0.000
Formal training and/or workshops***	22.20	78.60	80.33	1	0.000
Induction seminar***	9.00	43.80	41.385	1	0.000
International assignments***	11.10	27.70	11.537	1	0.001
Mentorship/tutorship activities***	18.80	58.90	43.968	1	0.000
Special training on the job***	12.50	58.00	59.621	1	0.000
We do not offer any formal support**	10.40	2.70	5.771	1	0.016

Notes: Significant indicators: *$n \leqslant 0.05$; **$n \leqslant 0.001$; ***$n \leqslant 0.0001$

Table II.
Comparison between graduates and employers' answers

References

Andrews, J. and Higson, H. (2008), "Graduate employability, 'soft skills' versus 'hard' business knowledge: a European study", *Higher Education in Europe*, Vol. 33 No. 4, pp. 411-422.

Archer, W. and Davison, J. (2008), *Graduate Employability: What do Employers Think and Want?*, The Council for Industry and Higher Education, London, available at: www.cihe-uk.com (accessed February 1, 2018).

Armbrüster, T. (2004), "Rationality and its symbols: signaling effects and subjectification in management consulting", *Journal of Management Studies*, Vol. 41 No. 8, pp. 1247-1269.

Balcar, J. (2016), "Is it better to invest in hard or soft skills?", *The Economic and Labour Relations Review*, Vol. 27 No. 4, pp. 453-470.

Barber, A.E., Hollenbeck, J.R., Tower, S.A. and Phillips, J.M. (1994), "The effects of interview focus on recruitment effectiveness. A field experiment", *Journal of Applied Psychology*, Vol. 79 No. 6, pp. 886-896.

Bauman, Z. (2003), *Liquid Life*, Blackwell Publishing, Oxford.

Beagrie, S. (2015), "Video interviewing: the future of recruitment?", *HR Magazine*, available at: www.hrmagazine.co.uk/article-details/video-interviewing-the-future-of-recruitment (accessed February 1, 2018).

Bloom, B.S., Krathwohl, D.R. and Masia, B.B. (1964), "Taxonomy of educational objectives: the classification of educational goals", *Handbook II: Affective Domain*, David McKay, New York, NY.

Christensen, C.R., Garvin, D.A. and Sweet, A. (1992), *Education for Judgment: The Artistry of Discussion Leadership*, Harvard Business School Press, Boston, MA.

Ciappei, C. and Cinque, M. (2014), *Soft skills per il governo dell'agire*, Franco Angeli, Milano.

Clarke, M. (2017), "Rethinking graduate employability: the role of capital, individual attributes and context", *Studies in Higher Education*, Vol. 43 No. 11, pp. 1923-1937, doi: 10.1080/03075079.2017.1294152.

Claxton, G., Costa, A.L. and Kallick, B. (2016), "Hard thinking about soft skills", *Educational Leadership*, Vol. 73 No. 6, pp. 60-64.

Conger, J.A. and Xin, K. (2000), "Executive education in the 21st century", *Journal of Management Education*, Vol. 24 No. 1, pp. 73-101, available at: https://doi.org/10.1177/105256290002400106

Cook, M. (2016), *Personnel Selection: Adding Value through People – A Changing Picture*, John Wiley & Sons, Chichester.

Crossman, J.E. and Clarke, M. (2010), "International experience and graduate employability: stakeholder perceptions on the connection", *Higher Education*, Vol. 59 No. 5, pp. 599-613.

Delamare-Le Deist, F. and Winterton, J. (2005), "What is competence?", *Human Resource Development International*, Vol. 8 No. 1, pp. 27-46.

Deloitte Access Economics (2017), "Soft skills for business success", available at: www2.deloitte.com/content/dam/Deloitte/au/Documents/Economics/deloitte-au-economics-deakin-soft-skills-business-success-170517.pdf (accessed February 1, 2018).

Dipboye, R.L., Macan, T. and Shahani-Denning, C. (2012), "The selection interview from the interviewer and applicant perspectives: can't have one without the other", in Schmitt, N. (Ed.), *The Oxford Handbook of Personnel Assessment and Selection*, Oxford University Press, Oxford, pp. 323-352.

EC (2012a), "An agenda for new skills and new jobs in Europe: pathways towards full employment", European Commission, available at: http://ec.europa.eu/research/social-sciences/pdf/new-skils-and-jobs-in-europe_en.pdf (accessed February 1, 2018).

EC (2012b), "Rethinking education strategy: investing in skills for better socio-economic outcomes", European Commission, available at: http://ec.europa.eu/education/news/rethinking/com669_en.pdf (accessed February 1, 2018).

EC (2013), "Modernisation of higher education", Report on Improving the quality of teaching and learning in Europe's higher education institutions, European Commission, available at: http://ec. europa.eu/education/library/reports/modernisation_en.pdf (accessed February 1, 2018).

Eshet, Y. (2004), "Digital literacy: a conceptual framework for survival", *Journal of Educational Multimedia and Hypermedia*, Vol. 13 No. 1, pp. 93-106.

European Union (2006), "Key competences for life long learning, recommendation the European Parliament and the Council of 18th December 2006", *Official Journal of the European Union*, (2006/962/EC), L394/10-18, available at: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri= celex:32006H0962 (accessed February 1, 2018).

Gilliland, S. and Steiner, D.D. (2012), "Applicant reactions to testing and selection", in Schmitt, N. (Ed.), *The Oxford Handbook of Personnel Assessment and Selection*, Oxford University Press, Oxford, pp. 629-666.

Goleman, D. (1995), *Emotional Intelligence*, Bantam, New York, NY.

Goleman, D. and Boyatzis, R. (2008), "Social intelligence and the biology of leadership", *Harvard Business Review*, Vol. 86 No. 9, pp. 74-81.

Grugulis, I. and Vincent, S. (2009), "Whose skill is it anyway? 'Soft' skills and polarization", *Work, Employment and Society*, Vol. 23 No. 4, pp. 597-615.

Hackathorna1, J., Solomonb, E.D., Blankmeyerb, K.L., Tennialb, R.E. and Garczynskib, A.M. (2011), "Learning by doing: an empirical study of active teaching techniques", *The Journal of Effective Teaching*, Vol. 11 No. 2, pp. 40-54.

Harvey, L. (2000), "New realities: the relationship between higher education and employment", *Tertiary Education & Management*, Vol. 6 No. 1, pp. 3-17.

Haselberger, D., Oberheumer, P., Perez, E., Cinque, M. and Capasso, D. (2012), *Mediating Soft Skills at Higher Education Institutions, Handbook of ModEs Project*, Education and Culture DG Lifelong Learning Programme, European Union, Brussels.

Heckman, J.J. and Kautz, T. (2012), "Hard evidence on soft skills", *Labour Economics*, Vol. 19 No. 4, pp. 451-464.

Hurrell, S.A. (2016), "Rethinking the soft skills deficit blame game: employers, skills withdrawal and the reporting of soft skills gaps", *Human Relations*, Vol. 69 No. 3, pp. 605-628.

ISFOL (2012), "Rapporto ISFOL 2012. Le competenze per l'occupazione e la crescita", ISFOL, Rome.

Johns, R., Teo, S. and Harrington, K. (2007), "Pick me! Perceptual differences of graduate recruitment and selection methods", *Employment Relations Record*, Vol. 7 No. 1, pp. 1-10.

Kajewski, K. and Madsen, V. (2013), "Demystifying 70:20:10", *Deakin Prime*, available at: http:// deakinprime.com/media/47821/002978_dpw_70-20-10wp_v01_fa.pdf (accessed February 1, 2018).

Kalfa, S. and Taksa, L. (2015), "Cultural capital in business higher education: reconsidering the graduate attributes movement and the focus on employability", *Studies in Higher Education*, Vol. 40 No. 4, pp. 580-595.

Keenan, T. (1995), "Graduate recruitment in Britain: a survey of selection methods used by organizations", *Journal of Organizational Behavior*, Vol. 16 No. 4, pp. 303-317.

Knight, P. and Page, A. (2007), "The assessment of 'wicked' competences", Report to the Practice Based Professional Learning Centre, available at: www.open.ac.uk/opencetl/sites/www.open. ac.uk.opencetl/files/files/ecms/web-content/knight-and-page-(2007)-The-assessment-of-wicked-competences.pdf (accessed February 1, 2018).

Lonergan, B. (1990), "Understanding and being: the Halifax lectures on insight", in Morelli, E.A. and Morelli, M.D. (Eds), *Collected Work by Bernard Lonergan, Book 5*, University of Toronto Press, Toronto.

Martin, B.O., Kolomitri, K. and Lam, T.C.M. (2014), "Training methods: a review and analysis", *Human Resource Development Review*, Vol. 13 No. 1, pp. 11-35.

Merrill, M.D. (1994), *Instructional Design Theory*, Educational Technology, Englewood Cliffs, NJ.

Moore, T. and Morton, J. (2017), "The myth of job readiness? Written communication, employability, and the 'skills gap' in higher education", *Studies in Higher Education*, Vol. 42 No. 3, pp. 1-19.

OECD (2003), "Definition and selection of competencies: theoretical and conceptual foundations (DeSeCo)", Summary of the final report Key Competencies for a Successful Life and a Well-functioning Society, OECD Publishing, Paris.

OECD (2012), *Better Skills, Better Jobs, Better Lives: A Strategic Approach to Skills Policies*, OECD Publishing, Paris.

Ployhart, R.E., Schneider, B. and Schmitt, N. (2006), *Staffing Organizations: Contemporary Practice and Theory*, Lawrence Erlbaum Associates, London.

Seligman, M.E.P. (2002), *Authentic Happiness: Using the New Positive Psychology to Realize your Potential for Lasting Fulfilment*, Free press, New York, NY.

Shalini, V. (2013), *Enhancing Employability @ Soft Skills*, Pearson, Chandigarh, Delhi and Chennai.

Sheikh, S.A. (2008), "Use of new knowledge and knowledge management to gain competitive advantage", *Communications of the IBIMA*, Vol. 1 No. 1, pp. 34-41.

Succi, C. (2019), "Are you ready to find a job? Ranking of a list of soft skills to enhance graduates' employability", *International Journal of Human Resources Management and Development*.

Wheeler, R.E. (2016), "Soft skills. The importance of cultivating emotional intelligence", Boston University School of Law, Public Law Research, Vol. 16 No. 6.

WHO (1993), "Life skills education in schools", *Skills for Life*, No. 1, Geneva.

Yorke, M. (2006), *Employability in Higher Education: What it is – What it is Not*, Learning and employability series 1, The Higher Education Academy, York.

125

Corresponding author
Chiara Succi can be contacted at: csucci@escpeurope.eu

Employee deviant behavior: role of culture and organizational relevant support

R. Arzu Kalemci
Cankaya Universitesi, Ankara, Turkey
Ipek Kalemci-Tuzun
Baskent Universitesi, Ankara, Turkey, and
Ela Ozkan-Canbolat
Cankiri Karatekin Universitesi, Cankiri, Turkey

Abstract

Purpose – The purpose of this paper is to increase the knowledge and understanding of organizational and supervisory support in the context of employee deviant workplace behavior (DWB) by examining the potential associations of employees' cultural value orientations. This paper aims to: clarify DWB; review perceived organizational support (POS) and perceived supervisory support (PSS); discuss the meaning of employees' cultural value orientations (individualism–collectivism, power distance and paternalism); use the fuzzy logic model to analyze relationships between DWB and POS, as well as PSS and employees' cultural value orientations.
Design/methodology/approach – This research applies a fuzzy-set qualitative comparative analysis.
Findings – The results show the role of employee perceived organizational and supervisory support and cultural dimension (power distance and paternalism) configurations on employee DWB.
Originality/value – The main originality of this study is to further increase the understanding of organizational and supervisory support in the context of employee DWB by examining the potential associations of employees' cultural value orientations. This study extends the previous research by providing evidence that organizational and supervisory support influences employees' DWB.

Keywords Cultural orientation, Perceived organizational support

Paper type Research paper

1. Introduction

Deviant workplace behavior (DWB), a voluntary behavior, violates significant organizational norms and, in so doing, is perceived as threatening to the well-being of the organization or its members (Bennett and Robinson, 2000). DWB gained attention from organizational behavior researchers with its negative psychological, social and tangible consequences for employees and organizations. Destructive behavior and constructive behavior are two types of DWBs discussed in literature (Bennett and Stamper, 2001). This study emphasizes and highlights destructive deviant behavior.

Upon review of relevant literature, it can be said that the effects of supportive organizational practices on DWB are an interesting area despite the extant evidence on the effect of organizational support on employee attitudes and behavior, including organizational commitment, job satisfaction, organizational citizenship behavior, turnover intention and job performance (Eisenberger *et al.*, 1986, 1990; Maertz *et al.*, 2003; Payne and Huffman, 2005; Tuzun and Kalemci, 2012; Tuzun *et al.*, 2016). Influence of a supportive

organizational climate on employee work performance is best explained by the social exchange theory (Blau, 1964; Gouldner, 1960).

Based on the social exchange theory, Eisenberger *et al.* (1986) developed the concept of perceived organizational support (POS) to understand employee–employer exchange relationships. POS refers to an individual's perception of how much the organization values employees' contributions and cares about their well-being. Organizational support theory adopts Levinson's (1965) view that employees perceive their supervisors as representatives of the organization. Employees may engage in exchange relationships with supervisors that differ from their experience with the organization (Eisenberger *et al.*, 1986; Levinson, 1965). In this manner, perceived supervisory support (PSS) refers to employee views about the extent to which a supervisor values contributions and care about their well-being (Kottke and Sharafinski, 1988). Greater social exchange with the effective application of organizational practices can be associated with stronger employee commitment, better work performance, lower turnover intention and violated behavior (Geddes and Baron, 1997; Geddes and Callister, 2007; Shore *et al.*, 2009). The logic behind work performance and deviant behavior is similar when employees feel they have not found support from both the organization and supervisor. In turn, employees develop negative attitudes and demonstrate negative behavior toward the organization. Negative attitudes and behaviors may cause employees to act against the organization (Dailey and Kirk, 1992; Skarlicki and Folger, 1997).

Although there is an apparent generalizability of social exchange theory, there are significant differences in the application of the social exchange in cultures with different value orientations. This is especially true in a relationship between two people. One of the most cited perspectives of cultural values comes from Hofstede's (1984) four dimensions, which explain differences between cultures. These are: power distance, individualism–collectivism, masculinity–femininity and uncertainty avoidance. In addition, psychologists have dealt with a range of values varying across and within cultures, including individualism–collectivism, power distance, masculinity–femininity and uncertainty avoidance (Hofstede, 1980; Schwartz, 1992; Tyler *et al.*, 2000). Accordingly, paternalistic relationship was nourished from the national cultural dimensions identified by Aycan *et al.* (2000).

Although past studies used value scores to identify the characteristics of entire cultures, researchers recognize that value orientations can also be used to reflect an individual's characteristics (e.g. Triandis, 1995). The focus of this prospective research is to moderate the effect of individual-level cultural values on social exchange relationships in organizational settings, as well as cultural values operationalized in the individual and the organizational domain (Dorfman and Howell, 1988).

This paper aims to: clarify DWB; review POS and PSS; discuss the meaning of employees' cultural value orientations (individualism–collectivism, power distance and paternalism); and use the fuzzy logic model to analyze relationships between DWB and POS, as well as PSS and employees' cultural value orientations.

2. Perceived organizational and supervisory support relations with employee DWB

Organizational norms are generally composed of expected behaviors, languages and principles (Coccia, 1998). Organizations express various behaviors, which eventually construct organizational norms (Appelbaum *et al.*, 2007). A group of terms associated with deviance has evolved with normal work behavior breaching the norms of the organization. These are defined as antisocial behaviors (Robinson and O'Leary-Kelly, 1998), organizational misbehaviors (Vardi and Wiener, 1996), non-complaint behaviors (Puffer, 1987), workplace deviance (Robinson and Greenberg, 1998) and dysfunctional work behaviors (Griffin *et al.*, 1998). Each term reflects a different pattern of behavior. Indeed, this lack of agreement requires researchers to use different theoretical frameworks to explain types of behavior.

A typology of behaviors (including the mentioned behaviors) has been developed by Robinson and Bennett (1995). Therefore, this paper focuses on the construct of DWB as defined by Robinson and Bennett (1995). This typology provides comprehensive information for the researchers to discuss their arguments in an organized manner (Everton *et al.*, 2007, p. 119; Yoo *et al.*, 2013). Accordingly, Robinson and Bennett (1995, p. 556) defined organizational deviant behavior as "voluntary behavior that violates significant organizational norms and in so doing threatens the well-being of an organization, its members, or both."

The theoretical framework of social exchange explains why employees want to participate in positive behaviors and why employees prefer to avoid negative behaviors when providing support and resources to their employing organization. According to social exchange theory, individuals act with the belief that the receiver will return the received benefit in a similar manner (Blau, 1964; Gouldner, 1960; Cropanzano and Mitchell, 2005). Based on the social exchange theory, Eisenberger *et al.* (1986) developed the theory of POS to understand employee–employer exchange relationships. POS refers to an individual's perception of how much the organization values their contributions and cares about their well-being. Consistent with the POS approach, employees balance their exchange relationships with their organizations. Studies show that a high level of POS leads to increased affective commitment and citizenship behavior (Eisenberger *et al.*, 1990; Hayton *et al.*, 2012; Kurtessis *et al.*, 2015; Rhoades *et al.*, 2001), reduced absenteeism and lower levels of intention to quit (Eisenberger *et al.*, 1986; Tuzun and Kalemci, 2012; Wayne *et al.*, 1997) and less deviant behavior (Geddes and Stickney, 2011; Van Emmerik *et al.*, 2007). According to these studies, employees may continue an exchange relationship with both the organization and their immediate supervisor (Settoon *et al.*, 1996; Wayne *et al.*, 1997). It also means that employees who perceive managers as representatives of the organization (Eisenberger *et al.*, 1986; Levinson, 1965; Shoss *et al.*, 2013) may engage in exchange relationships with supervisors.

According to Kottke and Sharafinski (1988), PSS refers to employee views about the extent to which supervisor values employees' contributions and cares about their well-being. Research indicates that supportive practices from supervisors cause favorable outcomes for both employees and the organization, including reduced stress and improved performance (Rhoades and Eisenberger, 2002; Shoss *et al.*, 2013). The idea that supportive practices affect work-related attitudes and behavior through employees' perceptions or experiences is supported by the social exchange theory (Blau, 1964; Eisenberger *et al.*, 1986). The link between organizational support and DWB by employees is possible because social exchange theories assert that relationships are built around norms of reciprocity (Gouldner, 1960). The theory argues that employees' perception of support, whether from the organization or supervisor, is reciprocated back to the organization (Allen *et al.*, 2003). Given this claim of social exchange theory and reciprocity, it is possible to link organizationally relevant support and DWB by employees (e.g. Tuzun *et al.*, 2016):

H1a. POS is related to DWB.

H1b. PSS is related to DWB.

3. Employee cultural orientations relations with employee DWB

It has been observed that the application of social exchange theory to cultures with different value orientations has significant differences, particularly in terms of the view of an individual relationship with others. Related literature suggests that cultural differences lead to differences in management practices (Bame-Aldred *et al.*, 2013; Newman and Nollen, 1996; Trompenaars and Hampden-Turner, 2004).

One of the most mentioned perspectives on cultural differences is developed by Hofstede (1984), who highlights a need for international managers to understand cultural systems

unique to a country. In fact, related studies show that management's effectiveness is culturally specific; management techniques appropriate for one national culture may not be appropriate for another culture (Hofstede, 1984; Kateb *et al.*, 2014). In fact, previous studies show that differences in national culture provide an important explanation for different compensation (Schuler and Rogocsky, 1998) and recruitment (Milikic, 2009) practices of countries. Accordingly, Aycan (2005) found that Hofstede's (1984) three cultural dimensions (uncertainty avoidance, individualism/collectivism, and power distance) influence job analysis and outcomes (i.e. job description and job specification).

According to Hofstede (2005, p. 76), "individualism pertains to societies in which the ties between individuals are loose: everyone is expected to look after himself or herself and his or her immediate family and collectivism as its opposite pertains to societies in which people from birth onward are integrated into strong, cohesive in-groups, which throughout people's lifetimes continue to protect them in exchange for unquestioning loyalty." While Hofstede (1984) saw individualist cultures as prioritizing personal goals and self-actualization, collectivist cultures prioritize family and groups, with the culture seeking satisfaction from a respectable job as defined by the group rather than by oneself. Individualist cultures prioritize individual goals over those of the group. On the contrary, those in collectivist cultures significantly consider their relations (Triandis, 2001). Despite country differences, this dimension may have significant within-country differences (Oyserman *et al.*, 2002). Individualism and collectivism, as important cultural dimensions, help to explain and clarify cultural differences with the assumption that people in the same culture are largely homogeneous. However, according to the literature, under different conditions, people selectively shape their attitudes and preferences from both individual and collectivistic cognitive structures (Triandis, 1995).

Thus, it would be misleading to assume that everyone in a collectivistic culture is a collectivist or everyone in an individualistic culture is an individualist. There is considerable evidence to suggest that distinctions between collectivist and individualist exist in the form of individual differences within cultures, and that the defining characteristics of individualism and collectivism exist at the individual level (Wasti, 2003). When measured at the individual level, individualism and collectivism are referred to as idiosentrism and allocentrism (Wasti, 2003), or individualistic and collectivistic values, respectively (Ramamoorthy and Carroll, 1998; Ramamoorthy and Flood, 2002, 2004). Consistent with these suggestions, this paper treats individualism and collectivism as a variable to differentiate individuals.

In the organizational context, individualism and collectivism describe the relationships of employees with coworkers, work teams, working groups, supervisors and the organization. Individuals with collectivist values define themselves as members of the group (Earley and Gibson, 1998; Triandis, 1995). Collectivists often see themselves as embedded in the social context as they seek close, long-term relationships. Within the working environment, the interpersonal harmony is important for the collectivist. On the other hand, the individualist sets up relationships with the organization in a calculative manner. Employees with individualistic values need a stronger freedom and establish low-context, unemotional relationships. According to Wagner (1995), employees with individualistic values view the self as separate from others, with an emphasis on personal achievements and goals. Employees with individualistic values cooperate with the working group as a tool to achieve individual goals which cannot be achieved through individual work (Ramamoorthy and Flood, 2002).

Employees with high values of collectivism expect beneficial behaviors with the organization, such as organizational citizenship behavior (e.g. Van Dyne *et al.*, 2000). It is important to emphasize the effect of groups in the workplace when evaluating DWB within the organization (Robinson and O'Leary-Kelly, 1998). Individuals with collectivist values aim to establish harmonious interpersonal relationships within the group (Kim *et al.*, 1994). Collectivists want to achieve group success vs individual success. On the other hand,

employees with high individual values focus on personal interests and self-satisfaction. Nevertheless, highly individualistic employees perceive heterogeneity within the group as a positive factor to increase group effectiveness (Sosik and Jung, 2002). According to Kim and Markus (1999), uniqueness can be perceived as a form of DWB in collectivist cultures because these cultures emphasize harmony and individual responsibility within a group (Fiske *et al.*, 1998; Markus *et al.*, 1997; Triandis, 1995). Collectivist orientation with organizational support in terms of POS and PSS has an interrelatedness relationship with DWB:

H1c. Employees' individualist/collectivist orientation is related to DWB.

Although individualism and collectivism variables influence employee response to organizational support, this paper argues that power distance is also critical due to its focus on understanding how employees reciprocate in situations with more (or less) powerful exchange partners. According to Hofstede (2005, p. 46), "power distance can be defined as the extent to which the less powerful members of institutions and organizations within a country expect and accept that power is distributed unequally." Although Hofstede (1980) introduces cultural values on the societal level, researchers find that a majority of studies investigate Hofstede's cultural values at the individual level rather than the societal level (Farh *et al.*, 2007; Kirkman *et al.*, 2006). In accordance with these studies, this paper defines and operationalizes power distance at the individual level. At an individual level, power distance refers to the extent to which an individual accepts the unequal distribution of power in organizations and its influence on how individuals perceive and react to authority (Clugston *et al.*, 2000). Social exchange theory, with its main argument of reciprocity, suggests that employees react to an abusive supervisor by engaging in deviant behaviors. In other words, employees are more likely to engage in behaviors that harm the organization and its members when they are abused by authority (Thau *et al.*, 2009):

H1d. Employees' power distance orientation is related to DWB.

The role of high power distance in relationship to POS, PSS and between DWB leads to the idea of paternalism. *Webster* (1975, p. 21) defines paternalism as "the principle or system of governing or controlling a country, group of employees, etc., in a manner of suggesting a father's relationship with his children." When paternalism is addressed in the organizational context, it refers to the supervisor's role of caring, protecting and guiding subordinates in both work and nonwork environments (Aycan *et al.*, 2000). Consistent with the social exchange theory's main argument of reciprocity, it is expected that subordinates will be loyal and virtuous against their supervisor. Paternalism is accepted in hierarchical societies. The paternalistic relationship is based on power inequality between the leader and the followers. Inequalities in power distribution are legitimized, especially in cultures with high power distances (Aycan, 2005). Western cultures criticize paternalism for creating inequality. One of the most important assumptions of paternalistic leadership is that the leader is superior to subordinates in knowledge, skills, experience and morals. Although this assumption may be untrue, it leads to unquestioned obedience and loyalty by subordinates (Aycan *et al.*, 2000). In addition, as part of the paternalistic role, the leader has social roles, such as joining employees' weddings or celebrations. Thus, leaders reduce the social distance between followers and act as a father (Aycan, 2001). Paternalism moderates the relationships between POS, PSS and DWB. Individuals with high paternalism values are more loyal due to the support they receive from the organization and their supervisors. These individuals are less likely to engage in DWB:

H1e. Paternalism is related to DWB.

H1f. POS, PSS, collectivism, power distance and paternalism have a bidirectional relationship with DWB.

4. Methodology

This paper aims to reveal the effects of POS, PSS and impacts of cultural values on the deviant behavior of employees in a comparative way. The analysis unit of the research is the actors-employees. The research uses a structured interview as its data collection method. To assess POS and PSS, this study uses Eisenberger *et al.* (1986) and Tate *et al.* (1997) items to assess employees' perception that their organization and supervisors take care of their workers. This paper assesses Bennett and Robinson's (2000) deviant behaviors of the employees' scale. Dorfman and Howell's (1988) scale is used to assess the impact of individualism/collectivism (high scores evaluated as collectivism and addressed as collectivism). Power distance cultural values and paternalism are assessed with Aycans *et al.* (2000). The interviews are carried out in 8 companies with 241 interviews, including the general manager, production manager, marketing manager and human resource manager (or their assistants).

The findings are the result of a descriptive analysis. Then, the process rates the findings on the basis of the hundred system intended for analysis through the fuzzy-set qualitative comparative analysis (fsQCA) program utilized in the assessment of the relationship between the deviant behavior and POS, PSS and the impact of cultural values. The industry selection process focuses on the service industry due to its dynamic market structure, which responds to employees' deviant behaviors. Thus, there is a need to examine reasons for deviant behaviors.

This portion of the research uses fsQCA. As a theoretical approach tool, the qualitative comparative analysis (QCA) technique studies cases including groups with different qualitative properties suitable for testing the configuration theories. As opposed to the regression and correlation methods matching the Boolean Algebra (Fiss, 2007) linearity theory, QCA may focus on equifinality and togetherness of the variables to obtain simplified statements creating specific results. QCA refers to scenarios that "enable a system to reach at the same final situation from different start points and through different (or multiple ways)" (Katz and Kahn, 1978, p. 2).

QCA offers a framework for the comparison of organizational configurations. This paper follows the recommendations of Fiss (2007) to avoid several analytic methods, including cluster analysis, interaction effects and deviation scores. When demanding complex causality and non-linear relationships, the paper follows the theories of the QCA method. A qualitative focus enables the analysis of a few cases as it is both intense and complementary (Ragin, 2008). For this reason, this paper uses a specific type of QCA (the fsQCA) to determine the relationships between product innovation and strategic flexibility configurations.

This research determines the impact of cultural values configurations, including individualism/collectivism, power distance and paternalism and perceived supports in organizational life configurations (i.e. POS and PSS as causes/conditions). The survey includes six questions to determine the collectivism dimension, six questions for power distance and five questions for paternalism. This survey uses eight questions to examine POS; three questions examine PSS. This paper assesses the cumulative of the questions for defining configurations. Deviant behavior scales are used as outcomes related to the hypotheses. The outcomes show the cumulative of deviant behavior questions in the survey.

While collecting the measures for conditions, researchers took the cumulative valuation of POS, PSS and impacts of cultural values. The following sub-effect summations were found: seven POS; two PSS; six individualism/collectivism cultural impact; six power distance cultural impact; five paternalism cultural affect. The researchers examined the deviant behavior of employees as an outcome and calculated outcomes with respect to 19 sub-effects. While determining the measures for outcome, researchers used the same conditions and took the cumulative valuation of these sub-effects.

After collecting measures for the conditions and the outcome, the researchers calibrated the conditions such that they were computable in an fsQCA (Schneider and Wagemann, 2012). For the outcome, the researchers set a maximum value of 54 for the outcome, the threshold for the crossover value for outcome at 29 and a minimum value at 19.

This paper presents quantitative analysis with data provided by 235 employees through a survey. The authors set the threshold for the crossover value at 29, meaning employees perceive deviant behavior occasionally on average. The minimum value indicates that employees perceive deviant behavior in no way. The maximum value for the outcome indicates employee's highest perceived deviant behavior in the organization.

For causes and conditions, the researchers set the maximum value for collectivism and power distance at 30, the threshold for the crossover value at 10 and minimum value at 6. The researchers set the maximum value for paternalism at 25, the threshold for the crossover value at 8 and minimum value at 5. The researchers determine the maximum value for POS and PSS at 35 and 10, the threshold for the crossover value at 11 and 4 and minimum value at 7 and 2, respectively. In doing so, the researchers calibrate the entire effects of cultural aspects, POS configurations and PSS configurations with respect to all cases. This research processes deviant behaviors of employees as the outcome testing for certain combinations of cultural impacts with respect to individualism/collectivism, power distance, paternalism effects and POS and PSS effects. The study uses these negations separately.

5. Solutions

The core of fsQCA is a truth table analysis, which seeks to identify casual combinations that are sufficient for the outcome. Truth tables give an indication of identical cases and limited diversity phenomenon. Table I presents a truth table for the interrelatedness of deviant behaviors and the effects of cultural factors and POS and PSS configurations.

The truth table lists every combination of conditions, in this case 2^5 with 5 being the number of conditions (Schneider and Wagemann, 2012). The researchers set the consistency threshold to 0.8, which is a value expected to create robust results (Fiss, 2011; Rihoux and Ragin, 2009; Schneider and Wagemann, 2012). Only solutions that belong to more than zero cases are reported. The truth table for the interrelatedness of deviant behaviors and the effects of cultural aspects and POS and PSS configurations satisfies the required assumptions.

Collectivism	Power distance	Paternalism	PSS	PSS	Row cons.	Pri cons.	Sym cons.
0	1	1	1	1	1	1	1
1	1	1	1	0	1	1	1
1	0	0	1	1	1	1	1
1	0	0	0	0	1	1	1
0	0	1	1	1	1	1	1
1	1	1	0	1	1	1	1
0	0	0	0	0	0.996	0.991	0.998
0	1	1	0	1	0.996	0.987	0.998
1	0	0	0	1	0.994	0.987	0.990
0	0	1	0	1	0.993	0.990	0.992
0	0	0	1	1	0.993	0.985	0.993
1	0	1	1	1	0.992	0.983	0.982
0	1	1	0	0	0.991	0.957	0.957
1	0	1	0	1	0.989	0.983	0.995
0	0	0	0	1	0.988	0.981	0.988
1	1	1	1	1	0.986	0.965	0.975
1	1	0	0	0	0.896	0.935	0.935

Table I.
Truth table for the outcome "deviant behavior"

The concept of asymmetric causality (Lieberson, 1985) is important when evaluating the potential of QCA for social science research. Different to most statistical procedures, QCA links conditions and the outcome through set asymmetric theoretical relations. Therefore, QCA provides both presence and absence of phenomenon in two different analyses (Schneider and Wagemann, 2010). The analysis of the negation of outcome determines understanding of casual logic driving the positive cases with respect to negative ones (Ragin and Rihoux, 2004). The researchers also contribute a truth table for the negation of deviant behaviors and the effects of cultural factors and POS and PSS configurations for checking the results (see Table II).

According to the first procedure, the researchers determine the following intermediate solutions (see Table III).

Table III shows six alternative solutions to explain the interrelatedness of cultural effects, POS and PSS configurations, and deviant behavior. Ragin (2006) suggests using raw and unique coverages to evaluate empirical importance. The findings of Schneider and Wagemann (2010) determine that raw coverage refers to the size of overlap between the causal condition sets and the outcome sets. Additionally, unique coverage that partitions the raw coverage controls the overlapping explanations.

The total coverage with respect to the importance of all causal paths is 0.894, which explains that a causal path covers most of the outcome. The raw coverage for the single causal paths ranges from 0.804 to 0.158. While all the unique coverage of the causal paths is above 0, three have unique coverage of 0.001, 0.002 and 0.003, which are close to 0. Therefore, the first three combinations are important in explaining deviant behaviors of employees' results.

The most notable expression with a unique coverage of 0.098 is PSS*~power distance. This solution (first solution) shows that configurations of PSS and negation power distance (absence of power distance) cultural effect are consistently indicators of deviant behaviors of employees. The second notable expression with a unique coverage of 0.027 is PSS*paternalism solution, which shows that PSS and paternalistic cultural effect interrelate with employees' deviant behaviors. The third empirically important causal path with unique coverage of 0.030 indicates that employees' deviant behaviors depend on the absence of paternalistic and power distance cultural effects, as well as the absence of POS (~POS*~Paternalism*~Power distance).

As the analysis of negation cases provides the causal logic driving the positive cases and/or help to understand substantively interesting insights in their own right (Ragin and

Collectivism	Power distance	Paternalism	POS	PSS	Row cons.	Pri cons.	Sym cons.	
1	1	0	0	0	0.805	0.065	0.065	
0	1	1	0	0	0.795	0.043	0.043	

Table II.
Truth table for outcome negation of deviant behavior

Solution term	Coverage (raw)	Coverage (unique)	Consistency
PSS*~power distance	0.804	0.098	0.960
PSS*paternalism	0.642	0.027	0.965
~POS*~ paternalism*~power distance	0.434	0.030	0.981
~PSS*~POS*~ paternalism*collectivism	0.156	0.002	0.988
~POS*paternalism*power distance*~collectivism	0.158	0.001	0.986
POS*paternalism*power distance*collectivism	0.173	0.003	0.987
Overall solution	0.894		0.948

Table III.
Solution terms for deviant behavior

Rihoux, 2004), researchers use negation of DWB as control variable for checking reliability of DWB variable interrelatedness with POS and PSS and cultural dimensions of employees' configurations. The researchers determine the following complex solutions for negation of deviant behavior (see Table IV).

Table IV determines that one solution may explain the interrelatedness of cultural effects, POS and PSS configurations, and the absence of employees' deviant behaviors. The most notable expression with a unique coverage of 0.526 is collectivism*power distance*~paternalism* ~POS*~PSS, which shows that cultural effects of collectivism, power distance and negotiation of paternalism, and negotiation of POS and PSS configurations affect are consistent indicators of negation of employees' deviant behaviors. The solution of the negation of employees' deviant behaviors is a different solution from employees' deviant behaviors. The researchers accept the three causal paths when they determine employees' deviant behavior and cultural effects, and POS and PSS configurations relatedness.

6. Discussion

The main purpose of this study is to further increase the knowledge and understanding of organizational and supervisory support in the context of employee DWB by examining the potential associations of employees' cultural value orientations. The results indicate that PSS with employees' cultural orientation interrelates with employee DWB in two ways. The first path explains a high level of employees' PSS with low or absent level of power distance (PSS*~power distance) related to employee DWB. Employees have a positive attitude toward their organization, which increases their motivation and performance, when they perceive that they are receiving support, courage and feedback to successfully improve their skills (Colbert *et al.*, 2004). The opposite case may lead to frustration (Colbert *et al.*, 2004), which also leads to deviant behavior, including hostility or aggression (Spector, 1997).

On the other hand, Bennett and Robinson (2000) suggest that perceived fairness and justice to the employees are negatively associated with interpersonal and organizational deviance. Employees with low power distance are more sensitive to unequal treatment by their supervisors. They react negatively compared to employees who have high power distance orientation (Thau *et al.*, 2009; Wang *et al.*, 2012). Individuals who are high in power distance orientation perceive their managers as superior, legitimizing power disparity and avoiding acts against their superiors as they obey leadership's decisions (Bochner and Hesketh, 1994). This also means that they are less likely to react adversely to distributive and procedural injustice from supervisors (Lian *et al.*, 2012). Therefore, high levels of power distance with organizational support in terms of PSS interrelate with DWB. Employees with high levels of power distance do not negatively react to distributive and procedural injustice from supervisors. They receive support from their supervisor; the organization makes more sense to the individual who is high in power distance orientation.

The second path shows that a high level of employees' PSS with paternalistic behavior of supervisor interrelates with DWB (PSS*paternalism). A main assumption of paternalistic leadership is that the leader is superior in knowledge, skill and experience. This assumption may lead to unquestioned obedience and loyalty by subordinates (Aycan *et al.*, 2000). Accordingly, as a part of the paternalistic role, the leader has social roles, including joining employees' celebrations and acting in a father role (Aycan, 2001). Based on this information,

Solution term	Coverage (raw)	Coverage (unique)	Consistency
collectivism*power distance*~paternalism* ~POS*~PSS	0.526	0.526	0.805
Overall Solution	0.526		0.805

Table IV.
Solutions terms for negation of deviant behavior

this paper concludes that paternalism moderates the relationship between PSS and DWB as individuals with high paternalism values will be more loyal to support from their supervisors and less likely to engage in DWB.

The third path shows different types of DWB relationships with employees' PSS, POS and cultural orientation. ~POS*~Paternalism*~Power distance indicates that absence or low level of POS with paternalism and power distance relates to DWB. Although related empirical research basically investigated the relationship between POS and positive work outcomes (e.g. Hayton *et al.*, 2012; Rhoades *et al.*, 2001; Wayne *et al.*, 1997), supportive practices in terms of POS and PSS are also negatively related to DWB (Colbert *et al.*, 2004; Ferris *et al.*, 2009; Liao *et al.*, 2004; Tuzun *et al.*, 2016). When employees feel desirable support, they will reciprocate the obligation through positive behaviors. On the other hand, when support is seen to be undesirable, employees will return such favor by engaging in unfavorable behavior.

Due to the above explanations, this paper finds that employees' PSS, POS, cultural dimensions, power distance and paternalism relate with DWB. Cultural dimension individualism/collectivism with employees PSS and POS only relates with the absence of employee deviant behavior (see Table IV) (collectivism*power distance*~paternalism*~POS*~PSS). This path explains that low level or absence of DWB may emerge with a high level of collectivism and power distance with the absence of paternalism where employees do not feel POS and PSS. Employees with high collectivist values think – and even internalize – that it is their duty to adopt organizational policies and norms. For this reason, it is less likely that these individuals show behaviors contrary to organizational goals. This research shows that employees' individualist/collectivist behavior does not relate with DWB in contrast to employees' individualist/collectivist behavior related to the absence of DWB.

7. Conclusion

Through different methodological perspectives, this study extends the previous research by providing evidence that organizational and supervisory support influences employees' DWB. With an fsQCA, results show the role of employee PSS, POS and cultural dimension configurations to foster employee DWB. This study also examines equifinality in POS, PSS, power distance and paternalism configurations with respect to DWB. Conclusive supportive PSS with lack of power distance orientation may cause employees to engage in deviant behavior. Supportive PSS with paternalistic orientation may also cause employees to engage in deviant behavior. On the other side, lack of supportive POS with lack of paternalistic and power distance orientation may cause deviant behavior. This study indicates that a lack of POS, power distance and paternalistic cultural orientation interrelates with DWB. Within this aspect, this research differs from other studies.

References

Allen, D.G., Shore, L.M. and Griffeth, R.W. (2003), "The role of perceived organizational support and supportive human resource practices in the turnover process", *Journal of Management*, Vol. 29 No. 1, pp. 99-118.

Appelbaum, S.H., Laconi, G.D. and Matousek, A. (2007), "Positive and negative deviant workplace behaviors: causes, impacts and solutions", *Corporate Governance*, Vol. 7 No. 5, pp. 586-598.

Aycan, Z. (2001), "Paternalism: Yönetim ve Liderlik Anlayışına İlişkin Üç Görgül Çalısma", *Yönetim Araştırmaları Dergisi*, Vol. 1 No. 1, pp. 11-32.

Aycan, Z. (2005), "The interface between cultural and institutional / structural contingencies in human resource management", *International Journal of Human Resource Management*, Vol. 16 No. 7, pp. 1083-1120.

Aycan, Z., Kanungo, R.N., Mendonca, M., Yu, K., Deller, J., Stahl, G. and Khursid, A. (2000), "Impact of culture on human resource management practices: Aten country comparison", *Applied Psychology: An International Review*, Vol. 49 No. 1, pp. 192-220.

Bame-Aldred, C.W., Culen, J.B., Martin, K.D. and Parboteeah, K.P. (2013), "National culture and firm-level tax evasion", *Journal of Business Research*, Vol. 66 No. 3, pp. 390-396.

Bennett, R.J. and Robinson, S.L. (2000), "Development of a measure of workplace deviance", *Journal of Applied Psychology*, Vol. 85 No. 3, pp. 349-360.

Bennett, R.J. and Stamper, C.L. (2001), "Corporate citizenship and deviancy: a study of work behavior", in Galbraith, C. and Ryan, M. (Eds), *International Research in the Business Disciplines: Strategies and Organizations in Transition*, Elsevier Science, Amsterdam, pp. 265-284.

Blau, P.M. (1964), *Exchange and Power in Social Life*, Wiley, New York, NY.

Bochner, S. and Hesketh, B. (1994), "Power distance, individualism/collectivism, and job-related attitudes in a culturally diverse work group", *Journal of Cross-Cultural Psychology*, Vol. 25 No. 2, pp. 233-257.

Clugston, M., Howell, J.P. and Dorfman, P.W. (2000), "Does cultural socialization predict multiple bases and foci of commitment?", *Journal of Management*, Vol. 26 No. 1, pp. 5-30.

Coccia, C. (1998), "Avoiding a toxic organization", *Nursing Management*, Vol. 29 No. 5, pp. 32-34.

Colbert, A.E., Mount, M.K., Harter, J.K., Witt, L.A. and Barrick, M.R. (2004), "Interactive effects of personality and perceptions of the work situation on workplace deviance", *Journal of Applied Psychology*, Vol. 89 No. 4, pp. 599-609.

Cropanzano, R. and Mitchell, M.S. (2005), "Social exchange theory: an interdisciplinary review", *Journal of Management*, Vol. 31 No. 6, pp. 874-900.

Dailey, R.C. and Kirk, D.J. (1992), "Distributive and procedural justice as antecedents of job dissatisfaction and intent to turnover", *Human Relations*, Vol. 45 No. 3, pp. 305-317.

Dorfman, P.W. and Howell, J.P. (1988), "Dimensions of national culture and effective leadership patterns: Hofstede revisited", in Farmer, R.N. and Goun, E.G. (Eds), *Advances in International Comparative Management: a research annual*, Elsevier Science, Amsterdam, pp. 127-150.

Earley, P.C. and Gibson, C.B. (1998), "Taking stock in our progress on individualism –collectivism: 100 years of solidarity and community", *Journal of Management*, Vol. 24 No. 3, pp. 265-304.

Eisenberger, R., Fasolo, P. and Davis-LaMastro, V. (1990), "Perceived organizational support and employee diligence, commitment, and innovation", *Journal of Applied Psychology*, Vol. 75 No. 1, pp. 51-59.

Eisenberger, R., Huntington, R., Hutchison, S. and Sowa, D. (1986), "Perceived organizational support", *Journal of Applied Psychology*, Vol. 71 No. 3, pp. 500-507.

Everton, W.J., Jolton, J.A. and Mastrangelo, P.M. (2007), "Be nice and fair or else: understanding reasons for employees' deviant behaviors", *Journal of Management Development*, Vol. 26 No. 2, pp. 117-131.

Farh, J.L., Hackett, R.D. and Liang, J. (2007), "Individual-level cultural values as moderators of perceived organizational support-employee outcome relationships in China: comparing the effects of power distance and traditionality", *The Academy of Management Journal*, Vol. 50 No. 3, pp. 715-729.

Ferris, D.L., Brown, D.J. and Heller, D. (2009), "Organizational support and organizational deviance: the mediating role of organization-based self-esteem", *Organizational Behavior and Human Decision Processes*, Vol. 108, pp. 279-286.

Fiske, A., Kitayama, S., Markus, H.R. and Nisbett, R.E. (1998), "The cultural matrix of social psychology", in Gilbert, D.T., Fiske, S.T. and Lindzey, G. (Eds), *The Handbook of Social Psychology*, McGraw-Hill, New York, NY, pp. 915-981.

Fiss, P.C. (2007), "A set-theoretic approach to organizational configurations", *The Academy of Management Review*, Vol. 32 No. 4, pp. 1180-1198.

Fiss, P.C. (2011), "Building better causal theories: a fuzzy set approach to typologies in organization research", *Academy of Management Journal*, Vol. 54 No. 2, pp. 393-420.

Geddes, D. and Baron, R.A. (1997), "Workplace aggression as a consequence of negative performance feedback", *Management Communication Quarterly*, Vol. 10 No. 4, pp. 433-454.

Geddes, D. and Callister, R.R. (2007), "Crossing the line(s): a dual threshold model of anger in organizations", *Academy of Management Review*, Vol. 32 No. 3, pp. 721-746.

Geddes, D. and Stickney, L.S. (2011), "The trouble with sanctions: organizational responses to deviant anger displays at work", *Human Relations*, Vol. 64 No. 2, pp. 201-230.

Gouldner, A.W. (1960), "The norm of reciprocity: a preliminary statement", *American Sociological Review*, Vol. 25 No. 2, pp. 161-178.

Griffin, R.W., O'Leary-Kelly, A. and Collins, J.M. (1998), "Dysfunctional work behaviors in organizations", in Cooper, C.L. and Rousseau, D.M. (Eds), *Trends in Organizational Behavior*, John Wiley & Sons, New York, NY, pp. 65-82.

Hayton, J.C., Carnabuci, G. and Eisenberger, R. (2012), "With a little help from colleagues: a social embeddedness approach to perceived organizational support", *Journal of Organizational Behavior*, Vol. 33 No. 2, pp. 235-249.

Hofstede, G. (1984), *Culture's Consequences: International Differences in Work Related Values*, Sage, Beverly Hills, CA.

Hofstede, G.H. (1980), *Culture's Consequences: International Differences in Work-related Values*, Sage, Newbury Park, CA.

Hofstede, G.J. (2005), *Cultures and Organizations: Software of the Mind*, McGraw-Hill, New York, NY.

Kateb, G.A., Swies, R., Obeidat, B. and Maqableh, M. (2014), "An investigation on the critical factors of information system implementation in Jordanian information technology companies", *European Journal of Business and Management*, Vol. 7 No. 36, pp. 11-28.

Katz, D. and Kahn, R.L. (1978), *The Social Psychology of Organizations*, 2nd ed., Wiley, New York, NY.

Kim, H. and Markus, H.R. (1999), "Deviance or uniqueness, harmony or conformity? A cultural analysis", *Journal of Personality and Social Psychology*, Vol. 77 No. 4, pp. 785-800.

Kim, U., Triandis, C., Kagitcibasi, C., Choi, S. and Yoon, G. (1994), *Individualism and Collectivism: Theory, Method, and Applications*, Sage, Thousand Oaks, CA.

Kirkman, B.L., Lowe, K.B. and Gibson, C.B. (2006), "A quarter century of culture's consequences: a review of empirical research incorporating Hofstede's cultural values framework", *Journal of International Business Studies*, Vol. 37 No. 3, pp. 285-320.

Kottke, J.L. and Sharafinski, C.E. (1988), "Measuring perceived supervisory and organizational support", *Educational and Psychological Measurement*, Vol. 48 No. 4, pp. 1075-1079.

Kurtessis, J., Eisenberger, R., Ford, M.T., Buffardi, L.C., Stewart, K.A. and Adis, C.S. (2015), "Perceived organizational support: a meta-analytic evaluation of organizational support theory", *Journal of Management*, Vol. 43 No. 6, pp. 1854-1884, doi: 10.1177/0149206315575554.

Levinson, H. (1965), "Reciprocation: the relationship between man and organization", *Administrative Science Quarterly*, Vol. 9 No. 4, pp. 370-390.

Lian, H., Ferris, D.L. and Brown, D.J. (2012), "Does power distance exacerbate or mitigate the effects of abusive supervision? It depends on the outcome", *Journal of Applied Psychology*, Vol. 97 No. 1, pp. 107-123.

Liao, H., Joshi, A. and Chuang, A. (2004), "Sticking out like a sore thumb: employee dissimilarity and deviance at work", *Personnel Psychology*, Vol. 57, pp. 969-1000.

Lieberson, S. (1985), *Making It Count: The Improvement of Social Research and Theory*, University of California Press, Berkeley and Los Angeles, CA.

Maertz, C.P., Stevens, M.J. and Campion, M.A. (2003), "A turnover model for the Mexican Maquiladoras", *Journal of Vocational Behavior*, Vol. 63 No. 1, pp. 111-115.

Markus, H.R., Mullally, P. and Kitayama, S. (1997), "Selfways: diversity in modes of cultural participation", in Neisser, U. and Jopling, D.A. (Ed.), *The Conceptual Self in Context: Culture, Experience, Self-understanding*, Cambridge University Press, Cambridge, pp. 13-61.

Milikic, B. (2009), "The influence of culture on human resources management processes and practices: the propositions for Serbia", *Economic Annuals*, Vol. 181 No. 1, pp. 93-118.

Newman, K. and Nollen, S. (1996), "Culture and congruence: the fit between management practices and national culture", *Journal of International Business Studies*, Vol. 27 No. 4, pp. 753-779.

Oyserman, D., Coon, H.M. and Kemmelmeier, M. (2002), "Rethinking individualism and collectivism: evaluation of theoretical assumption and meta-analysis", *Psychological Bulletin*, Vol. 128 No. 1, pp. 3-72.

Payne, S.C. and Huffman, A.H. (2005), "A longitudinal examination of the influence of mentoring on organizational commitment and turnover", *The Academy of Management Journal*, Vol. 48 No. 1, pp. 158-168.

Puffer, S.M. (1987), "Prosocial behavior, noncompliant behavior, and work performance among commission sales people", *Journal of Applied Psychology*, Vol. 72 No. 4, pp. 615-621.

Ragin, C.C. (2006), "Set relations in social research: evaluating their consistency and coverage", *Political Analysis*, Vol. 14 No 3, pp. 291-310, doi: 10.1093/pan/mpj019.

Ragin, C.C. (2008), *Redesigning Social Inquiry: Fuzzy Sets and Beyond*, University Of Chicago Press, Chicago and London.

Ragin, C.C. and Rihoux, B. (2004), "Qualitative comparative analysis (QCA): state of the art and prospects", *Qualitative Methods*, Vol. 2 No. 2, pp. 3-13.

Ramamoorthy, N. and Carroll, S.J. (1998), "Individualism/collectivism orientations and reactions toward alternative human resource management practices", *Human Relations*, Vol. 51 No. 5, pp. 571-588.

Ramamoorthy, N. and Flood, P.C. (2002), "Employee attitudes and behavioral intentions: a test of the main and moderating effects of individualism and collectivism orientations", *Human Relations*, Vol. 55 No. 9, pp. 1071-1096.

Ramamoorthy, N. and Flood, P.C. (2004), "Individualism/collectivism, perceived task interdependence and teamwork attitudes among Irish blue collar employees: a test of main and moderating effects", *Human Relations*, Vol. 57 No. 3, pp. 347-366.

Rhoades, L. and Eisenberger, R. (2002), "Perceived organizational support: a review of the literature", *Journal of Applied Psychology*, Vol. 87 No. 4, pp. 698-714.

Rhoades, L., Eisenberger, R. and Armeli, S. (2001), "Affective commitment of the organization: the contribution to perceived organizational support", *Journal of Applied Psychology*, Vol. 86 No. 5, pp. 825-836.

Rihoux, B. and Ragin, C.C. (2009), *Configurational Comparative Methods: Qualitative Comparative Analysis (QCA) and Related Techniques*, Sage Publications, Thousand Oaks, CA and London.

Robinson, S.L. and Bennett, R.J. (1995), "A typology of deviant workplace behaviors: a multidimensional scaling study", *Academy of Management Journal*, Vol. 38 No. 2, pp. 555-572.

Robinson, S.L. and Greenberg, J. (1998), "Employees behaving badly: dimensions, determinants, and dilemmas in the study of workplace deviance", in Cooper, C.L. and Rousseau, D.M. (Eds), *Trends in Organizational Behavior*, Wiley, New York, NY, pp. 1-30.

Robinson, S.L. and O'Leary-Kelly, A.M. (1998), "Monkey see, monkey do: the influence of work groups on the antisocial behavior of employees", *Academy of Management Journal*, Vol. 41 No. 6, pp. 658-672.

Schneider, C.Q. and Wagemann, C. (2010), "Standards of good practice in qualitative comparative analysis (QCA) and fuzzy-sets", *Comparative Sociology*, Vol. 9 No. 3, pp. 397-418.

Schneider, C.Q. and Wagemann, C. (2012), *Set-theoretic Methods for the Social Sciences: A Guide to Qualitative Comparative Analysis*, Cambridge University Press, Cambridge.

Schuler, R.S. and Rogocsky, N. (1998), "Understanding compensation practice variations across firms: the impact of national culture", *Journal of International Business Studies*, Vol. 29 No. 1, pp. 1-14.

Schwartz, S.H. (1992), "Universals in the content and structure of values: theoretical advances and empirical tests in 20 countries", in Zanna, M.P. (Ed.), *Advances in Experimental Social Psychology*, Academic Press, New York, NY, pp. 1-65.

Settoon, R.P., Bennett, N. and Liden, R.C. (1996), "Social exchange in organizations: perceived organizational support, leader member exchange and employee reciprocity", *Journal of Applied Psychology*, Vol. 81 No. 3, pp. 219-227.

Shore, L.M., Coyle-Shapiro, J.A.M., Chen, X.P. and Tetrick, L.E. (2009), "Social exchange in work settings: content, process, and mixed models", *Management and Organization Review*, Vol. 5 No. 3, pp. 289-302.

Shoss, M.K., Eisenberger, R., Restubog, S.L. and Zagenczyk, T.J. (2013), "Blaming the organization for abusive supervision: the roles of perceived organizational support and supervisor's organizational embodiment", *Journal of Applied Psychology*, Vol. 98 No. 1, pp. 158-168.

Skarlicki, D.P. and Folger, R. (1997), "Retaliation in the workplace: the roles of distributive, procedural, and interactional justice", *Journal of Applied Psychology*, Vol. 82 No. 3, pp. 434-443.

Sosik, J.J. and Jung, D.I. (2002), "Work group characteristics and performance in collectivistic and individualistic cultures", *The Journal of Social Psychology*, Vol. 142 No. 1, pp. 5-23.

Spector, P.E. (1997), *Job Satisfaction*, Sage, Thousand Oaks, CA.

Tate, U., Whatley, A. and Clugston, M. (1997), "Sources and outcomes of job tension: a three-nation study", *International Journal of Management*, Vol. 3 No. 3, pp. 350-358.

Thau, S., Bennett, R.J., Mitchell, M.S. and Marrs, M.B. (2009), "How management style moderates the relationship between abusive supervision and workplace deviance: an uncertainty management theory", *Organizational Behavior and Human Decision Processes*, Vol. 108 No. 1, pp. 79-92.

Triandis, H.C. (1995), *Individualism and Collectivism*, Westview Press, Boulder, CO.

Triandis, H.C. (2001), "Individualism-collectivism and personality", *Journal of Personality*, Vol. 69 No. 6, pp. 907-924.

Trompenaars, F. and Hampden-Turner, C. (2004), *Managing People Across Cultures*, Capstone Publishing, West Sussex.

Tuzun, I.K. and Kalemci, A. (2012), "Organizational and supervisory support in relation to turnover intentions", *Journal of Managerial Psychology*, Vol. 27 No. 5, pp. 518-534.

Tuzun, İ.K., Cetin, F. and Basım, N. (2016), "Deviant employee behavior in the eyes of colleagues: the role of organizational support and self-efficacy", *Eurasian Business Review*, Vol. 7 No. 3, pp. 389-405, doi: 10.1007/s40821-016-0061-5.

Tyler, T.R., Lind, E.A. and Huo, Y.J. (2000), "Cultural values and authority relations: the psychology of conflict resolution across cultures", *Psychology, Public Policy, and Law*, Vol. 6 No. 4, pp. 1138-1163.

Van Dyne, L., Vandewalle, D., Kostova, T., Latham, M.E. and Cummings, L.L. (2000), "Collectivism, propensity to trust and self-esteem as predictors of organizational citizenship in a non-work setting", *Journal of Organizational Behaviour*, Vol. 21 No. 1, pp. 3-23.

Van Emmerik, I.J.H., Euwema, M.C. and Bakker, A.B. (2007), "Threats of workplace violence and the buffering effect of social support", *Group and Organization Management*, Vol. 32 No. 2, pp. 152-175.

Vardi, Y. and Wiener, Y. (1996), "Misbehavior in organizations: a motivational framework", *Organization Science*, Vol. 7 No. 2, pp. 151-165.

Wagner, J.A. (1995), "Studies of individualism-collectivism: effects on cooperation in groups", *Academy of Management Journal*, Vol. 38 No. 1, pp. 152-172.

Wang, W., Mao, J., Wu, W. and Liu, J. (2012), "Abusive supervision and workplace deviance: the mediating role of interactional justice and the moderating role of power distance", *Asia Pacific Journal of Human Resources*, Vol. 50 No. 1, pp. 43-60.

Wasti, S.A. (2003), "Organizational commitment, turnover intentions and the influence of cultural values", *Journal of Occupational and Organizational Psychology*, Vol. 76 No. 3, pp. 303-321.

Wayne, S.J., Shore, L.M. and Liden, R.C. (1997), "Perceived organizational support and leader-member exchange: a social exchange perspective", *Academy of Management Journal*, Vol. 40 No. 1, pp. 82-111.

Webster (1975), *Webster's Dictionary*, Merriam-Webster, Springfield, MA.

Yoo, L., Flaherty, K. and Frankwick, G.L. (2013), "The effect of communication practice on deviance among Korean salespeople: the mediating role of intrinsic motivation", *Journal of Business Research*, Vol. 67 No. 9, pp. 1991-1999.

140

Further reading

Bandura, A. (1982), "Self-efficacy mechanism in human agency", *American Psychologist*, Vol. 37 No. 2, pp. 122-147.

Chen, M. (2001), *Asian Management Systems*, Thomson, London.

Eisenberger, R., Stinglhamber, F., Vandenberghe, C., Sucharski, I.L. and Rhoades, L. (2002), "Perceived supervisory support: contributions to perceived organizational support and employee retention", *Journal of Applied Psychology*, Vol. 87 No. 3, pp. 565-573.

Liden, R.C., Sparrowe, R.T. and Wayne, S.J. (1997), "Leader member exchange theory: the past and potential for the future", in Ferris, G.R. (Ed.), *Research in Personnel and Human Resource Management*, JAI, Greenwich, CT, pp. 47-119.

Loi, R., Hang-Yue, N. and Foley, S. (2006), "Linking employees' justice perceptions to organizational commitment and intention to leave: the mediating role of perceived organizational support", *Journal of Occupational and Organizational Psychology*, Vol. 79 No. 1, pp. 101-120.

Maertz, C.P., Griffeth, R.W., Campell, N.S. and Allen, D.G. (2007), "The effects of perceived organizational support ad perceived supervisory support on employee turnover", *Journal of Organizational Behavior*, Vol. 28 No. 8, pp. 1059-1075.

Masterson, S.S., Lewis, K., Goldman, B.M. and Taylor, M.S. (2000), "Integrating justice and social exchange: the differing effects of fair procedures and treatment on work relationships", *Academy of Management Journal*, Vol. 43 No. 4, pp. 738-748.

Pellegrini, E.K. and Scandura, T.A. (2006), "Leader-member exchange (LMX), paternalism and delegation in the Turkish business culture: an empirical investigation", *Journal of International Business Studies*, Vol. 37 No. 2, pp. 264-279.

Scarlicki, D.P. and Folger, P. (1997), "Retaliation in the workplace: the roles of distributive, procedural, and interactional justice", *Journal of Applied Psychology*, Vol. 82 No. 3, pp. 434-443.

Somers, M. (1995), "Organizational commitment, turnover and absenteeism: an examination of direct and indirect effects", *Journal of Organizational Behaviour*, Vol. 16 No. 1, pp. 49-58.

Sommer, S., Bae, S. and Luthans, F. (1996), "Organizational commitment across cultures: the impact of antecedents on Korean employees", *Human Relations*, Vol. 49 No. 7, pp. 977-993.

About the authors

R. Arzu Kalemci is Associate Professor in Management Department, Cankaya University, Turkey. She received the BA Degree in Economics in 1998 from Bilkent University, and the PhD Degree in Management and Organization in 2009 from Baskent University. Her research interest includes organizational behavior, organizational theory, social exchange and business ethic. R. Arzu Kalemci is the corresponding author and can be contacted at: arzukalemci@cankaya.edu.tr

Ipek Kalemci-Tuzun received the PhD Degree in Management from Gazi University. She is Assistant Professor at the Faculty of Commercial Sciences, Baskent University. She is currently lecturing Organizational Behavior and Human Resource Management courses. Her areas of research include human resource management applications and employee behavior, social exchanges in organization and social identity theory.

Ela Ozkan-Canbolat is Associate Professor in the Management Department, Cankiri Karatekin University in Turkey. She received the BA Degree in Economics in 2001 from İhsan Dogramaci Bilkent University, and the PhD Degree in Management and Organization in 2008 from Baskent University. She joined the Cankiri Karatekin University in 2009. She is interested in the influence of organizational network, evolutionary game theory, coopetition and innovation. She has focused a major portion of his teaching and research program on the use of evolutionary game theory and methods for understanding organizations and behavior strategies. She has received an award from the Global Innovation and Knowledge Academy Conference in 2015 with Aydin Beraha. Ela has had teaching experience in economics, management, sociology and statistics.

The relationship between brand attractiveness and the intent to apply for a job
A millennials' perspective

Joanna Santiago
*Department of Management, Instituto Superior de Economia e Gestao,
Universidade de Lisboa, Lisbon, Portugal*

Abstract

Purpose – The purpose of this paper is to understand the relation between the dimensions of employer brand (EB) attractiveness and the intention to submit a job application to the organisation. An increase of competitiveness in the business world has resulted in an increased effort by organisations to improve the processes of recruitment and retention of talented professionals, as the human capital of organisations is extremely important for their growth and sustainability. Regardless of an organisation's size, the difficulties faced in recruiting and retaining highly qualified human capital are tangible. In this sense, the research problem identifies EB as being a strategic element for attracting future employees to work for an organisation.

Design/methodology/approach – This study used both quantitative (a questionnaire survey) and qualitative (in-depth interviews) data to investigate the perceptions of future and current employees.

Findings – Evidence from 281 respondents (of which almost 60 per cent belong to the millennial generation) who participated in the quantitative study supports the multi-dimensionality of EB attractiveness, highlighting the importance of economic factors, such as an above-average salary or opportunities for promotion, which are seen to be less important to millennials when considering future job prospects. Interestingly, the results of the qualitative research for current employees show slightly different concerns, in that career progression appears to be crucial.

Originality/value – The study findings not only offer a basis for research on the dimensions of employer attractiveness, but also, they serve as a managerial guide towards enhancing companies' ability to attract, retain and motivate talented individuals.

Keywords Brand attractiveness, Employer brand

Paper type Research paper

1. Introduction

Over the past decade, the scope of branding activities has increased to include not only potential and current consumers, but also to broaden the understanding of other stakeholder groups, such as suppliers, shareholders, the local community and, in particular, employees (King and Grace, 2009; Jiang and Iles, 2011; Xie *et al.*, 2015; Jain and Bhatt, 2015). The changing paradigm of generations, society and cultures, which have become manifestly more technological, as well as the shortage of labour, global competition for employees, and persons' willingness to change careers more often have escalated the competitiveness and resulted in an increased effort by organisations in the processes of recruitment and retention of the best professionals (Rampl, 2014; Rampl and Kenning, 2014; Backhaus, 2016; Bellou *et al.*, 2015). This predominantly occurs in the services sector, where organisations must constantly find ways of managing their customer contract employees to ensure that their

behaviour supports the delivery of high-quality service (Chebat and Kollias, 2000) and therefore internal branding becomes a key strategic issue. The effective branding of an organisation as a potential or current employer can give a company an advantage in the "war for talent", by attracting and retaining a talented workforce (Alnıaçıka *et al.*, 2014), which is, in turn, crucial for delivering quality service to the customer (Dhar, 2015; Wu *et al.*, 2015). An employer's brand has thus become a powerful resource for recruiting employees for services and for attracting new candidates.

Despite the substantial investigation available on linking brand associations with employer brand (EB) attractiveness, research into how to become a first-choice employer is limited (Rampl, 2014). In this context and addressing this research gap, our study aims to test the relationship between employee brand attractiveness and intention to submit a job application to the organisation.

To test the study hypothesis, we apply the EmpAT scale proposed by Berthon *et al.* (2005) and link it with the intention to submit a job application, as proposed by Highhouse *et al.* (2003). Specifically, we test whether brand personality traits affect EB attractiveness for current and potential employees. This study aims to specifically understand job candidates' perceptions of the organisation to which they are applying, as well as the brand attractiveness perception of current employees. In particular, the behaviour of the millennial generation, which is a force that has begun to change the work culture of many organisations is analysed (Ferri-Reed, 2014). The empirical study was based on quantitative and qualitative data collected through questionnaires and in-depth interviews with both job candidates and current employees, focusing on one specific case – a financial group, which has a solid global presence and specialises in the provision of financial and banking services.

The paper is organised as follows. In Section 2, the literature is analysed, a definition of EB and its attractiveness is presented, and the features of the millennial generation are examined. Next, the conceptual framework and research hypotheses are introduced. Section 5, empirical section begins with the description of a sample and unit of analysis and it concludes with the study of EB as a factor of talent attraction for a company. The results of the questionnaire survey and in-depth interviews are presented. Finally, the conclusion section summarises the major contributions of the research, as well as the study limitations and the implications for theory, practice and future research.

2. Literature review

2.1 Employer brand

Organisations can cultivate close relationships with employees, just as consumers do with product brands (Ambler and Barrow, 1996). Consequently, employers reflect traits that correspond to those portrayed by product brands. The concept of employer branding has emerged as a consequence of the application of marketing principles to human resource management (Alnıaçıka *et al.*, 2014). To emphasise the fact that companies should become more people oriented, Ambler and Barrow (1996) introduced the term EB. According to the authors, EB refers to all those benefits offered by an organisation to its employees to build a unique identity in the eyes of employees and applicants and thus encourages them to stay with, or to join the company. Employer branding is therefore a term used to portray how organisations communicate their offer to potential and existing employees to acquire and maintain their loyalty and also promote the organisation as a firm that is a different and desirable employer (Backhaus and Tikoo, 2004; Jiang and Iles, 2011). Kucherov and Zavyalova (2012) also viewed employer branding as a new field of the study of human resource management and they considered employer branding to be a progressive approach based on general branding theory, which uses specific branding principles and tools to make the process of managing people more efficient.

Employees do indeed play a crucial role in corporate marketing and the organisational branding process (Punjaisri and Wilson, 2017), which is even more important when it comes to the services sector. According to Chebat and Kollias (2000, p. 67), "service firms depend heavily on the ability of customer contact employees to properly deliver their services". Accordingly, if employees lack adequate knowledge of the brand and do not demonstrate a connection with an externally promoted brand identity, then they are unable to behave in the way desired by the organisation. For this reason, organisations are increasingly using EB to attract new employees and as a means to ensure that current employees are involved in the organisation's culture and strategy (Rampl, 2014). EB thus represents a further extension of branding theory and research, "involving efforts to communicate to existing and prospective staff that the organisation is a desirable place to work" (Jiang and Iles, 2011, p. 98).

Several researchers have pointed out that organisations with a strong EB appeal to more talented job candidates and also help to retain talented employees (Alnıaçıka *et al.*, 2014; Rampl and Kenning, 2014). In order to develop a favourable EB, managers have to comprehend what the crucial factors are, in order to attract potential candidates to a company.

2.2 Employee brand attractiveness
The ability of EB to attract future employees expresses an organisation's position in the minds of candidates. One of the strong competitive advantages that EB attractiveness conveys is the selection of the target audience, which is a way to attract new talent to organisation and increases the possibility of recruiting such talent (Berthon *et al.*, 2005). Organisational attractiveness therefore represents "the envisioned benefits that a potential employee sees in working for a specific organisation" (Berthon *et al.*, 2005, p. 156). The stronger the attractiveness of an EB, the more robust is the perceived EB value in the candidates' perception. Jiang and Iles (2011) also saw EB as "a power" that draws candidates' attention to the organisation and encourages current employees to stay loyal to a company. In our paper, we consider employer branding by applying a progressive human resource development approach based on general branding theory, which uses some branding principles and tools (e.g. target audience identification, segmentation and promotion) to improve the efficiency of the process of people management.

In their paper, Kucherov and Zavyalova (2012) defined EB as a quintessence of those qualitative features of the employer that are attractive to a target audience. These features are described by a totally positive image and an appropriate set of both material (economic) and non-material (psychological and symbolic) advantages for differentiating a company in the job market.

Thus, employee brand attractiveness is regarded as a multi-dimensional construct. Berthon *et al.* (2005) developed and validated a multi-item scale to identify and operationalise the dimensions of employer attractiveness. According to these authors, the attractiveness of an employer's brand can be equated by the interest, social value, economic value and the development and cooperation that it can hold, according to the perspective of potential employees. As this concerns the social value, it is associated with a pleasant and relaxed work environment. With regard to economic value, the monetary question of above-average salary, contractual stability and career progression are core factors. Finally, development offers a strong valuation of the employee, providing security and appreciation of their contribution, which in the perspective of a future employee is considered to be an added value for career progression (Berthon *et al.*, 2005). EB is thus affected by the employer's notion of attractiveness, in the sense that a brand can be considered to be a key, strong, and advantageous factor, which influences the value judgements of potential employees. EB is essentially the reflection of the identity and culture of an organisation, and its employees are the main messengers of brand awareness. Berthon *et al.* (2005) appealed for further research of the employer attractiveness scale in different cultures to map out cross-cultural differences.

In this study, we examine Portuguese millennials' perception of EB attractiveness. According to projections for the Portuguese economy for 2018–2020, the labour market is expected to have some improvement. Employment growth will be accompanied by slightly positive changes in the labour force, which are associated with the return of inactive people to the labour market and a progressive increase in retirement age. The blend of these two factors should result in the unemployment rate maintaining its downward path, which is projected to be below 6 per cent by 2020 (Banco de Portugal, 2018).

2.3 Millennials in the workplace
Generational differences are likely to determine what individuals want from their work, what kind of workplace environment is wished for, and how organisations can satisfy these wants and desires (Maier *et al.*, 2015). According to authors, millennials think that "rules are made to be broken" (p. 388), as they reject the thought that their generation has to stay within the rigid restrictions of a job description. Millennials (also called Generation Y) are also the first generation to have grown up with the internet, and therefore they take electronic collaboration for granted and are highly adaptive to nascent technology. Members of Generation Y prefer to work in a transparent organisation in which the corporation's mission, values, operations and conflicts are openly shared (Ferri-Reed, 2014). Furthermore, they are more attracted to work for employers that engage in charitable and philanthropic causes and tend to place more importance on an organisation's social value, rather than its share value. Organisations need to embrace these generational differences in order to support their millennial employees in achieving creativity and productivity, and the organisation must first "inspire them", if it wants to attract and retain the Generation Y employees (Ferri-Reed, 2014).

According to the "Millennial Survey 2018" carried out by Deloitte (2018), which involved 10,455 millennials from 36 countries, millennials are less loyal and have less trust in companies. While suspicious of business motivation and ethics, they are looking for business leaders who are focused on contributing positively to society. According to the study, 43 per cent of millennials plan to leave their workplace within two years (compared to 38 per cent in 2017) and only 28 per cent expect to stay more than five years (compared to 31 per cent in 2017). Among those millennials who plan to leave their jobs during the next two years, 62 per cent would consider the "gig economy" as an alternative to full-time employment. As seen in the survey, those companies and senior management teams that are most aligned with millennials in terms of purpose, culture and professional development are more likely to attract and retain the best millennial talent and, in turn, are better positioned to potentially achieve greater organisational performance.

3. Conceptual framework and hypotheses
The purpose of this study is to understand the dimensions of the attractiveness of the employer's brand and its influence on the attraction of future millennial employees to work for organisations.

3.1 Conceptual model
This study proposes a conceptual model, focused on EB attractiveness (both for current as well as potential future employees) and the intention to submit a job application to the organisation. With this objective, this study proposes a conceptual framework (Figure 1) linking the dimensions of employer attractiveness based on a comprehensive 25-item EmpAT scale proposed by Berthon *et al.* (2005) (see Table AI) and the three dimensions of intention to submit a job application proposed by Highhouse *et al.* (2003) (see Table AII). Both of these scales have previously been validated in past research. In a more recent study, Saini and Chaudhary applied both concepts in the Indian context and confirm a positive
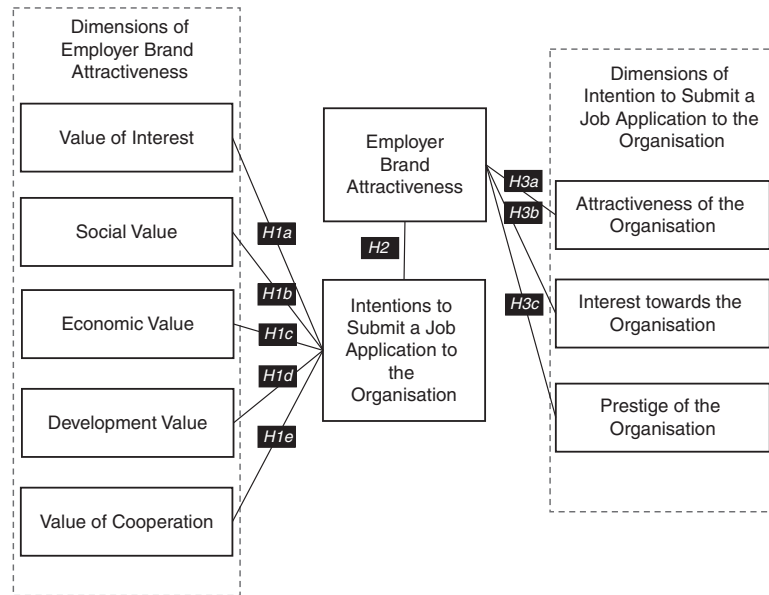
Figure 1.
Conceptual model

relationship between employer attractiveness and prospective employees' intention to apply to that organisation for a job. In our paper, we examine this relationship through the perspective of the millennial generation in Portugal and base our research on the premise that the attractiveness of an EB influences the intention to submit a job application to the organisation.

3.2 Research hypotheses

Being a first-choice employee brand is a valuable advantage for an organisation (Rampl, 2014). In her study, for the first time in the literature, Rampl (2014) investigated the drivers of employer first-choice brand and identifies employee's brand emotions as being essential for establishing a strong EB. According to Berthon *et al.* (2005), the benefits that a prospective employee expects to achieve while working for a specific organisation reveal the attractiveness of the employer's brand. The authors considered the following categories of principles: value of interest, social value, economic value, development value and value of cooperation. As these values have an impact on EB attractiveness and intention to submit a job application, we can propose the hypotheses *H1a–H1e*.

The value of interest is an improvement of the "psychological benefits" proposed by Ambler and Barrow (1996), which evaluate the extent to which a future employee is attracted by an organisation that offers innovative work practices and makes use of the employees' creativity to produce high-quality innovative products and services. As there are indications of a relationship between the value of interest and the intentions of submitting a job application to the organisation, this study proposes to test the following hypothesis:

H1a. There is a positive relationship between value of interest and intention to submit a job application to the organisation.

Social value is also an enhancement of the "psychological benefits" proposed by Ambler and Barrow (1996) who analysed to what extent a future employee is attracted by an

organisation that offers a fun, good working environment. Considering the relationship between social value and the intentions of submitting a job application, this study proposes the following hypothesis:

H1b. There is a positive relationship between social value and intention to submit a job application to the organisation.

Economic value is derived from an improvement of the three inductive dimensions (functional, psychological and economic) proposed by Ambler and Barrow (1996). This attests to the extent to which a future employee is attracted to an organisation that provides above-average salaries with a benefits package, job security and career development opportunities. Considering the relationship between economic value and intention to submit a job application, this study proposes to test the following hypothesis:

H1c. There is a positive relationship between economic value and intention to submit a job application to an organisation.

Cooperation value emerges from the improvement of Ambler and Barrow's (1996) "functional benefits", and it estimates to what extent a future employee is attracted to an organisation that offers recognition, self-esteem and trust, along with an experience that provides career enhancement and works as a "launch pad" for future jobs. In this sense, this study proposes the following hypothesis:

H1d. There is a positive relationship between development value and intention to submit a job application to the organisation.

The value of cooperation is again based on an improvement of the "functional benefits" of Ambler and Barrow (1996). This value verifies the extent to which a future employee is attracted to an organisation that provides an opportunity for the employee to apply what they have learned in the workplace and to share it with other employees in a customer-oriented and socially responsible environment. Thus, we propose that:

H1e. There is a positive relationship between value of cooperation and intention to submit a job application to the organisation.

Companies make a mindful effort to build themselves up as attractive brands and communicate their employer branding efforts to their relevant target audience. Some studies (e.g. Wilden *et al.*, 2010) have shown that companies invest in brand activities to build a stronger EB and that one of the major objectives of such efforts is to attract more talented employees.

Attractiveness of the employer's brand is defined as the imagined benefits that a future employee recognises when working for a specific organisation, which become important in as a way of attracting employees with superior skills and knowledge and a primary source of competitive advantage (Berthon *et al.*, 2005). The value of an organisation's job submission intention comes from evaluating the positive responses to organisation's recruitment messages, based on the assumption that these responses can be generalised, according to the actual choice of an organisation. According to this principle, the scale suggested by Highhouse *et al.* (2003) presents the following dimensions: attractiveness of the organisation, intentions in relation to an organisation and prestige of the organisation.

There is evidence that the stronger the attractiveness of an employer's brand, the stronger the intention is to submit a job application to an organisation, and thus the following hypothesis is proposed:

H2. There is a relationship between brand attractiveness of the employer and intention to submit a job application to the organisation.

Attractiveness of an organisation is reflected in the attitudes of future employees towards certain organisations as place for a potential future job. However, this attractiveness is passive in nature, because it does not necessarily imply that actual behaviour is carried out based on an opinion of an organisation. This passivity allows future employees to be attracted to many organisations simultaneously. More active research on the organisation by future employees would require resource conservation and a more limited number of accessible possibilities. Considering that there is a positive relation between the attractiveness of an organisation and the attractiveness of the employer's brand, the following hypothesis is proposed:

H3a. There is a positive relationship between attractiveness of the organisation and attractiveness of the employer's brand.

The intentions derived from the perceptions of the social adequacy of behaviour which results in the evaluation of intention will predict a more concrete pattern of behaviour, rather than the evaluation of attitudes. The notion that intention predicts behaviour with better than general attitudes has been based on empirical research (Kim and Hunter, 1993). Considering the positive relationship between intention to work for an organisation and the attractiveness of the employer's brand, the following hypothesis is stated:

H3b. There is a positive relationship between intention towards the organisation and EB attractiveness.

In addition to evaluating the attitudes and intention towards an organisation, many studies have attempted to evaluate the perception of the prestige of the organisation – the degree to which organisations are perceived as being a "good organisation to work with" (Highhouse *et al.*, 1998, 2003; Rampl, 2014; Rampl and Kenning, 2014). Therefore, we propose the following hypothesis:

H3c. There is a positive relationship between prestige of an organisation and EB attractiveness.

4. Methodology and data

The nature of this study is explorative, as it consists of causal links between the specificities of the attractiveness of the employer's brand and the intention of future employees to submit a job application. It consists of a cross-sectional analysis of a particular case, studied at a given time, and according to a predefined time interval (Saunders *et al.*, 2009). The selection of a single case study – Alpha C Portugal (whose real name remains confidential), an international service company operating in Portugal, offered an opportunity to observe and analyse the perception of this employer's brand attractiveness in Portugal.

The data collection techniques used were a combination of quantitative and qualitative analyses, using a mixed research model (Saunders *et al.*, 2009), as well as the use of multiple data sources, namely, a questionnaire survey (addressed to job candidates) and semi-structured interviews (with current employees). A non-probabilistic sampling technique (snowballing) was adopted for the questionnaire survey. A selection from the respondents was made, to ensure that the study population incorporates potential employees who intend to submit a job application to the organisation cited in the case study. The survey was carried out using the Qualtrics online platform, which facilitated the collection of data from a significant sample over a short period of time. Qualitative data collection was carried out in accordance with the concept of semi-structured interviews, conducted with the prior consent of the organisation and the interviewees. The interviews were conducted individually and face-to-face, using a tape recorder (with prior consent of the interviewee regarding the

recording of the interview) for later text transcription and analysis of the findings. The
questionnaire was predominately based on the Likert-type agreement scales and Cronbach's
αtest was applied to evaluate the consistency of each of the variables of the quantitative
scales present in this investigation. In order to verify the normality of the variables, the
Kolmogorov–Smirnov test was applied. Subsequently, in order to answer the research
questions and to validate the research hypotheses, simple and multiple linear regressions
were performed.

5. Statistical analysis and results
5.1 Unit of analysis
This study is grounded on one specific unit of analysis, known here as: Alpha C Portugal.
Alpha C Portugal is a financial group, with a solid global presence which specializes in
financial and banking services. It is a leader in Europe and is present in 74 countries,
employs 186,390 employees worldwide, and operates in 3 business areas, where it holds a
prominent position in the form of Alpha C, Alpha Invest and Alpha Retail. For investment,
Alpha occupies the top position in Europe and has a strong presence in the Americas, as
well as a solid and fast growth in the Asia Pacific region. The selection of a single case study
offered an opportunity to observe the intention to submit a job application to the
organisation by potential future employees.

Alpha C Portugal currently contracts approximately 4,000 employees. The average age
of Alpha C Portugal employee is 34 years old, and 54 per cent of employees are women.
Alpha C Portugal is supported by specialised teams in London and Paris, which provide
corporate and investment banking services to more than 350 national and international
organisations. Directed to serving organisations, financial institutions and institutional
clients, Alpha C Portugal offers a wide range of services, ranging from day-to-day banking
to more sophisticated investment banking solutions.

5.2 Sample characterisation
The survey was answered by 291 individuals, although only 281 of these responses were
considered complete and valid, with 10 responses being excluded (as the questionnaire was not
completed). The final quantitative sample was composed of 281 respondents, corresponding to
56.2 per cent females and 43.8 per cent males. Most of the respondents are young adults (up to 35
years of age), with the most pertinent age range being between 26 and 35 years old (58.7 per cent).
Therefore, we can assume that the study effectively represents the opinions of millennials.
Regarding the level of education, the majority of respondents (56.2 per cent) hold a Post-graduate
or Masters' degree, followed by those with a Bachelors' degree (40.2 per cent). With regards to
professional situation, 74.7 per cent of respondents are employed and 34.5 per cent of the
respondents stated that they have a work experience of 6–10 years, while 31 per cent mentioned
that their experience was less than 5 years, followed by 16.4 per cent who mentioned that they
have an experience of between 11 and 15 years.

The interviews were carried out with a total of nine employees of Alpha C Portugal: four
departments' directors, three team leaders and two co-workers. Most of the interviewees are
male (six out of nine). Regarding the length of service with Alpha C Portugal, three of the
respondents have worked for more than five years with this organisation, while four of the
interviewees have been employed by the organisation for at least three years and up to two
years with the organisation. See Table AIII for a more complete sample characterisation.

5.3 Reliability and internal consistency
Cronbach's α test was applied to evaluate the consistency of each of the variables of the
quantitative scales present in this investigation. According to the analysis, the

consistency of the EB attractiveness scale is very good, presenting a value of 0.912 and likewise, the scale of intention to submit a job application exhibits an excellent consistency, with a value of 0.916.

5.4 Hypotheses validation

In order to validate the research hypotheses, simple and multiple linear regressions were performed. The validity of the regression assumptions was first tested through the assumption of the normal distribution of errors/residues with the graphical representation of normal probability. The assumption of homoscedasticity or variance of errors is constant and is showed by the graphical representation of a scatter diagram, through which it can be determined that the values are close to 0 and that in this case the error variance proves to be constant. The D–W test was performed to ascertain the independence of the errors or absence of autocorrelation. The absence of multicollinearity was also confirmed. Taking into account the evidence of this evaluation, it can be stated that the assumptions are valid, which means that none of the assumptions is violated.

A multiple linear regression was used to answer the first research question and to validate the research hypotheses *H1a–H1e*, in which the dependent variable was the intention to submit a job application to an organisation and the independent variables are the value of cooperation, value of interest, social value, development value and economic value (see Table AIII for synthesis of the regression models).

With respect to the adjusted coefficient of determination (R^2 adjusted), it is indicated that 1.7 per cent of the total variation of the scale "intention to submit a job application to the organisation" is justified by the variation of the variables of: value of cooperation; value of interest; social value; value development; and economic value. Given that: $F(5) = 158.874$ test, p-value $= 0.104$, $\alpha = 0.05$), it can be assumed that the model is not significant, as it does not reject the null hypothesis and its validity cannot be attested. The standard error of the estimate ($S = 9.273$) is high, which indicates a less good fit between at least one of the analysed values of the sample and the values estimated by the model. In order to verify the impact that the independent variables have on intention to submit a job application to an organisation, it is observed that value of cooperation ($\beta = 0.156$, $t = 0.865$, p-value $= 0.388$, $\alpha =$), the value of interest ($\beta = 0.296$, $t = 1.503$, p-value $= 0.134$, $\alpha = 0.05$), social value ($\beta = 0.099$, $t = 0.445$, p-value $= 0.656$, $\alpha = 0.05$) and developmental value ($\beta = 0.182$, $t = 0.819$, p-value $= 0.414$, $\alpha = 0.05$) have an impact on the intention to submit a job application, confirming *H1a*, *H1b*, *H1d* and *H1e*; except for economic value ($\beta = -0.404$, $t = -1.265$, p-value $= 0.207$, $\alpha = 0.05$), which therefore does not validate *H1c*.

Thus, the regression model is presented as follows:

$$Y = 52.630 + 0.156 \times X1 + 0.296 \times X2 + 0.099 \times X3 + 0.182 \\ \times X4 + \epsilon j \quad (j = 1, \ldots, n), \tag{1}$$

where Y: intentions to submit a job application to an organisation, $X1$: value of cooperation, $X2$: value of interest, $X3$: social value, $X4$: development value and ϵj: model errors.

In order to validate hypothesis *H2*, two simple linear regressions were applied. For the regression model, the adjusted R^2 diagnosis that 2.3 per cent of the total range variation of EB attractiveness is justified by the variation of the variable "intention to submit a job application". According to the F-test ($F = 1,405.144$, p-value $= 0.010$, $\alpha = 0.05$), it can be assumed that the model is significant, as the null hypothesis of this test is rejected, and its validity is verified. The standard error of the estimate ($S = 14.429$) is high, which expresses a less good fit between at least one of the analysed values of the sample and the values estimated by the model. Finally, the influence that the independent variable has on the scale of attractiveness of the employer's brand was evaluated, attesting that intention to

submit a job application ($R = 0.165$, $t = 2.598$, p-value $= 0.010$, $\alpha = 0.05$) has an impact on EB attractiveness, which leads to the confirmation of *H2*. Thus, the regression model is represented as follows:

$$Y = 113.337 + 0.1258 \times X + \epsilon j \quad (j = 1, \ldots, n), \tag{2}$$

where *Y*: scale attractiveness of the employer's brand, *X*: intention to submit a job application and ϵj: model errors.

In order to answer the third research question and to validate the hypotheses *H3a–H3c*, a multiple linear regression was applied, with the varying scale depending on the employer's brand variety of attractiveness, and the independent variables of: attractiveness of the organisation; intentions in relation to the organisation, and; prestige of the organisation. Considering the regression model, through the adjusted R^2 analysis it is considered that 1.9 per cent of the total variation of the variable scale attractiveness of an employer's brand is expressed by the variation of the variables of: attractiveness of the organisation; intentions in relation to the organisation, and; prestige of the organisation. Using the *F*-test ($F(3) = 530.240$, p-value $= 0.057$, $\alpha = 0.05$), it can be verified that the model is significant, as the null hypothesis of this test is rejected, proving its validity. The standard error of the estimate ($S = 14.462$) is high, exposing a less good fit between at least one of the analysed values of the sample and the values estimated by the model. Regarding the impact that the independent variables have on the EB attractiveness scale, it was found that attractiveness of the organisation ($\beta = 0.139$, $t = 1.441$, p-value $= 0.151$, $\alpha = 0.05$), intention ($p = 0.715$, $\alpha = 0.05$) and organisational prestige ($\beta = 0.038$, $t = 0.365$, $p = 0.715$, $\alpha = 0.05$) has an influence on an employer's brand attractiveness, which confirms the validity of *H3a–H3c*. Thus, the regression model is represented as follows:

$$Y = 111.134 + 0.715 \times X1 + 0.41 \times X2 + 0.154 \times X3 + \epsilon j \quad (j = 1, \ldots, n), \tag{3}$$

where *Y*: attractiveness of the employer's brand, *X1*: attractiveness of the organisation, *X2*: intentions towards the organisation, *X3*: prestige of the organisation and ϵj: model errors.

5.5 Results of the qualitative study

In order to determine what makes EB attractive to current employees, a qualitative analysis was based on the Social Identity Approach to organisational identification model explored by Maxwell (2009). On closer examination, attributes related with employee compensation include tangible rewards, such as salaries and benefits, and also intangible rewards, such as training and career advancement opportunities. There are some differences when it comes to the importance of salary – whereby some of the interviewees stated that levels of salary were good, while others claimed that they are not the best in the market. Interestingly, the most-emphasised component of compensation that was most appreciated by all the respondents were the learning opportunities, both in terms of training and career progression. Management style was considered favourably by most of the employees and the most appreciated factors were: promotion and opportunities to participate in cross-cutting projects; career progression, greater openness and internal information sharing. Importantly, the interviewees stressed that management does not have any concern when it comes to retaining talented employees. Finally, the characteristics and values attributed to the products and services of the organisation reveal some small divergence, but predominantly the company is considered to be an organisation of excellence, reflecting a strong internal brand image and the existence of social responsibility policies and ethics.

5.6 Discussion of the results
The quantitative analysis of this study focused on the intention to submit a job application to Alpha C Portugal by future employees and also their perceptions of this particular employer's brand attractiveness. Interestingly, all the hypotheses were validated, except for hypothesis *H1c* "there is a positive relationship between Economic Value and Intention to Submit a Job Application to an Organisation". This leads us to conclude that for the perception of Portuguese millennials, above-average salary, compensation package, job security and promotional opportunities are not the key factors that influence their intention to submit a job application.

Interestingly, the results of the qualitative analysis show that those attributes that the current employees and managers of Alpha C Portugal consider to be the most attractive are slightly different from those mentioned by job candidates, which may imply that the efforts applied to become the "first-choice employer" may not have had the desired effect, especially from an internal point of view. The needs, skills and knowledge of the employees are part of an organisation's competitive advantage and it is thus fundamental that all the employees of an organisation have the opportunity to understand the organisation's brand, as the brand is intrinsically linked to their job functions and thus employees can be the brand's drivers.

6. Conclusions
The way in which an employee sees the organisation becomes an echo of perceptions regarding it, which is an essential point for organisations to take into consideration when developing their messages according to the needs of internal and external markets. The results obtained in this study indicate that almost all the dimensions of EB attractiveness have an influence on the intention of millennials to apply for a job, with the only exception being economic value. This is an interesting finding, both from an academic as well as a professional perspective, and therefore we would suggest future research into what millennials find to be truly attractive in an organisation and what can help them to decide where to apply for a job. It is crucial for organisations to understand these elements of brand attractiveness, in order that they can appeal and retain talented employees. By looking at the strongest dimensions of their EB attractiveness, companies can be capable of developing their marketing and human resource strategies in accordance with the needs and objectives desired by job candidates and current employees. The changing generations and the different attributes that attract their attention with regards to EB may not have an equal weighting in the eyes of current employees.

With regards to the limitations of this study, the generalisability of the findings may be placed into question, based on two major restraints. First, the study covers only one case study, and second, it is based on the analysis of a small sample sizes for both the qualitative and the quantitative study. Future research is suggested which should use wider company/sector coverage and employ a larger sample size.

References

Alnıaçıka, E., Alnıaçıka, U., Eratb, S. and Akçin, K. (2014), "Attracting talented employees to the company: do we need different employer branding strategies in different cultures?", *Procedia – Social and Behavioral Sciences*, Vol. 150, pp. 336-344.

Ambler, T. and Barrow, S. (1996), "The employer brand", *Journal of Brand Management*, Vol. 4 No. 3, pp. 185-206.

Backhaus, K. (2016), "Employer branding revisited", *Organisation Management Journal*, Vol. 13 No. 4, pp. 193-201.

Backhaus, K. and Tikoo, S. (2004), "Conceptualizing and researching employer branding", *Career Development International Journal*, Vol. 9 No. 5, pp. 501-517.

Banco de Portugal (2018), "Projeções económicas", *Boletim Económico*.

Bellou, V., Chaniotakis, I., Kehagias, I. and Rigopoulou, I. (2015), "Employer brand of choice: an employee perspective", *Journal of Business Economics and Management*, Vol. 16 No. 6, pp. 1201-1215.

Berthon, P., Ewing, M. and Hah, L.L. (2005), "Captivating company: dimensions of attractiveness in employer branding", *International Journal of Advertising*, Vol. 24 No. 2, pp. 151-172.

Chebat, J.C. and Kollias, P. (2000), "The impact of empowerment on customer contact employees' roles in service organisations", *Journal of Service Research*, Vol. 3, pp. 66-81.

Deloitte (2018), *The Deloitte Millennial Survey 2018*, Deloitte Touche Tohmatsu Limited.

Dhar, R.L. (2015), "Service quality and the training of employees: the mediating role of organisational commitment", *Tourism Management*, Vol. 46, February, pp. 419-430.

Ferri-Reed, J. (2014), "Millennializing the workplace", *The Journal for Quality and Participation*, Vol. 37 No. 1, pp. 13-14.

Highhouse, S., Lievens, F. and Sinar, E.F. (2003), "Measuring attraction to organisations", *Educational and Psychological Measurement*, Vol. 63 No. 6, pp. 986-1001.

Highhouse, S., Beadle, D., Gallo, A. and Miller, L. (1998), "Get'em while they last! Effects of scarcity information in job advertisements", *Journal of Applied Social Psychology*, Vol. 28 No. 9, pp. 779-795.

Jain, N. and Bhatt, P. (2015), "Employment preferences of job applicants: unfolding employer branding determinants", *Journal of Management Development*, Vol. 34 No. 6, pp. 634-652.

Jiang, T.T. and Iles, P. (2011), "Employer-brand equity, organisational attractiveness and talent management in the Zhejiang private sector, China", *Journal of Technology Management in China*, Vol. 6 No. 1, pp. 97-110.

Kim, M.S. and Hunter, J.E. (1993), "Attitude-behaviour relations: a meta-analysis of attitudinal relevance and topic", *Journal of Communication*, Vol. 43 No. 1, pp. 1001-1142.

King, C. and Grace, D. (2009), "Employee based brand equity: a third perspective", *Services Marketing Quarterly*, Vol. 30 No. 2, pp. 122-147.

Kucherov, D. and Zavyalova, E. (2012), "HRD practices and talent management in the companies with the employer brand", *European Journal of Training and Development*, Vol. 36 No. 1, pp. 86-104.

Maier, T., Tavanti, M., Bombard, P., Gentile, M. and Bradford, B. (2015), "Millennial generation perceptions of value-centered leadership principles", *Journal of Human Resources in Hospitality and Tourism*, Vol. 14 No. 4, pp. 382-397.

Maxwell, R. (2009), "Motivating employees to 'live the brand': a comparative case study of employer brand attractiveness within the firm", *Journal of Marketing Management*, Vol. 25 Nos 9-10, pp. 893-907.

Punjaisri, K. and Wilson, A. (2017), "The role of internal branding in the delivery of employee brand promise", *Journal of Brand Management: Advanced Collections*, Vol. 15 No. 1, pp. 57-70.

Rampl, L.V. (2014), "How to become an employer of choice: transforming employer brand associations into employer first-choice brands", *Journal of Marketing Management*, Vol. 30 Nos 13-14, pp. 1486-1504.

Rampl, L.V. and Kenning, P. (2014), "Employer brand trust and affect: linking brand personality to employer brand attractiveness", *European Journal of Marketing*, Vol. 48 Nos 1-2, pp. 218-236.

Saunders, M., Lewis, P. and Thornhill, A. (2009), *Research Methods for Business Students*, 5th ed., Prentice-Hall, Harlow.

Wilden, R., Gudergan, S. and Lings, I. (2010), "Employer branding: strategic implications for staff recruitment", *Journal of Marketing Management*, Vol. 26 Nos 1-2, pp. 56-73.

Wu, Y.C., Tsai, C.S., Hsiung, H.W. and Chen, K.Y. (2015), "Linkage between frontline employee service competence scale and customer perceptions of service quality", *Journal of Services Marketing*, Vol. 29 No. 3, pp. 224-234.

Xie, C., Bagozzi, R.P. and Meland, K.V. (2015), "The impact of reputation and identity congruence on employer brand attractiveness", *Marketing Intelligence and Planning*, Vol. 33 No. 2, pp. 124-146.

154

Further reading

Berry, L.L. (2000), "Cultivating service brand equity", *Journal of the Academy of Marketing Science*, Vol. 28 No. 1, pp. 128-137.

Foster, C., Punjaisri, K. and Cheng, R. (2010), "Exploring the relationship between corporate, internal and employer branding", *Journal of Product and Brand Management*, Vol. 19 No. 6, pp. 401-409.

Gapp, R. and Merrilees, B. (2006), "Important factors to consider when using internal branding as a management strategy: a healthcare case study", *Journal of Brand Management*, Vol. 14 Nos 1-2, pp. 162-176.

Keller, K.L. (1993), "Conceptualizing, measuring, and managing customer-based brand equity", *Journal of Marketing*, Vol. 57 No. 1, pp. 1-22.

Saini, G.K., Rai, P. and Chaudhary, M.K. (2013), "What do best employer surveys reveal about employer branding and intention to apply?", *Journal of Brand Management*, Vol. 21 No. 2, pp. 95-111.

Corresponding author
Joanna Santiago can be contacted at: joannas@iseg.ulisboa.pt

Appendix 1

Dimension	Definition	Items
Value of interest	"[…] the extent to which an individual is attracted to an employer that provides an exciting work environment, novel work practices and that makes use of its employees' creativity to produce high-quality, innovative products and services"	Working in a challenging work environment Innovative employer – innovative work practices/disruptive ideas The organisation values and makes use of its creativity The organisation provides high quality products and services The organisation provides innovative products and services
Social value	"[…] the extent to which an individual is attracted to an employer that provides a working environment which is fun, happy, and which provides good collegial relationships and a team atmosphere"	A fun work environment Have a good relationship with your superiors Have a good relationship with your colleagues Encouraging and collaborative colleagues Good working environment
Economic value	"[…] the extent to which an individual is attracted to an employer that provides an above-average salary, a compensation package, job security, and opportunities for promotion"	Good opportunities for promotion within the organisation Opportunity for inter-departmental practical experience Good working environment Above-average base salary
Development value	"[…] the extent to which an individual is attracted to an employer that provides recognition, self-worth and confidence, together with a career-enhancing experience and a springboard to future employment"	Appreciation of your performance by management A launching pad for future jobs Feeling good about yourself as a result of working for a particular organisation Feeling more confident as a result of working for a particular organisation Gaining professional experience
Value of cooperation	"[…] the extent to which an individual is attracted to an employer that provides an opportunity for the employee to apply what they have learned and to teach others, in an environment that is both customer-orientated and humanitarian"	Socially responsible organisation – contributes to society Opportunity to apply what has been learned in a tertiary institution Opportunity to teach others what you have learned in the work context Acceptance and belonging The organisation is customer-oriented

Source: Berthon *et al.* (2005)

Table AI.
Employer brand
attractiveness

Appendix 2

Dimension	Definition	Items
Attractiveness of the organisation	"The company as a potential place for employment"	For me, this organisation is a good place to work I am only interested in this organisation as a last resort This organisation is attractive to me as a place of employment I am interested in learning more about this organisation Playing a role in this organisation is very appealing to me
Intentions towards the organisation	"[…] should reflect a forward-looking approach to dealing with the company in the future"	I would accept an offer of employment from this organisation I chose this organisation as one of my first choices as an employer If this organisation invited me for a job interview, I would accept I am willing to give my best to work for this organisation I would recommend this organisation to a friend who is looking for a job
Prestige of the organisation	"[…] aspects of a company with regards to social influence, such as reputation, popularity, and status"	Employees are proud to say that they work in this organisation This organisation has a good reputation This organisation has a reputation for being an excellent employer I consider this organisation to be a prestigious place to work at There are many people who enjoy working in this organisation

Table AII.
Intentions to submit a job application to the organisation

Synthesis of the regression Model 1

Model	Variables	R² adjusted	ANOVA F	df	Sig.	SE of estimative (S)	Standardised coefficients (β)	t	Sig.	Non-standardised coefficients (B)
1	(Constant)	0.017	158.874	5	0.104	9.273		17.817	0.000	113.337
	Value of cooperation						0.072			
	Value of interest						0.139			
	Social value						0.040			
	Development value						0.075			
	Economic value						−0.121			
	Intentions to submit a job application to the organisation scale							2.598	0.010	0.1258

Synthesis of the regression Model 2

Model	Variables	R² adjusted	ANOVA F	df	Sig.	SE of estimative (S)	R	t	Sig.	Non-standardised coefficients (B)
2	(Constant)	0.023	1,405.144	1	0.010	14.429	0.165			
	Intentions to submit a job application to the organisation scale									
	Employer brand attractiveness scale									

Synthesis of the regression Model 3

Model	Variables	R² adjusted	ANOVA F	df	Sig.	SE of estimative (S)	R	t	Sig.	Non-standardised coefficients (B)
3	(Constant)	0.023	576.834	1	0.010	9.245	0.165	9.366	0.000	49.755
	Employer brand attractiveness scale							2.598	0.010	0.106
	Intentions to submit a job application to the organisation scale									

Synthesis of the regression Model 4

Model	Variables	R² adjusted	ANOVA F	df	Sig.	SE of estimative (S)	Standardised coefficients (β)	t	Sig.	Non-standardised coefficients (B)
4	(Constant)	0.019	530.240	3	0.057	14.462		16.209	0.000	111.134
	Attractiveness of the organisation						0.139	1.441	0.151	0.715
	Intentions towards the organisation						0.011	0.097	0.923	0.41
	Prestige of the organisation						0.038	0.366	0.715	0.154
	Employer brand attractiveness scale									

Table AIII.
Synthesis of the
regression models

Entrepreneurship, firms creation and regional performance

Paz Rico and Bernardí Cabrer-Borrás
Facultat d'Economia, Universitat de Valencia, Valencia, Spain

Abstract

Purpose – The purpose of this paper is to analyse if the divergences in the economic growth of the Spanish regions are a result of sectoral differences, company size or technological level of the new firms that emerge in the market.

Design/methodology/approach – For this purpose, a model is specified and estimated in which the total factor productivity of Spanish regions is explained by business dynamics, innovation, human capital and the level of entrepreneurship in each region.

Findings – The results obtained lead the authors to conclude that entrepreneurship understood as both the creation of new firms and entrepreneurial activity, have a positive effect on productive efficiency and can explain the differences in the economic growth of the regions. In addition, the stock of human capital and the promotion of innovation act as catalysts for the productive efficiency of the regions. However, the results show that it is not enough to generate new firms to boost economic growth; these businesses must also be oriented towards sectors that promote technological innovation and with the objective to reach an adequate size.

Originality/value – Empirical studies use either the creation of new firms or the index of entrepreneurial activity as alternative measures of entrepreneurship. In this research, however, both variables are considered together. Specifically, the creation of new companies is used as a measure of regional business dynamics, and the entrepreneurial activity index, provided by the Global Entrepreneurship Monitor, as a measure of regional entrepreneurship. The main novelty of this paper's approach is that it considers different types of entrepreneurial capital in considering productive sector, size and technological level of the new companies.

Keywords Innovation, Entrepreneurship, Human capital, Total factor productivity, Creation of firms, Productive efficiency

Paper type Research paper

1. Introduction

It is a proven fact that there is a strong relationship between regional economic growth and the level of knowledge and innovation, demonstrated by the fact that the regions with the highest level of technological development and innovation present higher growth. However, knowledge by itself does not generate economic growth; there needs to be a channel to transform this knowledge into economic growth. In this sense, Braunerhjelm *et al.* (2010) point out that for innovations in new products or processes to generate growth they require an entrepreneur willing to assume the risk involved in launching new products or processes onto the market. Therefore, entrepreneurial capital is one of the factors that generate externalities that contribute to economic growth[1].

Entrepreneurship is understood as not only the creation of new firms but also the activity of introducing new products or new productive processes onto the market. In the empirical studies, no clear agreement has been reached on how to collect the entrepreneurship. It is true that the activity of entrepreneurs involves, in most cases, the creation of firms, thus establishing a link between entrepreneurship and firm's creation.

JEL Classification — J24, M13, O11, O47

In this sense, Acs (2006) considers that the creation of firms generates jobs, intensifies competitiveness and promotes innovation. Therefore, it is usual to use the creation of new firms as an indicator of entrepreneurship (OECD, 2008; Carree and Thurik, 2008; Koellinger and Thurik, 2012; Van Praag and Van Stel, 2013; Erken *et al.*, 2016). However, acknowledging the creation of firms as the only entrepreneurial would overlook other important entrepreneurship contributions. Empirical studies use either the creation of new firms or the index of entrepreneurship activity as alternative measures of entrepreneurship. In this research, however, both variables are considered together. Our main contribution is that we consider both entrepreneurship and creation of firms in explaining cross-regional differences in economic growth. Specifically, the creation of new companies is used as a measure of regional business dynamics, and the total entrepreneurial activity (TEA) index, provided by the Global Entrepreneurship Monitor (GEM), as a measure of regional entrepreneurship. Moreover, the main novelty of this paper's approach is that it considers different types of entrepreneurial capital in considering productive sector, size and technological level of the new companies.

As Acs *et al.* (2018) pointed out Baumol (1990, 1993) argued that, even if all countries had similar supplies of entrepreneurs, the institutional structure would determine the allocation to productive, unproductive and destructive forms of activity. This leads to empirical literature consider whether entrepreneurship and institutions are pivotal in explaining cross-country differences in economic growth (Braunerhjelm *et al.*, 2010; Bjørnskov and Foss, 2016; Acs *et al.*, 2017; Sussan and Acs, 2017). In order to ignore the institutional structure, this paper focuses on Spanish regional data that provide data from only one country.

We analyse the impact of the creation of new firms and the entrepreneurship activity on the inequalities in the level of growth in the different Spanish regions. In addition, another contribution of the paper is that it also focuses on analysing whether the effect of business dynamics on regional economic growth differs according to the productive sector, the firm size and the technological level of the new firms that emerge in the market.

This paper is divided into six sections. Following the introduction, the second section presents the theoretical framework. The third section presents the methodology used and the fourth section analyses the data used in the research. The fifth section shows the empirical results obtained and, finally, the last section includes the main conclusions of the paper.

2. Theoretical framework

In his seminal article, Solow (1956) proposed a model in which production was a function of two explicit factors, physical capital and labour, and an implicit factor, technological advance, the residual factor. Solow acknowledged that growth was influenced by technological change, but in the formalization of its production function he considered it exogenous. In fact, Solow considered that productive factors, capital and labour, did not necessarily explain the growth variation given that most of its variation was explained by the residual contained in technological progress.

Subsequently, the models of endogenous growth of Romer (1986) and Lucas (1988, 1993) explicitly introduced technological progress, considering that knowledge is transmitted through externalities and generates effects of drag on the economy. However, knowledge by itself does not generate economic growth; the externalities assumed to exist by Romer and Lucas need to be produced. Entrepreneurship is one of the channels of knowledge transmission that contributes to economic growth. In this sense, Audretsch (2007) considered that the policy of promoting entrepreneurial activity promotes economic growth.

As indicated by Acs *et al.* (2018), the theory that there is a positive relationship between entrepreneurship and growth goes back to Schumpeter (1934). The literature attempting to show the existence of this positive relationship has been prolific since then. Wennekers and Thurik (1999) and, more recently, Carree and Thurik (2010) provide a review of the literature

that includes the relationship between entrepreneurship and economic growth. From the empirical evidence obtained in the literature, it can be concluded that entrepreneurial capital, understood as both the creation of new firms and entrepreneurial activity, are key factors in achieving an improvement in productivity and, therefore, generating economic growth (Callejón and Segarra, 1999; Holtz-Eakin and Kao, 2003; Audretsch and Keilbach, 2004, 2008; Van Stel *et al.*, 2005; Audretsch *et al.*, 2006; Van Praag and Versloot, 2007; Thurik *et al.*, 2008; Bjørnskov and Foss, 2013; Van Praag and Van Stel, 2013; Aubry *et al.*, 2015; Huggins and Thompson, 2015; González-Pernía and Peña-Legazkue, 2015; Prieger *et al.*, 2016; Erken *et al.*, 2016; Acs *et al.*, 2018).

Based on the evidence that there is a positive relationship between entrepreneurial capital and economic growth, our contribution is to verify whether the differences in productive sector, size and the technological level of the new companies generated can explain the inequalities in productivity growth in the regions of Spain. Fritsch (2008) and Fritsch and Schroeter (2011) indicate that the effect of new firms creation is different between regions. On the other hand, Aubry *et al.* (2015) consider that entrepreneurial capital contributes in varying intensity to the growth of regions in industrialised countries.

3. Methodology

The total factor productivity (TFP) is a fundamental variable to measure the growth and development of an economy as it reflects the productive efficiency with which its economic system works. For Krugman (1994) "productivity is not everything, but in the long term it is almost everything". The growth of productivity generates economic growth since technical progress leads to an increase in the yields of all productive factors, especially those of labour. Therefore, the growth capacity of an economy depends, fundamentally, on technical progress and this capacity is reflected in the rate of growth of the TFP.

There are different approaches for obtaining TFP and one of them is based on growth accounting. According to this methodology, the growth of TFP is obtained as part of the endogenous growth of the production of an economy that is not explained by the variations of all the inputs used to obtain production. Specifically, the methodology of growth accounting decomposes the growth of production into three sources: the growth of the labour factor, the growth of the capital factor and the growth of the TFP[2] (Audretsch and Keilbach, 2004).

The accounting approach to the decomposition of growth sources begins from considering a production function. The most used production function is the Cobb-Douglas (1928), which is specified as follows:

$$Y_{it} = A_{it}K_{it}^{\alpha}L_{it}^{\beta}, \tag{1}$$

where Y_{it} is the output level or production in real terms, A_{it} measures the technological advance or productivity efficiency, K_{it} is the physical capital stock, L_{it} is the employment level, whilst α is the elasticity of production for the factor labour and β the elasticity of production for the factor capital.

Taking logarithms from Equation (1), and assuming constant returns to scale, $\alpha + \beta = 1$, we obtain:

$$\ln Y_{it} = \ln A_{it} + \alpha \ln K_{it} + (1-\alpha) \ln L_{it}. \tag{2}$$

When taking first differences, the following relationship is obtained:

$$\Delta \ln Y_{it} = \Delta \ln A_{it} + \alpha \Delta \ln K_{it} + (1-\alpha)\Delta \ln L_{it}. \tag{3}$$

Equation (3) indicates that the growth rate of production is determined by the growth of physical capital, employment and the improvement of efficiency or increase in TFP. In this

way, the increase of the TFP would be obtained as follows:

$$\Delta \ln A_{it} = \Delta \ln Y_{it} - \alpha \Delta \ln K_{it} - (1-\alpha)\Delta \ln L_{it}. \tag{4}$$

According to Cuadrado and Moral (2016), the coefficient α refers to the arithmetic mean of the share of labour income in production in period t and t–1. As indicated by Cuadrado and Moral (2016), the temporal variability of the elasticity of production to the labour factor is usually ignored and assumed to be a constant elasticity equal to 0.65. In our case, the elasticity of the labour factor is calculated over the sample period and for each of the regions. From this calculation, the growth of the TFP for each region is obtained.

In this research we consider the creation of new firms and entrepreneurship as indicators of entrepreneurial capital. In addition, there are other variables or exogenous factors that influence the growth of TFP, such as human capital and R&D expenditures in each region. In literature, both theoretical and empirical, the contribution of investment in R&D in economic growth is evidenced (Griliches and Lichtenberg, 1984; Aghion and Howitt, 1992; Coe and Helpman, 1995; Griliches, 1998; Jacobs *et al.*, 2002; Guellec and Van Pottelsberghe de la Potterie, 2004; Aghion, 2017). With respect to human capital, it should be noted that this is one of the most used factors in growth models, as cited in the contributions by Becker (1975), Mincer (1984), Romer (1986), Barro and Lee (1993), Barro and Sala-i-Martin (1995) and Barro (2001), among others. Another school of economic thought relates human capital with the creation of firms and technological diffusion, as indicated in the contributions of Sevilir (2010), Kato and Honjo (2015) and Vila *et al.* (2015), among others.

Thus, in the model finally specified, the following explanatory variables for the growth of the TFP are used; the increase of TEA, the R&D expenses and the stock of human capital as well as the creation of new companies[3]:

$$\Delta TFP_{it} = \alpha_1 + \alpha_2 \Delta TEA + \alpha_3 \Delta R\&D_{it} + \alpha_4 \Delta HK_{it-1} + \alpha_5 \Delta F_{it} + u_{it}. \tag{5a}$$

However, in general, the behaviour of an economy is subject to a strong tendency usually captured by an inertial term. In the present case, the regressor ΔTFP_{it-1} has been included in Equation (5a), so that the behaviour equation is defined by:

$$\Delta TFP_{it} = \alpha_1 + \alpha_2 \Delta TEA + \alpha_3 \Delta R\&D_{it} + \alpha_4 \Delta HK_{it-1} + \alpha_5 \Delta TFP_{it-1} + \alpha_6 \Delta F_{it} + u_{it}. \tag{5b}$$

Given the characteristics of the data used, the possible existence of fixed effects in the behaviour Equation (5b) is contrasted. For this purpose, the following alternative model is specified:

$$\Delta TFP_{it} = \alpha_2 \Delta TEA + \alpha_3 \Delta R\&D_{it} + \alpha_4 \Delta HK_{it-1} + \alpha_5 \Delta TFP_{it-1}$$

$$+ \alpha_6 \Delta F_{it} + \sum_{j=1}^{17} \beta_j \text{Dummy}_{jit} + u_{it}, \tag{5c}$$

The variable Dummy takes value 1 for region j and 0 for the rest of the regions.

Using Equation (5c) four hypotheses can be tested empirically:

H1. Regions with higher levels of entrepreneurial activity will grow faster.

H2. Regions with higher levels R&D expenditure will have faster growth rates.

H3. Regions with higher levels human capital endowment will have faster growth rates.

H4. Regions with higher levels of creation of new companies will have faster growth rates.

Then, through a sensitivity analysis, the importance of the different characteristics of the new companies and their influence on the productive efficiency of the regions is analysed.

In the first place, the importance of the size of the firm is analysed, second, the production sector to which it belongs and, third, the technological level of the company.

In order to study the contribution of the size of the firm in the explanation of the TFP, and taking Equation (5b) as reference, we propose the following equation. This model analyses the importance of the size of new companies when explaining the behaviour of productive efficiency:

$$\Delta TFP_{it} = \alpha_1 + \alpha_2 \Delta TEA + \alpha_3 \Delta R\&D_{it} + \alpha_4 \Delta HK_{it-1} + \alpha_5 \Delta TFP_{it-1} + \beta_j \Delta FG_{jit} + u_{it}, \quad (6)$$

where the variable ΔFG_{jit} is a variable that measures the creation of new companies, according to size ($j = 1, 2, 3, \ldots, 6$) and the parameter β_j quantifies the elasticity of the size of the company in productive efficiency.

Likewise, the analysis of the importance of the production sector is carried out through the following model:

$$\Delta TFP_{it} = \alpha_1 + \alpha_2 \Delta TEA + \alpha_3 \Delta R\&D_{it} + \alpha_4 \Delta HK_{it-1} + \alpha_5 \Delta TFP_{it-1} + \gamma_j \Delta FS_{jit} + u_{it}, \quad (7)$$

where the variable ΔFS_{jit} measures the creation of new firms according to the productive sector ($j = 1, 2, 3, \ldots, 6$) and the parameter γ_j, of Equation (7), quantifies the elasticity of the production sector j to which the new firm in region i belongs.

Finally, the analysis of the importance of the level of technology used by new firms is done through the following model:

$$\Delta TFP_{it} = \alpha_1 + \alpha_2 \Delta TEA + \alpha_3 \Delta R\&D_{it} + \alpha_4 \Delta HK_{it-1} + \alpha_5 \Delta TFP_{it-1}$$
$$+ \beta_j \Delta FS_{jit} + u_{it} \Delta HK_{it-1} + \delta_j \Delta FT_{jit} + u_{it}, \quad (8)$$

where the variable ΔFT_{jit} measures the degree of technological development of the new companies ($j = 1, 2$), while the parameter δ_j quantifies the elasticity of the technological level of the new companies in the TFP.

Equations (6)–(8) allow testing empirically the following hypothesis:

H5. There are differences in regional economic growth by the size of the new companies.

H6. There are differences in the regional economic growth by the productive sector of the new companies.

H7. There are differences in the regional economic growth by the technological level of the new companies.

Figure 1 shows in a schematic way the relationship between the variables of the proposed model that determine the output of the regional economies through the TFP.

4. Data and the variables selected

The data used in this analysis come from different institutions, both public and private. Thus, the National Institute of Statistics (INE) has provided information on the level of output, quantified through the gross domestic product (GDP) in constant euros for each of the regions or autonomous communities, expressed in thousands of euros. The same source has been used to obtain information on the number of inhabitants of each region over the period 2000–2016. In addition, the 17 Spanish regions have been considered as study units. This statistical information incorporates a data panel of 268 observations.

The information on the labour production factor is obtained from the INE, using as its measurement the number of workers expressed in thousands, while the data used for the other basic production factor, the stock of physical capital, come from the BBVA Foundation–IVIE. The source of the stock of human capital comes from the estimates made
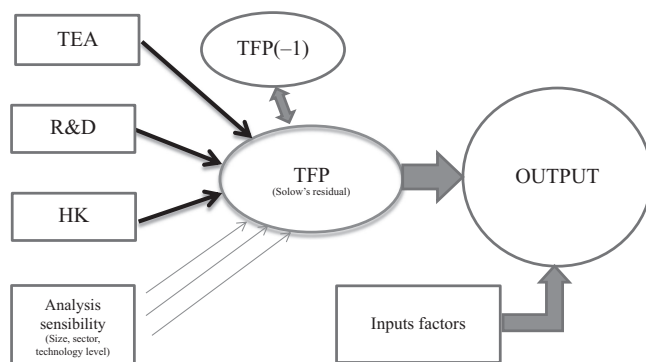
Source: Compiled by the authors

Figure 1.
Diagram of the model

by the BBVA Foundation–IVIE, while the R&D expenses per inhabitant of each region for each year of the sample period have been obtained from the INE.

The number of firms for each year has been obtained from the Central Companies Directory (DIRCE). The difference in the number of firms between two consecutive years is considered as the net creation of firms for each region. To take into account the size of the region, this variable has been divided by the population, obtaining the new firm creation per inhabitant, as proposed by Audretsch and Keilbach (2008). With regard to the production sectors considered, the European Classification of Economic Activities 2009 uses a two-digit numerical code. The production sectors are classified, in line with DIRCE, as: industry, construction, commerce, transport/storage, tourism and other services. With regard to firm size, in line with DIRCE, firms are grouped into those without employees, those with 1–2 workers, with 3–5 workers, 6–9 workers, 10–19 workers and more than 20 workers.

Furthermore, depending on the degree of technology used, the production sectors can be classified into: technological and non-technological. In this way, the INE considers the following sectors as high and medium-high technology sectors:

- Sectors qualified as high technology: pharmaceutical industry (21), manufacturers of computer, electronic and optical products (26), aeronautical and space construction and machinery (303), motion picture, video and television programme activities, recording of sound and music publishing (59), programming activities and broadcasting of radio and television (60), telecommunications (61), programming, consulting and other activities related to computer science (62), information services (63) and, finally, research and development (72).

- Sectors of medium-high technology: chemical industry (20), manufacturers of weapons and ammunition (254), manufacturers of electrical equipment and equipment (27), manufacturers of machinery and equipment not specified elsewhere (28), manufacturers of motor vehicles, trailers and semi-trailers (29), manufacturers of other transport equipment (30) except shipbuilding (301) and aeronautical and space construction and machinery (303) and manufacturers of instruments and supplies medical and dental (325).

- The other sectors, not considered in the two previous categories, are classified as non-technological sectors.

The indicator of entrepreneurship activity has been obtained from the GEM. The GEM prepares the TEA annually based on a survey of the adult population to obtain the percentage of entrepreneurial activity of the region or country. The data for the 17 regions

cover the period 2003–2016, which means that the sampling period of this research covers the same period and in this way a data panel of 221 observations is specified.

In relation to productivity, as indicated in the previous section, first the elasticity of the labour factor over time and for each of the regions is calculated. Second, the results of the elasticity of the labour factor are applied to the calculation of the growth of the TFP, for each region, through Equation (4). In summary, Table I presents the definitions and sources of the variables used.

Table II shows the descriptive statistics of the variables. On the one hand, Figure 2 shows the average TEA of each region for the period 2003–2016. On the other hand, Figure 3 shows the average growth rates of each region for the following three sub-periods: before the economic and financial crisis (2001–2007), during the crisis period (2008–2012) and recovery period of the economy (2013–2016).

From Figures 2 and 3 it can be concluded that Catalonia is the region with the highest level of entrepreneurship while Asturias is the Autonomous Community with the lowest TEA. When comparing this graph with the average growth of GDP (see Figure 3), it can be seen that regions with lower TEA, such as Asturias, have lower growth rates and also, after the financial crisis, their economy recovers with less intensity compared to regions such as Catalonia or the Balearic Islands which present higher rates of entrepreneurial activity.

Finally, Figure 4 graphically analyses the relationships between the variables that intervene in the model. In general, it shows that those regions which have greater provision in physical capital per head, of human capital, a higher rate of business activity and allocate more resources to R&D are those that have a higher GDP per capita. Therefore, the most innovative regions, with the highest level of entrepreneurship and business dynamism, present higher rates of economic growth.

5. Empirical results

Once the TFP_{it} figures of the Spanish regions are obtained from Equation (4), we estimate the econometric models specified in Section 3, which enables us to analyse the productive efficiency of each region, quantified through the TFP. In the proposed model, the rate of entrepreneurial activity, R&D expenditure per capita, human capital and the creation of new firms per capita are used as explanatory variables of the growth of the TFP of each region.

Subsequently, the sensitivity of the results is analysed taking into account the production sector to which the new company belong, as well as their size and technological level.

F_{it}	Number of firms divided by population, by region and year (Source: DIRCE and INE)
FG_{jit}	Number of firms according to size i divided by population, by region and year (Source: DIRCE and INE)
FS_{jit}	Number of firms according to production sector i divided by population, by region and year (Source: DIRCE and INE)
FT_{ijt}	Number of firms according to level of technology i divided by population, by region and year (Source: DIRCE and INE)
HK_{it}	Human capital stock. Percentage of workers who have completed their studies at different levels of education, by region and year (Source: IVIE)
K_{it}	Stock of physical capital, by region and year (Source: BBVA Foundation–IVIE)
L_{it}	Labour. Number of workers, in thousands, of people by region and year (Source: INE)
$TFP_{it} = \ln A_{it}$	Productive efficiency. Total productivity of factors, by region and year (Source: INE and BBVA Foundation–IVIE. Compiled by authors from Equation (4))
$R\&D_{it}$	Investment in knowledge. R&D expenditure per inhabitant, by region and year (Source: INE)
TEA_{it}	Total entrepreneurial activity, by region and year (Source: GEM)
Y_{it}	Output. Gross domestic product, in thousands of constant euros, by region and year (Source: INE)

Source: Compiled by the authors

Table I.
Definition and sources of the variables used

	Growth TFP		No. of firms		Variation firms		R&D		Human capital		TEA	
	Avge	Deviation	Avge	Deviation	Avge	Deviation	Avge	Deviation	Avge	Deviation	Avge	Deviation
Andalusia	0.017	0.046	486,172	21,987	5,565	15,100	1,424.9	263.1	10.51	0.51	5.97	0.75
Aragon	0.025	0.052	90,207	2,496	583	2,335	298.3	63.8	11.23	0.43	5.45	1.75
Asturias	0.011	0.058	69,240	2,223	201	1,434	184.2	43.3	11.36	0.59	3.72	1.74
Balearic Island	0.019	0.039	88,081	2,829	1,030	3,217	86.7	17.5	10.48	0.45	6.14	1.85
Canary Island	0.016	0.034	133,154	6,079	1,388	4,131	225.6	34.2	10.58	0.47	5.63	1.70
Cantabria	0.015	0.048	38,031	1,389	283	962	108.0	34.9	11.31	0.51	5.43	1.35
Castile and Leon	0.017	0.043	164,369	5,339	763	3,295	553.9	96.5	11.02	0.55	5.08	1.04
Castile La Mancha	0.023	0.057	127,018	6,555	1,471	4,238	207.2	58.4	10.33	0.57	5.84	1.40
Catalonia	0.025	0.047	591,440	22,953	5,434	14,735	2,942.2	444.4	10.98	0.40	6.84	1.18
Valencian Region	0.019	0.052	345,898	16,696	3,470	11,639	996.7	129.2	10.83	0.42	5.61	1.57
Extremadura	0.026	0.048	64,108	3,086	552	2,351	121.9	30.3	10.41	0.44	5.98	1.75
Galicia	0.025	0.053	194,677	6,233	1,805	3,942	486.7	78.8	10.86	0.47	5.10	1.39
Madrid	0.027	0.038	494,182	24,098	8,366	13,149	3,537.8	558.7	12.23	0.57	6.16	1.62
Murcia	0.021	0.055	90,692	4,936	1,233	3,739	226.1	44.4	10.36	0.44	5.65	1.18
Navarre	0.034	0.045	42,034	1,335	382	924	326.5	49.3	11.51	0.40	5.01	1.33
The Basque Country	0.032	0.047	160,269	8,742	−268	4,806	1,211.5	233.5	12.05	0.45	4.35	1.42
Rioja	0.017	0.051	22,698	784	229	536	69.5	17.2	11.12	0.60	5.42	1.75
Total	0.025	0.047	186,704	172,023	2,206	7,312	741.8	989.9	10.95	0.75	5.59	1.58

Source: Compiled by the authors from the INE, DIRCE and IVIE
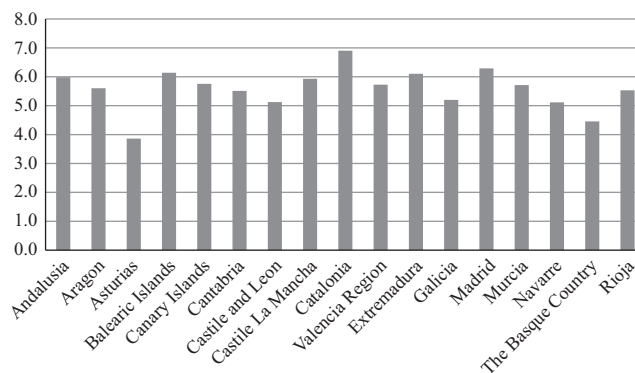
Table II.
Descriptive statistics

Source: Compiled by the authors from the GEM
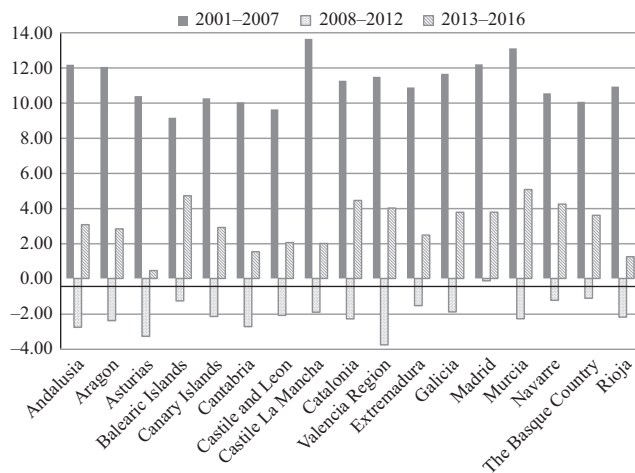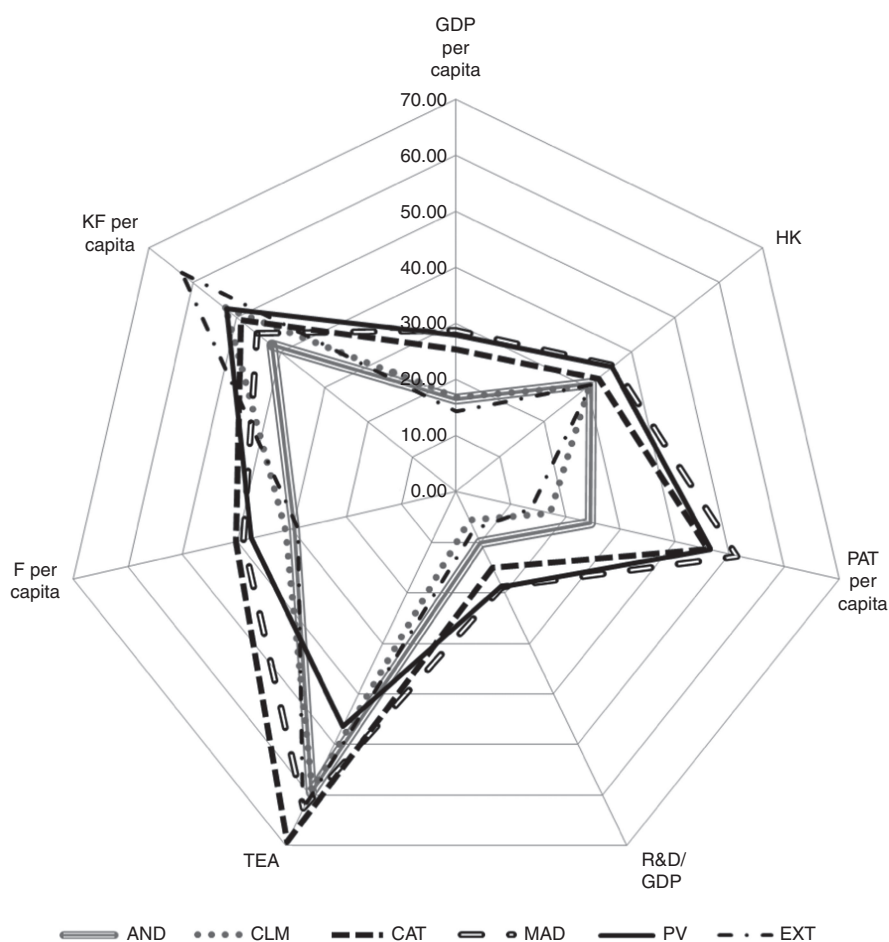
Source: Compiled by the authors from the INE

The model proposed in Equation (5a) is estimated, initially, by OLS as the Hausman endogeneity test, for the variables TEA and the net creation of firms F_{it}, permits verification that both variables can be considered exogenous.

The results obtained from the estimates presented in Table III, Model (1), show that the growth of TFP in each region is driven by entrepreneurship activity, by the promotion of knowledge, measured through increases in R&D expenditure per capita, by increases in human capital endowment and by the creation of new companies. These results show the fulfilment of the *H1–H4* of the previous section, and they endorse the evidence of literature about that the entrepreneurial capital, R&D expenditure and human capital endowment have a positive effect on regional growth.

The estimates obtained from Equation (5a) show that the regional productive efficiency presents inertia. In order to model the trend in productive efficiency, Equation (5b) is formulated. The results of the estimation of this model are presented in Table III, Model (2). From their analysis, it can be deduced that the TFP has a marked dynamism that is captured empirically through its own past value, TFP_{it-1}. In effect, the estimations obtained

Figure 4.
Relationship
between the variables
of the model

Notes: PAT, Patents; AND, Andalusia; CLM, Castile La Mancha; CAT, Catalonia; MAD,
Madrid; PV, The Basque country; EXT, Extremadura. The data used are the average of the sample
Source: Compiled by the authors

(see Table III, Model (2)) confirm that the variable TFP_{it-1} is significant and contributes to improving the goodness of fit, since the model as a whole is more adequate than the model without inertial term, corroborated by the AIC statistic.

Since the sample used in the study configures a data panel, Equation (5c) has been specified and estimated in order to capture the possible existence of fixed effects. The results of the estimation are presented in Table III, Model (3). These results confirm the non-existence of fixed effects since both the individual significance of the dummies variables and the joint significance confirm this. In this way, the one specified by Equation (5b), which includes the inertial term and excludes fixed effects, is considered as the basic model of the study.

When differentiating by the size of the company (see Table IV), it is clear that the effect of the creation of firms on the growth of the TFP increases with the size. These results allow conclude that H5 is satisfied and there are differences in regional economic growth by the size of the new companies. As can be seen, there is a substantial increase in the elasticity of

Variables	Model (1) Coefficients	Model (2) Coefficients	Model (3) Coefficients
Constant	0.002	0.002	–
TEA	0.003**	0.003**	0.003**
R&D	0.491***	0.424***	0.407***
HK	0.054***	0.058***	0.060***
TFP(−1)	–	0.148**	0.120*
F	12.414***	10.527***	11.406***
Dummy region	No	No	Yes
R^2	0.629	0.640	0.652
AIC	−4.238	−4.258	−4.148
No. of observations	221	221	221

Table III.
Results of the model

Notes: *,**,***Significant at 10, 5 and 1 per cent, respectively

Variables	Model (1) Coefficients	Model (2) Coefficients	Model (3) Coefficients	Model (4) Coefficients	Model (5) Coefficients	Model (6) Coefficients
Constant	−0.002	0.000	0.008**	0.012***	0.012***	0.010**
TEA	0.003**	0.004***	0.002*	0.002**	0.002	0.003**
R&D	0.513***	0.541***	0.447**	0.507***	0.535***	0.831***
HK	0.061***	0.052***	0.041**	0.024	0.031*	0.039*
TFP(−1)	0.306***	0.357***	0.138**	0.231***	0.212***	0.006
Without employees	8.085***					
1–2 workers		9.395***				
3–5 workers			72.670***			
6–9 workers				115.740***		
10–19 workers					151.831***	
Over 20 workers						28.564***
R^2	0.573	0.564	0.655	0.643	0.659	0.454
AIC	−4.087	−4.068	−4.302	−4.265	−4.313	−3.842
No. of observations	221	221	221	221	221	221

Table IV.
Results of the
model for different
size of firms

Notes: *,**,***Significant at 10, 5 and 1 per cent, respectively

new firms with three to five workers compared to new companies without employees and smaller firms. This elasticity continues to grow in line with the size of the firms until it is seen to reduce significantly in larger companies, with more than 20 workers. These results highlight that the size of the firms affects the regional productive efficiency and, far from being linear, the effect presents an inverted U form.

By sectors, the industrial sector is the one that generates the greatest growth in productive efficiency of the region (see Table V), followed by the transport sector while the tourism sector has no effect on the productive efficiency. Therefore, those regions more industrialised and with greater presence of the logistics sector will be regions with greater productivity growth. These results evidence the compliance of *H6* so there are differences in the regional economic growth by the productive sector of the new companies.

Finally, from the estimation of Equation (6), where the technological level of the new firms is an explanatory factor, you can see that this variable is statistically significant (see Table VI). In addition, it can be provided that the effect on the growth of the TFP of new companies with a greater level of technology is substantially higher than in the rest.

Variables	Model (1) Coefficients	Model (2) Coefficients	Model (3) Coefficients	Model (4) Coefficients	Model (5) Coefficients	Model (6) Coefficients
Constant	0.007	0.020	0.005	0.004	0.001	−0.008
TEA	0.004***	0.003**	0.0037***	0.003**	0.004***	0.003**
R&D	0.584***	0.528***	0.557***	0.572***	0.577***	0.452***
HK	0.056***	0.059***	0.051***	0.055***	0.053***	0.045***
TFP(−1)	0.315***	0.295***	0.353***	0.315***	0.382***	0.305***
Industry	50.864**					
Construction		7.924***				
Commerce			26.642***			
Transport				44.827**		
Tourism					6.962	
Other services						15.754***
R^2	0.5527	0.559	0.591	0.550	0.543	0.614
AIC	−4.041	−4.055	−4.132	−4.036	−4.019	−4.189
No. of observations	221	221	221	221	221	221

Notes: **,***Significant at 5 and 1 per cent, respectively

Table V.
Results of the model for different productive sector of firms

Variables	Model (1) Coefficients[a]	Model (2) Coefficients
Constant	0.008	0.000
TEA	0.007***	0.002**
R&D	0.076**	0.435***
HK	0.062**	0.056***
TFP(−1)	0.150**	0.147***
Technology	40.731***	
No technology		11.242***
R^2	0.208	0.640
AIC	−3.471	−4.283
No. of observations	221	221

Notes: [a]The variable R&D in this equation is the increase of R&D expenses over GDP. **,***Significant at 5 and 1 per cent, respectively

Table VI.
Results of the model for different technology level of firms

This result shows that *H7* is true. Moreover, this result corroborates the evidence that technology catalyses growth in the productive efficiency of the regions and therefore regional economic growth. This result is similar to the result of Dejardin and Fritsch (2011), to whom the knowledge intensity of new companies explains differences in the effect of new business on regional growth.

6. Conclusions

The aim of this paper is to quantify the divergences in regional growth as a result of sectoral differences, firm size and technological level of new firms generated in the regions. For this, a model is specified and estimated in which the TFP of the regions is a function of the business dynamics of each region and its level of entrepreneurship. Likewise, investment in R&D and human capital are included as control variables.

The results obtained corroborate that both the entrepreneurial activity and the creation of new firms have a positive effect on the productive efficiency of the regions. In addition, the stock of human capital and the promotion of technological innovation act as catalysts that favourably influence economic activity overall and, in particular, productive efficiency. In fact,

the great importance of the promotion of knowledge in economic growth and, in particular, in productive efficiency is confirmed. Likewise, it is noteworthy that the dynamic part of the model shows the existence of a high inertia in the productive efficiency of the regions.

The differences in the promotion of knowledge, in the quality of the workforce, in the entrepreneurial level and in the business fabric of the regions explain the divergences in the growth and economic development of the regions. Regional advances in efficiency require the promotion of knowledge, which depends on the local emphasis on R&D and education of the workforce. However, two regions with the same level of knowledge can continue to present divergences in their level of economic development if the knowledge is implemented in different productive sectors, such that the most industrialised regions with greater presence of sectors with high- and medium-level technology show a greater level of development.

Finally, the size of the companies can also explain the differences in regional growth, such that regions with a greater proportion of firms without employees or with only one or two workers show a lower level of growth than the regions with larger companies.

From the empirical evidence of the model, important implications for economic policy can be extracted. Thus, if an increase in productivity of a region is desired, the relevant authorities should encourage investment in R&D and investment in education to increase the quality of human capital. The promotion of entrepreneurship may also be important in reducing regional differences, but the results will be more effective when the volume of innovation and knowledge incorporated into new businesses is greater. However, it must be borne in mind that business dynamics are also a factor in regional divergence, such that two regions with the same policies for promoting knowledge can present different economic development. Thus, those regions with a business network not conducive to increasing economic productivity should compensate for this with greater encouragement of innovation and education. Likewise, an increase in the size of companies would be desirable, for which the fiscal, administrative and regulatory barriers that set thresholds for the growth of companies could be eliminated. In this sense, the World Bank Report (2015) identifies these obstacles in the regions of Spain and a future research could extend the analysis to the importance of these regulatory differences in explaining the differences in regional economic growth.

Notes

1. In the words of Audretsch (2007), entrepreneurial activity is the missing link between investment in new knowledge and economic growth.

2. As indicated in the previous section, under the neoclassical hypothesis, the growth of the TFP reflects unincorporated technological progress. However, in practice, the growth of TFP is obtained as a residual that also includes improvements in the efficiency of productivity inputs.

3. All the exogenous variables of the equation are in first differences since the endogenous variable is the rate of variation of the TFP.

References

Acs, Z. (2006), "How is entrepreneurship good for economic growth?", *Innovations: Technology, Governance, Globalization*, Vol. 1 No. 1, pp. 97-107.

Acs, Z.J., Audretsch, D.B., Lehmann, E. and Licht, G. (2017), "National systems of innovation", *Journal of Technology Transfer*, Vol. 42 No. 5, pp. 997-1008.

Acs, Z.J., Estrin, S., Mickiewicz, T. and Szerb, L. (2018), "Entrepreneurship, institutional economics, and economic growth: an ecosystem perspective", *Small Business Economics*, Vol. 51 No. 2, pp. 501-514, available at: https://doi.org/10.1007/s11187-018-0013-9

Aghion, P. (2017), "Entrepreneurship and growth: lessons from an intellectual journey", *Small Business Economics*, Vol. 48 No. 1, pp. 9-24.

Aghion, P. and Howitt, P.A. (1992), "Model of growth through creative destruction", *Econometrica*, Vol. 60 No. 2, pp. 323-351.

Aubry, M., Bonnet, J. and Renou-Maissant, P. (2015), "Entrepreneurship and the business cycle: the 'Schumpeter' effect versus the 'refugee' effect – a French appraisal based on regional data", *The Annals of Regional Science*, Vol. 54 No. 1, pp. 23-55.

Audretsch, D.B. (2007), "Entrepreneurship capital and economic growth", *Oxford Review of Economic Policy*, Vol. 23 No. 1, pp. 63-78.

Audretsch, D.B. and Keilbach, M. (2004), "Entrepreneurship capital and economic performance", *Regional Studies*, Vol. 38 No. 8, pp. 949-959.

Audretsch, D.B. and Keilbach, M. (2008), "Resolving the knowledge paradox: knowledge-spillover entrepreneurship and economic growth", *Research Policy*, Vol. 37 No. 10, pp. 1697-1705.

Audretsch, D.B., Keilbach, M. and Lehmann, E.E. (2006), *Entrepreneurship and Economic Growth*, Oxford University Press, New York, NY.

Barro, R.J. (2001), "Human capital and growth", *American Economic Review*, Vol. 91 No. 2, pp. 12-17.

Barro, R.J. and Lee, J.W. (1993), "International comparisons of educational attainment", *Journal of Monetary Economics*, Vol. 32 No. 3, pp. 363-394.

Barro, R.J. and Sala-i-Martin, X. (1995), *Economic Growth*, MIT Press, Cambridge, MA.

Baumol, W.J. (1990), "Entrepreneurship: productive, unproductive and destructive", *Journal of Political Economy*, Vol. 98 No. 5, pp. 893-921.

Baumol, W.J. (1993), "Formal entrepreneurship theory in economics: existence and bounds", *Journal of Business Venturing*, Vol. 8 No. 3, pp. 197-210.

Becker, G.S. (1975), *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*, National Bureau of Economic Research (NBER), ISBN: 0-226-04109-3, New York, NY.

Bjørnskov, C. and Foss, N. (2013), "How strategic entrepreneurship and the institutional context drive economic growth", *Strategic Entrepreneurship Journal*, Vol. 7 No. 1, pp. 50-69.

Bjørnskov, C. and Foss, N.J. (2016), "Institutions, entrepreneurship, and economic growth: what do we know and what do we still need to know?", *Academy of Management Perspectives*, Vol. 30 No. 3, pp. 292-315.

Braunerhjelm, P., Acs, Z.J., Audretsch, D.B. and Carlsson, B. (2010), "The missing link: knowledge diffusion and entrepreneurship in endogenous growth", *Small Business Economics*, Vol. 34 No. 2, pp. 105-125.

Callejón, M. and Segarra, A. (1999), "Business dynamics and efficiency in industries and regions: the case of Spain", *Small Business Economics*, Vol. 13 No. 4, pp. 253-271.

Carree, M.A. and Thurik, R. (2008), "The lag structure of the impact of business ownership on economic performance in OECD countries", *Small Business Economics*, Vol. 30 No. 1, pp. 101-110.

Carree, M.A. and Thurik, R. (2010), "The impact of entrepreneurship on economic growth", in Acs, Z.J. and Audretsch, D.B.D. (Eds), *Handbook of Entrepreneurship Research, International Handbook Series on Entrepreneurship*, Springer, New York, NY, Vol. 5, pp. 557-594, doi: 10.1007/978-1-4419-1191-9.

Cobb, C. and Douglas, P. (1928), "A theory production", *The American Economic Review*, Vol. 18 No. 1, pp. 139-165.

Coe, D.T. and Helpman, E. (1995), "International R&D spillovers", *European Economic Review*, Vol. 38 No. 5, pp. 859-887.

Cuadrado, P. and Moral, E. (2016), "El crecimiento potencial de la economía española", Banco de España, Documentos Ocasionales, No. 1603, Madrid.

Dejardin, M. and Fritsch, M. (2011), "Entrepreneurial dynamics and regional growth", *Small Business Economics*, Vol. 36 No. 4, pp. 419-442.

Erken, H., Donselaar, P. and Thurik, R. (2016), "Total factor productivity and the role of entrepreneurship", *Journal Technology Transfer*, Vol. 43 No. 6, pp. 1493-1521, available at: https://doi.org/10.1007/s10961-016-9504-5

Fritsch, M. (2008), "How does new business formation affect regional development? Introduction to the special issue", *Small Business Economics*, Vol. 30 No. 1, pp. 1-14.

Fritsch, M. and Schroeter, A. (2011), "Why does the effect of new business formation differ across regions", *Small Business Economics*, Vol. 36 No. 4, pp. 383-400.

González-Pernía, J.L. and Peña-Legazkue, I. (2015), "Export-oriented entrepreneurship and regional economic growth", *Small Business Economics*, Vol. 45 No. 3, pp. 505-522.

Griliches, Z. (1998), *R&D and Productivity: the Econometric Evidence*, University of Chicago Press, Chicago, IL.

Griliches, Z. and Lichtenberg, F.R. (1984), "R&D and productivity growth at the industry level: is there still a relationship?", in Griliches, Z. (Ed.), *R&D, Patents, and Productivity*, Chicago University Press and NBER, Chicago, IL, pp. 465-496.

Guellec, D. and Van Pottelsberghe de la Potterie, B.P. (2004), "From R&D to productivity growth: do the institutional settings and the source of funds of R&D matter?", *Oxford Bulletin of Economics and Statistics*, Vol. 66 No. 3, pp. 353-378.

Holtz-Eakin, D. and Kao, C. (2003), "Entrepreneurship and economic growth: the proof is in the productivity", Working Paper No. 50, Center for Policy Research, Syracuse.

Huggins, R. and Thompson, P. (2015), "Entrepreneurship, innovation and regional growth: a network theory", *Small Business Economics*, Vol. 45 No. 1, pp. 103-128.

Jacobs, B., Nahuis, R. and Tang, P.J.G. (2002), "Sectoral productivity growth and R&D spillovers in the Netherlands", *De Economist*, Vol. 150 No. 2, pp. 181-210.

Kato, M. and Honjo, Y. (2015), "Entrepreneurial human capital and the survival of new firms in high- and low-tech sectors", *Journal of Evolutionary Economics*, Vol. 25 No. 5, pp. 925-957.

Koellinger, P.D. and Thurik, A.R. (2012), "Entrepreneurship and the business cycle", *Review of Economics and Statistics*, Vol. 94 No. 4, pp. 1143-1156.

Krugman, P. (1994), *The Age of Diminished Expectations*, The MIT Press, Cambridge, MA.

Lucas, R. (1988), "On the mechanics of economic development", *Journal of Monetary Economics*, Vol. 22 No. 1, pp. 3-42.

Lucas, R. (1993), "Making a miracle", *Econometrica*, Vol. 61 No. 2, pp. 251-272.

Mincer, J. (1984), "Human capital and economic growth", *Economics of Education Review*, Vol. 3 No. 3, pp. 195-205.

OECD (2008), *A Framework for Addressing and Measuring Entrepreneurship*, OECD Publishing, Paris.

Prieger, J.E., Bampoky, C., Blanco, L.R. and Liu, A. (2016), "Economic growth and the optimal level of entrepreneurship", *World Development*, Vol. 82 No. C, pp. 95-109.

Romer, P.M. (1986), "Increasing returns and long-run growth", *The Journal of Political Economy*, Vol. 94 No. 5, pp. 1002-1037.

Schumpeter, J. (1934), *The Theory of Economic Development*, Transaction Publishers, New Brunswick.

Sevilir, M. (2010), "Human capital investment, new firm creation and venture capital", *Journal of Financial Intermediation*, Vol. 19 No. 4, pp. 483-508.

Solow, R.M. (1956), "A contribution to the theory of economic growth", *The Quarterly Journal of Economics*, Vol. 70 No. 1, pp. 65-94.

Sussan, F. and Acs, Z.J. (2017), "The digital entrepreneurial ecosystem", *Small Business Economics*, Vol. 49 No. 1, pp. 55-73.

Thurik, A.R., Carree, M.A., Van Stel, A.J. and Audretsch, D.B. (2008), "Does self-employment reduce unemployment?", *Journal of Business Venturing*, Vol. 23 No. 6, pp. 673-686.

Van Praag, C.M. and Van Stel, A. (2013), "The more business owners, the merrier? The role of tertiary education", *Small Business Economics*, Vol. 41 No. 2, pp. 335-357.

Van Praag, C.M. and Versloot, P. (2007), "What is the value of entrepreneurship?", *Small Business Economics*, Vol. 29 No. 4, pp. 351-382.

Van Stel, A.J., Carree, M.A. and Thurik, A.R. (2005), "The effect of entrepreneurial activity on national economic growth", *Small Business Economics*, Vol. 24 No. 3, pp. 311-321.

Vila, L., Cabrer-Borras, B. and Pavia, J.M. (2015), "On the relationship between knowledge creation and economic performance", *Technological and Economic Development of Economy*, Vol. 21 No. 4, pp. 539-556.

Wennekers, A.R.M. and Thurik, A.R. (1999), "Linking entrepreneurship and economic growth", *Small Business Economics*, Vol. 13 No. 1, pp. 25-55.

World Bank (2015), "Doing business in Spain 2015", Comparing business regulations for domestic firms in 17 autonomous communities, 2 autonomous cities and 5 ports with 188 other countries, Washington, DC.

Corresponding author
Paz Rico can be contacted at: prico@uv.es

INVITED PAPER
Additive manufacturing – digitally changing the global business landscape

Christina Öberg

*Weatherhead Center for International Affairs, Harvard University,
Cambridge, Massachusetts, USA and
The Ratio Institute, Stockholm, Sweden*

Abstract

Purpose – Additive manufacturing, that is, layer-based manufacturing technologies, is thought to change supply chain operations from global to local, while also affecting design processes and product structures. As this transformation happens, a power struggle among various actors relating themselves to additive manufacturing has emerged. The purpose of this paper is to discuss and explain the development of additive manufacturing from a power dependence point of view.

Design/methodology/approach – The paper is based on data collected from a number of seminars hosting a total of 620 industry experts representing 102 companies in the area, and reflecting every step of the supply chain.

Findings – The paper points out how measures to deal and create power imbalances occur also related to indirect parties, and how the disruptive character of the supply chain leads to exercised power.

Originality/value – The power struggle provides new insights into how an emerging technology is realised and the effect of protectionism on such attempts. Specifically related to additive manufacturing, the paper illustrates the business side from various actors' point of view, which adds to technological perspectives on additive manufacturing, as well as studies viewing the supply chain from a bird's-eye perspective.

Keywords Power, 3D printing, Supply chain

Paper type Research paper

Introduction

Additive manufacturing, that is, layer-based technologies for the production of goods (e.g. Achillas *et al.*, 2015), is assumed to change supply chains from global to local (Zeleny, 2012), and disrupt operations of several firms along the supply chain (Hoover and Lee, 2015; Kietzmann *et al.*, 2015; Mohr and Khan, 2015; Oettmeier and Hofmann, 2016; Rogers *et al.*, 2016). While the new technology assumes to change the supply chain to a demand chain (Christopher and Ryals, 2014), implying how customers become the core of home fabrication (Rayna and Striukova, 2016), additive manufacturing also wipes out certain activities – and potentially also actors – along the supply chain (Shams and Öberg, 2017). This makes it interesting to understand those mechanisms that come into play as such disruption occurs.

Along the disruptive characteristics of additive manufacturing operations follows, namely, as demonstrated in this paper, how various actors fight to build, maintain and defend positions in the supply chain. Therefore, while the technology as such would be destined to create disruption (Hoover and Lee, 2015; Kietzmann *et al.*, 2015; Mohr and Khan, 2015), its various actors create power struggles along the supply chain, increasing uncertainties and complicating the introduction of additive manufacturing. This is what this

paper sets to highlight. The purpose of the paper is to discuss and explain the development of additive manufacturing from a power dependence point of view.

Power dependence research reaches back to Emerson's (1962) seminal work on how parties need to depend equally on one another, or they would find solutions to uneven such imbalances. It thereby puts focus not only on power issues but also on how parties try to solve disadvantages of dependencies (Casciaro and Piskorski, 2005). This is in this paper translated to how various supply chain parties create strategies to uneven dependencies, while also potentially trying to create power advantages for themselves. How they go about to do so, along with the reactive steps taken by other parties, is extracted from descriptions by representatives engaging in additive manufacturing, and categorised to shape theoretical understandings for power struggles in a disruptive supply chain. The objective of the paper is to enhance knowledge on individual actors' whereabouts as disruption occurs in a supply chain by specifically highlighting the case of additive manufacturing. The relevance of this study relates to how additive manufacturing constructs a contemporary change of working methods in industry (Jiang *et al.*, 2017), while the observed struggle along supply chain actors indicates a topic not covered in previous research on disruption (Christensen, 2006, Riemer *et al.*, 2017; Kask and Öberg, 2019), yet important as it shapes the conditions of actors during disruption.

The paper contributes to previous research in the following ways: most previous research on additive manufacturing focusses on the technological side of it, while the business side has largely concerned optimisations in production (e.g. Gardan and Schneider, 2015; Paul and Anand, 2015; Zhang *et al.*, 2017). The descriptions of supply chains related to additive manufacturing tend to focus on home fabrication (Rayna and Striukova, 2016) and thereby omit how additive manufacturing may disrupt, for instance, logistics and prototyping. Those studies acknowledging such changes quite factually describe the supply chain changes from a bird's-eye view (Christopher and Ryals, 2014; Oettmeier and Hofmann, 2016, 2017; Rayna and Striukova, 2016), and do not take into account individual parties' perspectives. The power dependence lens is thereby unique to this type of research, while it links to disruption in its creation of uncertainty and act-to-survive orientations. In the broader perspective of theorising about disruption (Christensen, 2006), disruption and power struggles rarely concern supply chains, but focus on industries and individual (dyadic) relationships, respectively. The linking of the empirical phenomenon of additive manufacturing and the theoretical lens of power dependence thereby adds to previous knowledge and does so through the theorising of proactive and reactive balancing and unbalancing attempts of various actors along a disruptive supply chain.

The remainder of the paper is structured as follows: after this introduction follows a brief overview of previous research on additive manufacturing related to management and business. The theoretical lens of power dependence is then introduced. The research design is presented thereafter. The empirical part of this paper is collected through a number of seminars focussing on additive manufacturing and including 620 industry representatives of various companies engaging with additive manufacturing along the supply chain (mining firms, steel producers, logistics firms, car manufacturers, package manufacturers, etc.). The empirics from these seminars are presented after the research method and outlined to follow the supply chain and struggles among various parties. The analysis is then presented, followed by conclusions including theoretical contributions, managerial implications and ideas for further research.

Theory
This section first provides a brief overview of previous business research on additive manufacturing to narrow the scope of this paper, to then turn to present the theoretical lens of power dependence.

Theoretical background: previous business research on additive manufacturing
As implied in the Introduction, most studies on additive manufacturing (or its synonymous term, 3D printing) concern the technological side: the layer-based technique and how to advance its functionality. In the business and management area, as an emerging field of study, the literature is dominated by research on product optimisation in companies (Öberg *et al.*, 2017, 2018). In that vein of research, additive manufacturing is compared with traditional manufacturing methods to conclude how and when it is most useful (e.g. Gardan and Schneider, 2015; Paul and Anand, 2015; Aboutaleb *et al.*, 2017). While considering business aspects, that research focusses on the internal conditions of a company.

Enlarging the perspective, some few recent studies have concerned themselves with the change that additive manufacturing would bring about for the supply chain. Centring around the supply chain changes, a pull effect from customers is expected, launching the idea of demand chains (Christopher and Ryals, 2014), which is also the centre of much research: home fabrication of customers (Bogers *et al.*, 2016; Rayna and Striukova, 2016; Wang *et al.*, 2016). Rayna and Striukova (2016) described how home-based production will disrupt supply chains, while also pointing to the role of prototyping and tooling, and as stated by Oettmeier and Hofmann (2016, 2017), Sasson and Johnson (2016) and Rogers *et al.* (2016), additive manufacturing could expect to show several supply chain consequences, not only related to the end customer. Oettmeier and Hofmann (2017) described how supply chain consequences impact decisions of firms to adapt additive manufacturing, while more closely studying such supply chain effects in Oettmeier and Hofmann (2016). Li *et al.* (2017) specifically pointed at the effects for supply chains if spare parts are 3D printed, essentially meaning that they become internalised by the manufacturing firm. In line with Li *et al.* (2017), most other effects seem to suggest how make-or-buy decisions are increasingly a matter of making rather than buying as additive manufacturing is introduced, which indeed indicates a core point of this paper: that additive manufacturing may wipe out actors along the supply chain.

But while previous research thus acknowledges changes also beyond home fabrication and localisation of production, it does not recognise how various parties may fight each other off and how the disruptive stage of additive manufacturing (cf. Hoover and Lee, 2015; Kietzmann *et al.*, 2015; Mohr and Khan, 2015) causes power struggles along the supply chain, which is thus the focus of this paper based on those empirical observations inspiring the writing of it.

Theoretical framing: power dependence
Disruption denotes how new solutions replace current ways of acting (Christensen, 1997, 2006; Adner, 2002; Gilbert and Bower, 2002; Danneels, 2004), based on how customers adapt to the new solutions (Adner, 2002). Such adaptation occurs as the consequence of how the new solutions are simpler, reduce costs, increase reliability and are more convenient (Adner, 2002). Disruption, often described as a sector-level change, generally includes how existing companies are replaced by new ones (Cooper and Schendel, 1976; Henderson and Clark, 1990; Utterback, 1994), also implying how the new solutions – often a technology – arise from outside the industry sector. A request for new competences along with within-sector inertia explains these circumstances (Foster, 1986; Moreau, 2013).

While the literature has focussed on how new technologies may bring sectors apart, less is known about the behaviours of those seeing their industries disrupting. The uncertainty is self-evident at this point, which again creates a link to selfish, survival-focussed behaviour (cf. Eyuboglu and Buja, 2007) and for those currently integrating with the technology challenged by disruption, attempts to create positions also following the disruptive stage.

Among any interacting parties, there would be dependencies of resources and competences causing the power of parties upon which someone is dependent (Emerson, 1962). The dependency follows from how companies become specialised in various areas of knowledge and production, which is also seen in the supply chain idea based on core

competences and make-or-buy decisions (Harland, 1996; Nordin *et al.*, 2010). Power dependence denotes the influencing forces where one party can (partly) control and influence another party, as the other party needs those resources or competences held by the first party (Casciaro and Piskorski, 2005). The power may though be mutual, meaning that both parties have influencing power over one another, and if in balance, their dependence on each other is equal (as is their power). Again, an imbalance would imply that someone depends more on the other party than the reverse. The ideas of power dependence (Emerson, 1962) lay the ground for resource dependence (Pfeffer and Salancik, 1978), emphasising how dependences occur as the result of resource specialisations, but also implying that parties strive for balance in their interactions.

While Emerson's (1962) work indeed discusses how balance can be obtained, it does not set to focus on that parties really want to achieve balance. Rather, they may well strive to have power advantages over counterparts (cf. Casciaro and Piskorski, 2005; Drees and Huegens, 2013) and connections between parties may well remain imbalanced (Kumar, 1996; Hingley, 2005). Any strive for power advantages, or aims to deal with power disadvantages or dependency, would cause dynamics in the connections between firms. More precisely, those being highly dependent in disadvantageous power connections would try to minimise the role played by the other party or strive to strengthen their own situation. Emerson (1962) presented four strategies to deal with imbalances: decreased engagement or withdrawal by the more dependent party; changed structures on network levels through diffusion of dependency into new relationships; the dependent party achieving status recognition; and the dependent party forming coalitions to on the group level meet the more powerful party. Similar strategies would also be used by a party trying to strengthen its power even further.

Most research adopting a power or resource dependence lens has focussed on connections between two parties. A supply chain constructs a flow including multiple parties (MacCarthy *et al.*, 2016) and thus describes structures where multiple parties contest for power advantages or attempt to even powers. This creates a dynamic that occurs in parallel among different supply chain parties. Theoretically, this is the issue that this paper tackles using additive manufacturing as the empirical phenomenon under study. Disruption, as introduced in this section, would be the antecedent causing uncertainties, potentially changing power structures, but also leading to selfish behaviours as a result of perceived challenges and threats to current positions and parties in the supply chain, while behaviours of actors would create or attempt to even imbalances created. Figure 1 summarises the relations of concepts as an analytical tool.

Figure 1 points at how additive manufacturing could be regarded as the technology that disrupts current structures, while power imbalances and attempts to regain balance would follow from those changes and uncertainties created among the actors in the supply chain as they see their current positions challenged by the new technology and by how other parties adapt to it.

Research design

The inspiration for this paper was a number of seminars with the author as one of those arranging the seminars, and with the broad focus on the seminars being the
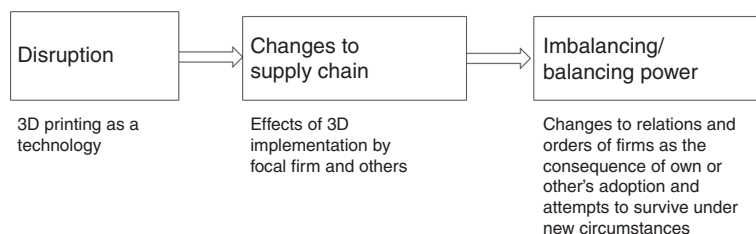

Figure 1.
Analytical tool
(order of argument)

business side of additive manufacturing. These seminars also constituted the main source of data collection.

Data collection
The seminars included how the author and two co-researchers presented some early thoughts on additive manufacturing and changes to businesses, how company representatives described steps taken by their firms, ideas on further developments in relation to additive manufacturing and how the audience debated their ideas, questioned current propositions and helped to create understandings for the development. As such, the research design resembles an action research approach (Whyte, 1995; Greenwood and Levin, 1998; Reason and McArdle, 2004), which suggests being suitable when the phenomenon studied is in a state of flux. Studying additive manufacturing at this stage was also fundamental for capturing the ongoing power struggles among parties, which would not be as easily captured in retrospect (Huber and Power, 1985).

A total of 620 individuals participated in the seminars, representing 102 different companies. The companies included sub-suppliers to manufacturing companies, raw material refining companies, large and small manufacturing firms, consultancy agencies and representatives of companies manufacturing 3D printers with the aim to thereby cover the entirety of a supply chain. They represented different industries, such as car manufacturing, steel production, mining and the packaging industry, while being there to discuss an interest for metal-based additive manufacturing (cf. Ren *et al.*, 2008; Asnafi *et al.*, 2018). Covering various positions of the supply chain allowed for the capturing of the different firms' adoption and consequences, while representatives from different industries enabled comparative analyses (Eisenhardt, 1989). The seminars were held at different locations in Sweden. The seminars and estimated number of participants are listed in Table I, as well as companies having representatives there for talks.

Participants held such roles as CEO, researcher, production manager and similar in the companies they represented. In addition to the talks and informal discussions, various representatives were also approached individually for follow-up questions and deepened discussions (Sarantakos, 1998). These discussions included descriptions about what the companies were to do next, challenges in connection with other parties and whether and how present ideas challenged current structures. Several company visits were also made to participating companies.

Data analysis
While the main scope of the data collection was not that of power struggles, this emerged as a relevant perspective based on the descriptions at the seminars. In the analysis of data, notes from the seminars were first sorted to represent various companies along the

Date	Location	Participating talks	No. of participants (approx)
30 May 2017	Örebro	Uddeholm, Region Örebro	110
8 June 2017	Gothenburg	Volvo Cars, Lasertech, Chalmers Tekniska Högskola	80
14 June 2017	Östersund	AIM Sweden, Handelskammaren Jämtland, Mittuniversitetet	80
29 August 2017	Olofström	Techtank, Olofströms kommun	110
14 September 2017	Luleå	Swerea, IUC, Luleå Tekniska Högskola	110
20 September 2017	Värnamo	Acrom Formservice, Campus Värnamo, MetPrint, Jönköpings Tekniska Högskola	110
25 September 2017	Lund	Tetra Pak, AlfaLaval, Lunds Tekniska Högskola	20

Table I.
Seminars

supply chain. If companies in the same position acted in different ways, these were all included for the particular position. Descriptions were thereafter produced based on the notes and targeting current developments for the particular supply chain position, along with the parties' view on the development at other places in the supply chain (Pratt, 2009). This latter aspect was particularly important since the power dependence could best be recognised and understood in comments on other parties (Casciaro and Piskorski, 2005), their ways to behave and proactive and reactive steps to meet challenges caused by others. Furthermore, the descriptions allowed for the capturing of whether and how the parties experienced any power imbalances, let alone tried to create them.

The activities of firms were classified, using iterative coding of empirical instances (Eisenhardt and Graebner, 2007; Pratt, 2009), to see how they behaved to create power balances or imbalances. The empirical codes were thereafter categorised as proactive or reactive, and as attempts to regain balance or create power advantages, meaning that in the second round of coding (Pratt, 2009), empirical notes were theoretically categorised with the means to better understand the power struggles of firms. The four codes (proactive, reactive, regain balance and create power advantage) were compared among firms based on their various supply chain positions to grasp the overall understanding of power dependencies as the consequence of additive manufacturing. Meanwhile, the empirical codes of activities were synthesised to create understandings for how power was created among the parties. This was done in several steps of reduction of codes to theorise these aspects.

In the last step of the analysis, findings were compared with previous research on power dependencies and parties' behaviours (Emerson, 1962; Pfeffer and Salancik, 1978; Casciaro and Piskorski, 2005), while also linked to the supply chain order and disruptive character caused by the additive manufacturing technology. This helped to narrow down the research gap and define the more exact theoretical contribution while also link it to the empirical setting.

Empirics

In the following paragraphs, the findings are described per position following the supply chain downstream. For each type of actor, they are briefly introduced, followed by how they handled the introduction of additive manufacturing and the power dependence consequences of this way of acting.

Manufacturers of 3D printers

Firms manufacturing 3D printers are dominated by some few international companies, mostly with a European foundation, and with two of the larger companies being owned by General Electric. Most of the companies have been founded as separate start-ups for the sake of manufacturing the printers. These companies, being launched or established to address the need for 3D printers, obviously try to drive this development, while also creating advantages for themselves.

As a means to create market share and uphold revenues, the companies have ensured that their printers only work with a specific type of powder. This has created niches in the 3D printing markets and means that manufacturers (and the sub-suppliers, see below) need to buy specific, often quite expensive powder once they have acquired a printer. This way of handling the market allows for power positions relative companies buying printers and powder, while it would also mean that the further spread of use is actually constrained. Prices of printers are kept at a high level as a consequence, while the individual printer manufacturers create silos in the market directing their printers at certain customers and thereby minimising competition among the manufacturers of printers.

Raw material producers
The raw material for additive manufacturing in metals consists of fine-grained powder, or the printers use metal threads to build surfaces. In the production, the raw material is heated to melt as the layers or threads are built by the printer.

One of the raw material producers in the study focusses on various types of metals. The company decided to add powder to its product portfolio, which is also how those other producers of the raw material seem to have entered this production niche: they are presently producing steel or metal powder for other uses. The reason for entering into the production of 3D powder (or threads) is to meet competition based on how the demand for metals currently sold by the companies may be challenged by additive manufacturing requiring powder. The powder is then niched to advanced, complex applications, thus also potentially constructing an additional niche of metal solutions to be offered to manufacturing companies; that is, 3D powder would either replace some current raw materials of the firms or add to their current product portfolio.

As a means to meet the lock-in effects caused by manufacturers of 3D printers, the studied raw material producer has decided that its powder would work in any printer, thus trying to decrease the dependence on 3D printer manufacturers not only for itself but also for sub-suppliers and manufacturers. Again, this means challenging the power advantage created by the manufacturers of 3D printers, while also thereby potentially increasing the scope of the market for the raw material producers. Here though, some other raw material producers rather work to meet the requirements of a specific manufacturer of 3D printers, constructing also a struggle among the raw material producers for the specialising or not of powders.

Sub-suppliers specialising in additive manufacturing
Sub-suppliers in the supply chain would generally be characterised as any (often small-sized) company manufacturing parts or pre-producing materials for firms assembling them into sellable products. These latter companies are typically large-scale production units, surrounded by the sub-supplying specialists on parts and materials to be used in their final products.

If home production, or increased in-housing of production, was to follow as manufacturers (and customers) increasingly adhere to additive manufacturing, these sub-suppliers could well be out of business. As a means to break against this trend, some sub-suppliers have decided to offer additive manufacturing as part of their production methods. This means that the products – or components – are still manufactured by the sub-suppliers (and thereby transported to the manufacturing firms). This again means that the sub-suppliers attempt to build a position of competence and production capacity to maintain their position in the supply chain.

The high price of 3D printers means that for a piece of machinery to be profitable, it needs to be run more or less continuously, and this is the niche that the sub-suppliers currently try to cover: how it would be too expensive for manufacturing firms to own their own 3D printers. Various sub-suppliers collaborate to develop their business proposition, while the companies often work closely with universities (that may own their printers) as testbeds for production methods. Thus, the sub-suppliers attempt to create some advantages over their customers – the manufacturing firms – based on competence creation and more efficient use of printers. Several of them, however, work against time and the potential price drop on printers in this regard.

Logistics firms
Logistics firms are any company specialised in the transportation of other parties' goods and end products. They would traditionally operate between any position in the supply

chain, transporting raw materials (and machinery) from those mining or producing it to those using it and again delivering goods from manufacturing firms (and among these) to retailers and consumers. As such, logistics firms are challenged by two developments: the more general trend of retailers taking on their own transportation routes; and the risks of home fabrication, and internalisation of production, decreasing the number, value and length of transports.

Being specialised in transportation, additive manufacturing would at its core of home productions cause a considerable threat. As one logistics firm plans, it wants to create a position of a fab lab, a 3D printing house that prints products for end customers. This would mean placing fab labs or shops close to end customers or airports so as to minimise transportation while maximising printer use. Sketches would be wired to these labs and printed for customers on demand to advocate the customisation trend enabled through the printing. Again, and similar to the sub-suppliers, the logistics firms would take advantage of printers being too expensive to become everyone's property, but then especially relating this to home fabrication and close-to-customer printing. In this regard, the logistics firms try to defend their current position through creating a partly new one, but then also mostly adhering to the trend of home fabrication and less so to the internalisation of production by manufacturing firms.

Manufacturing firms
Manufacturing firms, like sub-suppliers, engage in the production of products. The difference between the parties would largely be that the sub-suppliers do so while mainly relying on designs from the manufacturing firms, and furthermore, the sub-suppliers focus on components rather than ready-to-use products. Traditionally, the manufacturing firms would be large-scale production sites, while the sub-suppliers are small- or middle-sized companies highly dependent on the manufacturing firms as customers.

For manufacturing firms, additive manufacturing would allow for the change of product design and also the replacement of solid materials for more advanced surfaces. While being so, the manufacturing firms have somewhat lagged behind in that regard and focussed more on the production technique than the design of products. Several of these firms have also had difficulties to make additive manufacturing a management concern, and discussions have largely been suppressed to production management levels.

One of the manufacturing companies in the study has decided to take up the production of spare parts for its own machinery by 3D printing such parts. Rather than buying spare parts from suppliers and having them shipped to the production sites, this would mean that each production site would have CAD drawings for the spare parts and produce them locally on demand. Some other manufacturing firms have focussed on prototyping, meaning that they use printers to test early ideas of innovation as real products, and yet some other firms have started using additive manufacturing for tool production.

This development challenges any supplier to the manufacturing firm, be it a supplier of spare parts or a sub-supplier manufacturing tools based on CAD files from the manufacturing firm. Again, this creates a power advantage over the sub-suppliers, let alone the logistics firms, while the power advantage would be challenged by the expensive printers and powder, meaning that the development is restricted for monetary reasons. At the current stage, the manufacturing firms could be regarded as holding an advantageous position when it comes to the introduction of additive manufacturing. Them being slow in adopting the technology and the high price of printers has, however, created several of those loops that firms at other supply chain positions try to use to create or regain some power.

Customers
Additive manufacturing is said to be customer driven, or allow for increased customisation, shorter series of production, and indeed that the customer (consumer)

manufactures the products himself/herself. While the latter may be the case for additive manufacturing in plastic materials, it is quite a long reach before customers would do the same for metal-based products.

In the shorter run, the customers rather only become more active parties for customisation purposes, influencing what is manufactured and when. The dependence on others to manufacture these products remains high, while the influence of customer specificities creates disruption in production techniques among manufacturing firms. Again, customers create a pull effect for additive manufacturing but are constrained in their requirements based on the lack of knowledge on what is really possible to manufacture and how. In the longer-term perspective, and given more dispersed knowledge and a decreased cost of printers – as seen for plastics – customers may well take on activities currently performed by the manufacturing firms, while also decrease or even erase the need for fab labs.

Societal support
The social support for additive manufacturing consists of how universities and municipality representatives sponsor and bring knowledge to the regional development and adaptation of the technology. There has been a tendency for such organisations to work with sub-suppliers – representing ownership interest in two of the three sub-suppliers focussing on additive manufacturing in Sweden – while sponsoring the 3D printers at the last sub-supplier. The organisations, in return, use these sub-suppliers to run tests of various kinds, also potentially contributing to the knowledge of the sub-suppliers. Their role, thereby, is basically to foster the adaptation to additive manufacturing, while their way of acting creates power advantages for the sub-suppliers. While this may be seen as initiatives to the help local sub-suppliers and extending general knowledge on additive manufacturing, these parties thus also play a part in constructing imbalances along the supply chain.

Analysis
Table II summarises the various parties described above, and in dimensions of proactive and reactive activities, and aims to create a power imbalance or even current imbalances (cf. Emerson, 1962; Casciaro and Piskorski, 2005). This way of analysing the data – proactive, reactive, imbalance and regain balance – followed from the theoretical perspective of power dependence (imbalance and regain balance) and the more empirical idea of parties either doing so in response to others (reactive) or so as to achieve their own advantages (proactive) at a stage of disruption.

Looking first at the table from the various actors' point of view, it seems quite evident that there are those whose position would be strengthened (or at least not harmed) by additive manufacturing: The manufacturers of 3D printers would benefit from a demand for printers, manufacturing firms could increasingly internalise production and customers would both be able to push for increased customisation and take on more production through home fabrication. This again indicates some initial things: disruption, albeit as a technology with several adopters along a supply chain, would not cause as severe an effect for all parties along the supply chain. And, although most research on disruption implies that disruption replaces current actors with new ones (Christensen, 1997, 2006; Adner, 2002; Gilbert and Bower, 2002; Danneels, 2004), some parties may actually persist and drive – or be able to drive – the further development of the new technology.

But while it could be assumed that those parties – the manufacturers of printers, the manufacturing firms and customers – would be those proactively gaining power as the supply chain disrupts, the empirical data for this paper tell a different story: both those potentially benefitting from and those being challenged by additive manufacturing acted proactively to create power advantages for themselves. Sub-suppliers acted to build a position of competence, for instance, while raw material producers took on the manufacturing of powder.

Party	Activities related to additive manufacturing	Proactive	Reactive	Regain balance/create imbalance
Manufacturers of 3D printers	Manufacture printers	Creating silos of lock-in effects through requesting specific powder for each printer		Trying to rule the market through specific powders (create imbalance)
Raw material producers	Complement product portfolio with powder	Powder to avoid future competition	Powder that can be used in various printers	Manufacturing of powder to meet competition (regain) Powder not for specific printers to decrease such dependence between manufacturers of printers and sub-suppliers/ manufacturers (regain)
Sub-suppliers	Manufacture components for manufacturing firms; creating around-the-clock production	Utilisation of printers	Avoid risk of being outperformed by manufacturing firms' home fabrication	Avoid risk of manufacturing firms (customers) doing the production themselves (regain balance, partially)
Logistics firms	Create fab labs for local printing		Risk that less transportation is needed	Balance decreased use of transport (regain)
Manufacturing firms	Produce prototypes, spare parts, etc.	Home fabrication of spare parts. Changed design or products. Increased customisation		Increase home fabrication (create imbalance towards sub-suppliers; regain from customers)
Customers	Potentially manufacture goods themselves. Demand of customisation	Demand for customisation	Home fabrication	Home fabrication and customisation (create imbalance)
Societal support	Support and test technologies	Trying to advance additive manufacturing use		Sponsor sub-suppliers with printers (no attempt to create or regain power, but affects the balance in the supply chain)

Table II.
Summary of findings

The difference, however, relates to reactive behaviours, where, again as seen in Table II, those being challenged by additive manufacturing are also those to act reactively to it. Therefore, two mechanisms occur more or less simultaneously: a proactive aim to reposition the firm based on new activities, and a reactive aim to deal with those issues caused by how parties at other positions in the supply chain adapt to additive manufacturing. To exemplify, raw material producers acted reactively towards manufacturers of printers through starting to offer powder usable in various types of printers, while they also acted proactively to create a niche of manufacturing powder. Sub-suppliers, in a similar manner, acted reactively to avoid being wiped out by manufacturing firms' internalisation of production, while proactively attempting to build a knowledge hub and provide efficient use of printers.

As for the regaining of power or attempts to create imbalance (Emerson, 1962; Casciaro and Piskorski, 2005), there seems to be an upstream pressure to create imbalance, and a downstream one to regain power. To exemplify, manufacturing firms tried to create a power advantage to sub-suppliers, while regaining power from customers. Meanwhile, there is the link between regaining power and acting reactively and creating imbalance and acting proactively, though influenced by such upstream and downstream pressures. The pairs of

imbalances and proactivity and balancing and reactivity seem quite natural and are in line with how Casciaro and Piskorski (2005) argued that companies do not only attempt to regain balance but also actually create imbalance. However, reactive steps may thus aim to create imbalance and links to the disruptive characteristics of the supply chain as well as the upstream/downstream focus on power.

Compared to previous research on power dependence, this paper highlights how the changes to power dependencies arose from the "outside", being driven by the disruption caused by additive manufacturing, but even more so important: how power balancing/ unbalancing occurs beyond dyadic connections. More precisely, companies' proactive and reactive whereabouts focussed on balancing/unbalancing connections also to parties that the company only had indirect relations with. To exemplify, raw material producers attempted to balance the power imbalance created by 3D printer producers and did so with the attempt to create sounder conditions for sub-suppliers and manufacturers. Logistics firms tried to balance the general imbalance created by manufacturers and, in the end, customers, about the decreased demand for transportation.

Previous literature has either argued dependence from a power point of view or linked it to resources (Pfeffer and Salancik, 1978). Viewing such resources broadly and including knowledge and competences (Penrose, 1959; Eisenhardt and Martin, 2000) in the definition of resources, this present paper seems to suggest that the resources are a means to create the power advantages: the sub-suppliers use knowledge to regain a power balance with manufacturing firms, while raw material producers reconfigure current resources to be able to produce powder. While this suggests being the case, it is thus not the resources as such that create the dependencies. This, again, is based on the state of flux caused by the ongoing disruption. At the current stage, the various companies act quite independently from one another from a resource point of view. This is so since the rules of the game, manifested through standards and dominant design, are yet to be decided, as seen in, for instance, the different types of powder and printers for various such variants currently being launched. Again, this indicates how resources are reactive, while power positioning may be proactive along the supply chain.

Conclusions

This paper discusses and explains the development of additive manufacturing from a power dependence point of view. The theoretical framing was selected based on how the empirical material for this paper proved to include many controversies, uncertainties and parties aiming to build or (re)gain positions along the disrupted supply chain.

The paper points at how power dependence is not dyadic, but how the unbalancing and balancing of power may occur *vis-à-vis* parties that the company is only indirectly connected to. What is more, and in addition to such works pursued by Casciaro and Piskorski (2005) and Emerson (1962), an external force or disruptive stage may lead to how previous balances become imbalanced, and also to how parties aim to exercise powers to an increased extent when the supply chain disrupts. In addition, the uncertainties created suggest that parties attempt to create imbalances and advantages to a higher extent than before. This would be linked to increased selfishness in decisions among parties and struggles to stay alive among the companies, and is specifically noted when proactive attempts are made to create imbalances, yet also when reactive activities aim to lead to such imbalances. Figure 2 summarises the various dependencies as outlined in the empirical part of the paper.

Theoretical implications

The paper's foremost theoretical contribution consists of how it discusses power dependence in a supply chain setting. This extends previous knowledge mostly focussing

on dependencies between any two parties only (Emerson, 1962; Pfeffer and Salancik, 1978; Casciaro and Piskorski, 2005; Hillman *et al.*, 2009), and it introduces the idea of indirect and direct dependence by pointing at how one firm may act to balance or imbalance powers *vis-à-vis* a party only indirectly connected to the firm. Furthermore, the paper notes how imbalance or balancing may occur towards a set of parties, not just a single actor.

The link between disruption and changes to power dependencies is denoted in the paper and indicates foremost how the disruption causes changes in the power dependencies, but furthermore: how it awakes behaviours of exercising power and selfishness caused by uncertainties and fights for survival.

Empirically, the paper makes a contribution to research on additive manufacturing, and specifically to business studies on additive manufacturing. While the interest for supply chain disruption has lately emerged related to the technology, it is often with a bird's-eye perspective on the supply chain and more rarely captures changes and how individual parties drive and respond to these.

Managerial implications
For managers, and regardless of which position their companies hold in the supply chain, this paper points at the importance to recognise activities pursued not only by direct business parties but also by all parties along the supply chain. This introduces the notion of carefully "picturing" (Öberg, 2012) the activities of others in the supply chain and keeping track of their current whereabouts. Scenario analyses and other tools would help to understand the consequences of other parties' activities.

When it comes to additive manufacturing and looking at positions that would be especially difficult as the consequence of additive manufacturing, sub-suppliers and logistics firms would need to really consider their long-term development, whether to try to build positions on their own or ally closer to manufacturing firms, for instance. Questions to address would include what core activities additive manufacturing consists of, how this would change current ways to operate, risks for changes related to make-or-buy decisions as well as resource needs and what core activities would also be needed in the future.

Limitations and ideas for future research
The empirical part of this paper evolved from the seminars, capturing real-time problems and scenarios for the future for various parties along the supply chain. Still, those represented did so in a specific country setting – Sweden – and while they represented different industries, the scope of the empirics would still be constrained to those specific industries and the geographical setting they acted in. For further research, it would, therefore, be interesting to explore similar phenomena in other countries and industries. This would help to validate those results presented regarding proactive and reactive power balances and imbalances. Following companies over time would in addition to this help to
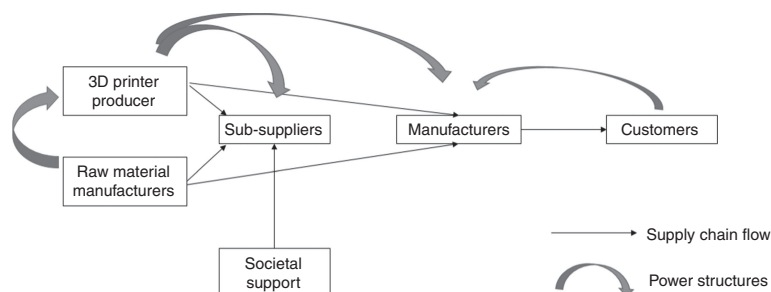

Figure 2.
Power dependencies
along the
supply chain

see short- and long-term effects and what happens as dominant designs and ways of acting emerge, for additive manufacturing, but also with those power struggles currently marking the disruptive stage.

The idea of disruption causing uncertainty and power struggles would be worth investigating in other settings, and additive manufacturing would be interesting to study related to different materials (plastics, metals, etc.) and compare different settings.

References

Aboutaleb, A.M., Bian, L.K., Elwany, A., Shamsaei, N., Thompson, S.M. and Tapia, G. (2017), "Accelerated process optimization for laser-based additive manufacturing by leveraging similar prior studies", *IIIE Transactions*, Vol. 49 No. 1, pp. 31-44.

Achillas, C., Aidonis, D., Iakovou, E., Thymianidis, M. and Tzetzis, D. (2015), "A methodological framework for the inclusion of modern additive manufacturing into the production portfolio of a focused factory", *Journal of Manufacturing Systems*, Vol. 37 No. 1, pp. 328-339.

Adner, R. (2002), "When are technologies disruptive: a demand-based view of the emergence of competition", *Strategic Management Journal*, Vol. 23 No. 8, pp. 667-688.

Asnafi, N., Shams, T., Aspenberg, D. and Öberg, C. (2018), "3D metal printing from an industrial perspective – product design, production and business models", MAMC, Vienna.

Bogers, M., Hadar, R. and Bilberg, A. (2016), "Additive manufacturing for consumer-centric business models: implications for supply chains in consumer goods manufacturing", *Technological Forecasting and Social Change*, Vol. 102 No. 1, pp. 225-239.

Casciaro, T. and Piskorski, M.J. (2005), "Power imbalance, mutual dependence, and constraint absorption: a closer look at resource dependence theory", *Administrative Science Quarterly*, Vol. 50 No. 2, pp. 167-199.

Christensen, C.M. (1997), *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*, Harvard Business School Press, New York, NY.

Christensen, C.M. (2006), "The ongoing process of building a theory of disruption", *Journal of Product Innovation Management*, Vol. 23 No. 1, pp. 39-55.

Christopher, M. and Ryals, L.J. (2014), "The supply chain becomes the demand chain", *Journal of Business Logistics*, Vol. 35 No. 1, pp. 29-35.

Cooper, A.C. and Schendel, D. (1976), "Strategic responses to technological threats", *Business Horizons*, Vol. 19 No. 1, pp. 61-69.

Danneels, E. (2004), "Disruptive technology reconsidered: a critique and research agenda", *Journal of Product Innovation Management*, Vol. 21 No. 4, pp. 246-258.

Drees, J.M. and Huegens, P.P.M.A.R. (2013), "Synthesizing and extending resource dependence theory: a meta-analysis", *Journal of Management*, Vol. 39 No. 6, pp. 1666-1698.

Eisenhardt, K.M. (1989), "Building theories from case study research", *Academy of Management Review*, Vol. 14 No. 4, pp. 532-550.

Eisenhardt, K.M. and Graebner, M.E. (2007), "Theory building from cases: opportunities and challenges", *Academy of Management Journal*, Vol. 50 No. 1, pp. 25-32.

Eisenhardt, K.M. and Martin, J.A. (2000), "Dynamic capabilities: what are they?", *Strategic Management Journal*, Vol. 21 Nos 10-11, pp. 1105-1121.

Emerson, R. (1962), "Power-dependence relations", *American Sociological Review*, Vol. 27 No. 1, pp. 31-41.

Eyuboglu, N. and Buja, A. (2007), "Quasi-Darwinian selections in marketing relationships", *Journal of Marketing*, Vol. 71 No. 1, pp. 48-62.

Foster, R.N. (1986), *Innovation: The Attacker's Advantage*, Summit Books, New York, NY.

Gardan, N. and Schneider, A. (2015), "Topological optimization of internal patterns and support in additive manufacturing", *Journal of Manufacturing Systems*, Vol. 37 No. 1, pp. 417-425.

Gilbert, C. and Bower, J.L. (2002), "Disruptive change: when trying harder is part of the problem", *Harvard Business Review*, Vol. 80 No. 5, pp. 94-101.

Greenwood, D.J. and Levin, M. (1998), *Introduction to Action Research – Social Research for Social Change*, Sage Publications, Thousand Oaks, CA.

Harland, C.M. (1996), "Supply chain management: relationships, chains and networks", *British Journal of Management*, Vol. 7 No. 1, pp. 63-80.

Henderson, R.M. and Clark, K.B. (1990), "Architectural innovation: the reconfiguration of existing systems and the failure of established firms", *Administrative Science Quarterly*, Vol. 35 No. 1, pp. 9-30.

Hillman, A.J., Withers, M.C. and Collins, B.J. (2009), "Resource dependence theory: a review", *Journal of Management*, Vol. 35 No. 6, pp. 1404-1427.

Hingley, M.K. (2005), "Power to all our friends? Living with imbalance in supplier-retailer relationships", *Industrial Marketing Management*, Vol. 34 No. 8, pp. 848-858.

Hoover, S. and Lee, L. (2015), "Democratization and disintermediation disruptive technologies and the future of making things", *Research-Technology Management*, Vol. 58 No. 6, pp. 31-36.

Huber, G.P. and Power, D.J. (1985), "Retrospective reports of strategic-level managers: Guidelines for increasing their accuracy", *Strategic Management Journal*, Vol. 6 No. 2, pp. 171-180.

Jiang, R., Kleer, R. and Piller, F.T. (2017), "Predicting the future of additive manufacturing: a Delphi study on economic and societal implications of 3D printing for 2030", *Technological Forecasting and Social Change*, Vol. 117 No. 1, pp. 84-97.

Kask, J. and Öberg, C. (2019), "Why 'majors' surge in the post-disruptive recording industry", *European Journal of Marketing* (forthcoming).

Kietzmann, J., Pitt, L. and Berthon, P. (2015), "Disruptions, decisions, and destinations: enter the age of 3-D printing and additive manufacturing", *Business Horizons*, Vol. 58 No. 2, pp. 209-215.

Kumar, N. (1996), "The power of trust in manufacturer-retailer relationships", *Harvard Business Review*, Vol. 74 Nos 11-12, pp. 92-106.

Li, Y., Jia, G.Z., Cheng, Y. and Hu, Y.C. (2017), "Additive manufacturing technology in spare parts supply chain: a comparative study", *International Journal of Production Research*, Vol. 55 No. 5, pp. 1498-1515.

MacCarthy, B.L., Blome, C., Olhager, J., Singh Srai, J. and Zhao, X. (2016), "Supply chain evolution – theory, concepts and science", *International Journal of Operations & Production Management*, Vol. 36 No. 12, pp. 1696-1718.

Mohr, S. and Khan, O. (2015), "3D printing and its disruptive impacts on supply chains of the future", *Technology Innovation Management Review*, Vol. 5 No. 11, pp. 20-25.

Moreau, F. (2013), "The disruptive nature of digitization: the case of the recorded music industry", *International Journal of Arts Management*, Vol. 15 No. 2, pp. 18-31.

Nordin, F., Öberg, C., Kollberg, B. and Nord, T. (2010), "Building a new supply chain position: an exploratory case study within the construction industry", *Construction Management and Economics*, Vol. 28 No. 10, pp. 1071-1083.

Öberg, C. (2012), "Using network pictures to study inter-organisational encounters", *Scandinavian Journal of Management*, Vol. 28 No. 2, pp. 136-148.

Öberg, C., Shams, T. and Asnafi, N. (2017), "Additive manufacturing – current knowledge and missing perspectives", CiNet, Potsdam.

Öberg, C., Shams, T. and Asnafi, N. (2018), "Additive manufacturing and business models: current knowledge and missing perspectives", *TIM Review*, Vol. 8 No. 6, pp. 15-33.

Oettmeier, K. and Hofmann, E. (2016), "Impact of additive manufacturing technology adoption on supply chain management processes and components", *Journal of Manufacturing Technology Management*, Vol. 27 No. 7, pp. 944-968.

Oettmeier, K. and Hofmann, E. (2017), "Additive manufacturing technology adoption: an empirical analysis of general and supply chain-related determinants", *Journal of Business Economics*, Vol. 87 No. 1, pp. 97-124.

Paul, R. and Anand, S. (2015), "Optimization of layered manufacturing process for reducing form errors with minimal support structures", *Journal of Manufacturing Systems*, Vol. 36 No. 1, pp. 231-243.

Penrose, E.T. (1959), *The Theory of the Growth of the Firm*, Basil Blackwell, Oxford.

188

Pfeffer, J. and Salancik, G.R. (1978), *The External Control of Organizations – A Resource Dependence Perspective*, Harper & Row, New York, NY.

Pratt, M.G. (2009), "From the editors: for the lack of boilerplate: tips on writing up (and reviewing) qualitative research", *Academy of Management Journal*, Vol. 52 No. 5, pp. 856-862.

Rayna, T. and Striukova, L. (2016), "From rapid prototyping to home fabrication: how 3D printing is changing business model innovation", *Technological Forecasting and Social Change*, Vol. 102 No. 1, pp. 214-224.

Reason, P. and McArdle, K.L. (2004), "The theory and practice of action research", in Becker, S. and Bryman, A. (Eds), *Understanding Research for Social Policy and Practice*, The Policy Press, Bristol, pp. 1-6.

Ren, L., Sparks, T., Ruan, J.Z. and Liou, F. (2008), "Process planning strategies for solid freeform fabrication of metal parts", *Journal of Manufacturing Systems*, Vol. 27 No. 4, pp. 158-165.

Riemer, K., Gal, U., Harnann, J., Gilchriest, B. and Teixeira, M. (2017), "Digital disruptive intermediaries: finding new digital opportunities by disrupting established business models", The University of Sydney Business School/Cap Gemini, Sydney.

Rogers, H., Baricz, N. and Pawar, K.S. (2016), "3D printing services: classification, supply chain implications and research agenda", *International Journal of Physical Distribution & Logistics Management*, Vol. 46 No. 10, pp. 886-907.

Sarantakos, S. (1998), *Social Research*, Palgrave Macmillan, New York, NY.

Sasson, A. and Johnson, J.C. (2016), "The 3D printing order: variability, supercenters and supply chain reconfigurations", *International Journal of Physical Distribution & Logistics Management*, Vol. 46 No. 1, pp. 82-94.

Shams, T. and Öberg, C. (2017), "Disruptive positions and roles? The effect of additive manufacturing on business networks", IMP Journal Seminar, Poznan.

Utterback, J.M. (1994), *Mastering the Dynamics of Innovation*, Harvard Business School Press, Boston, MA.

Wang, Q.F., Sun, X., Cobb, S., Lawson, G. and Sharples, S. (2016), "3D printing system: an innovation for small-scale manufacturing in home settings? Early adopters of 3D printing systems in China", *International Journal of Production Research*, Vol. 54 No. 20, pp. 6017-6032.

Whyte, W.F. (1995), "Encounters with participatory action research", *Qualitative Sociology*, Vol. 18 No. 3, pp. 289-299.

Zeleny, M. (2012), "High technology and barriers to innovation: from globalization to relocalization", *International Journal of Information Technology & Decision Making*, Vol. 11 No. 2, pp. 441-456.

Zhang, J.L., Zhang, Z. and Han, Y. (2017), "Research on manufacturability optimization of discrete products with 3D printing involved and lot-size considered", *Journal of Manufacturing Systems*, Vol. 43 No. 1, pp. 150-159.

Corresponding author
Christina Öberg can be contacted at: christina.oberg.se@gmail.com

Innovations in intellectual property rights management
Their potential benefits and limitations

Dolores Modic
Nord University Business School, Bodø, Norway
Ana Hafner
Faculty of Information Studies in Novo Mesto, Novo Mesto, Slovenia
Nadja Damij
Newcastle Business School, Northumbria University, Newcastle upon Tyne, UK, and
Luka Cehovin Zajc
Faculty of Computer and Information Science, Univerza v Ljubljani, Ljubljana, Slovenia

Abstract

Purpose – The purpose of this paper is to evaluate innovations in intellectual property rights (IPR) databases, techniques and software tools, with an emphasis on selected new developments and their contribution towards achieving advantages for IPR management (IPRM) and wider social benefits. Several industry buzzwords are addressed, such as IPR-linked open data (IPR LOD) databases, blockchain and IPR-related techniques, acknowledged for their contribution in moving towards artificial intelligence (AI) in IPRM.

Design/methodology/approach – The evaluation, following an original framework developed by the authors, is based on a literature review, web analysis and interviews carried out with some of the top experts from IPR-savvy multinational companies.

Findings – The paper presents the patent databases landscape, classifying patent offices according to the format of data provided and depicting the state-of-art in the IPR LOD. An examination of existing IPR tools shows that they are not yet fully developed, with limited usability for IPRM. After reviewing the techniques, it is clear that the current state-of-the-art is insufficient to fully address AI in IPR. Uses of blockchain in IPR show that they are yet to be fully exploited on a larger scale.

Originality/value – A critical analysis of IPR tools, techniques and blockchain allows for the state-of-art to be assessed, and for their current and potential value with regard to the development of the economy and wider society to be considered. The paper also provides a novel classification of patent offices and an original IPR-linked open data landscape.

Keywords Artificial intelligence, Software tools, Big data, Social benefits, Intellectual property rights management, Linked open databases

Paper type Research paper

1. Introduction

The world today seems to be characterised by the effects of information and communication technology (ICT) on every aspect of our lives, including that of intellectual property rights (IPR) (Modic, 2017). Freeman and Louca (2002, p. 301) wrote that "even those who have disputed the revolutionary character of earlier waves of technological change, have little

difficulty accepting that a vast technological revolution is now taking place". The surge of intellectual property is mirrored in rising IPR numbers with dissemination efforts dependent upon the available data, channels and skills. IPR data are big data, as its characteristics are high volume, high variety and high velocity of changes (Ciccatelli, 2017). Consequently, merging different types of IPR data from various databases presents a challenge (Stading, 2017; Abbas *et al.*, 2014).

When huge amounts of IPR data are connected, a new ecosystem for (open) innovation emerges. It is important to examine the best available IPR data sources, and their merge-readiness, in order to extract the maximum value. Furthermore, it is important to ensure the availability of appropriate IPR techniques and tools if we are to harness the benefits for IPR management (IPRM) and the wider social benefits of this new open IPR landscape and move towards knowledge creation assisted by artificial intelligence (AI). Examining the latest trends in technological solutions and their potential is the foci of our paper.

Figure 1 presents two dimensions: the benefits and the technology. Looking at the technology dimension, all three layers represent issues companies face. IPR software tools and techniques should better respond to business requirements, and as such support changes in databases when dealing with IPR big data, such as the implementation of blockchain technology and linked open databases.

The benefits dimension is also facing several gaps. One refers to the identification of the accessibility of employees' knowledge both in SMEs and IPR-savvy companies. In addition, there are inefficiencies when trying to transform tacit to explicit knowledge in order to further knowledge creation.

Both the technology and benefits dimensions are linked, as the technology aims to, largely unsuccessfully at the present time, to support the requirements of the IPRM, thus increasing the IPRM-derived benefits. These would consequently be translated, especially through the use of blockchain technology and IPR-linked open data (IPR LOD) databases, into increased social benefits. The question as to when, and if, the technology will become smart enough to create IPR software tools and techniques that will function in an intelligent manner remains open to debate, as we are faced with increasing transparency and inherently imbued trust.
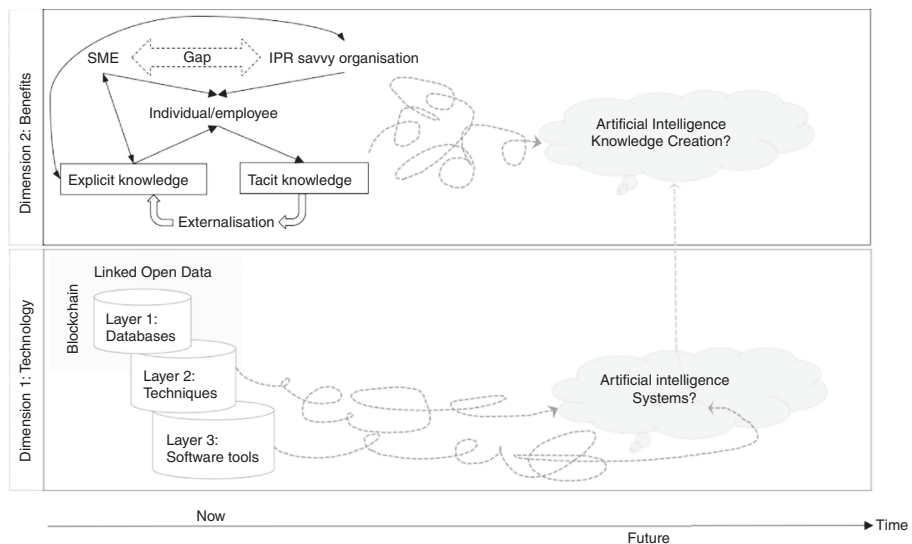

Figure 1.
Technology and benefits in IPR landscapes

If AI systems provide the best possible answer to every IPR-related business requirement, in order to maximise business potential, does this mean that the employees' knowledge creation will become obsolete and AI systems will be able to effectively create new knowledge?

The paper offers a review and an interview-based analysis of the requirements and expectations of some of the top IPR experts from IPR-savvy multinationals, as well as a consideration of the potential social benefits. This is followed by a web-based analysis and data retrieval-based evaluation of the current evolution of IPR (LOD) databases. Furthermore, the practical solutions available have been critically evaluated with respect to IPR databases and IPR software tools. The results of the analysis of the state-of-the-art with the available techniques are presented. Finally, a debate-style conclusion is presented.

2. Background and prepositions

This paper investigates IPRM and IPR social benefits by answering what are the potential social and IPRM benefits of adopting new ICT solutions when dealing with IPR, and especially what is the current state of all three technological layers? The research is based on the following prepositions constructed following the literature review and the evidence-based approach.

The first preposition is linked to the availability of data and its connectivity, hence to state-of-the-art of Layer 1 in our framework in Table I. One of the newer directions for the field of intellectual property is IPR data in linked open data (LOD) format. This is following two trends: the linked open data idea, introduced as a vision more than a decade ago by Berners-Lee (2006) – envisioning the web as a web of data rather than a web of linked documents; the second is based on the notion of open government. European countries are developing policies to release data as open data and putting in place the "systemic" prerequisites for effective use and re-use of them (European Data Portal, 2017; Bauer and Kaltenböck, 2012). The road to effective open data systems are nonetheless long, hence we investigate where on the Berners-Lee Five Star Open Data Plan individual patent offices are at the moment, before presenting the LOD IPR map:

P1. The IPR-linked open data (IPR LOD) map is still in its infancy, thus the full potential of their social benefits are still not realized.

There is a certain hype created in the IPR community either under the moniker of augmented intelligence (Fleischman, 2018) or augmented expertise (White, 2018). In connection to the

Type	Data available in	Patent offices
***** (and ****)	LOD (and RDF)	EPO; USPTO[a]; Korean Patent Office[b]; IPO UK[b]; IP Australia[c]
***	CSV[d]	French Patent Office; Norwegian Patent Office; German Patent Office
**	XLS	Hungarian Patent Office; Austrian Patent Office; Polish Patent Office; Swedish Patent Office
*	PDF[d]	Italian Patent Office; Bulgarian Patent Office; Benelux Patent Office; Spanish Patent Office; Estonian Patent Office ; Finish Patent Office; Irish Patent Office; Czech Republic Patent Office; Lithuanian Patent Office; Slovak Patent Office; Portuguese Patent Office; HR Office; Slovenian IP Office; Swiss Patent Office; Hellenic Patent Office; Romanian Patent Office; Danish Patent Office

Notes: [a]Taking into account the AKSW database (different provider); [b]the patent offices have done additional steps non-related to the format to make merging of data easier; [c]the database can be described as providing linking data, yet it is not an LOD database in classical sense; [d]if taking into account the bibliographical export in .csv by Espacenet on its web-pages designed in cooperation with national patent offices (e.g. https://sk.espacenet.com/), there are such data provided for most, however, the end document exports remain .pdf

Table I.
Classification of patent offices according to the Berners-Lee Open Data Plan

second preposition, our presumption is that the current state of techniques do not support a sufficient level of semantic understanding that would contribute to successful automation of retrieval and comparison scenarios. Techniques like deep learning show some promise to significantly contribute in this case, yet these approaches are still in active development. Through the investigation of this preposition, we focus on Layer 2 in the begin framework:

P2. AI is a term used very broadly when connected to IPR techniques, to oversell various information retrieval (IR) and machine learning (ML) methods.

The third preposition is connected to Layer 3. In this part – in contrast to the first preposition – we move from the public sector to the private sector, and to especially IPRM benefits. We theorise there is a lack of accessibility and transfer of employees' knowledge, and a low level of transformation of tacit to explicit knowledge, as we believe the current tools function more as visualisation, project management and docking tools. The holistic IPRM-supporting tools, which would allow for internal/external merge of data, as well as support back office (in particular also information, technology and knowledge transfer) as well as front-office IPR activities (Modic and Damij, 2018) are lacking. This part deepens the work started in the study of Modic and Damij (2018) and the evidence is both interview-based as well as a results of IPR tools testing and web searches:

P3. The tools do not correspond to the needs of users as expressed by top IPR managers.

Amongst the several IPRM and social benefits that the paper investigates, due consideration is given to blockchain potential IPR-connected benefits (*P4*). Several private companies as well as governmental and intergovernmental organisations are currently researching the possibilities of blockchain use in many different fields, including record keeping and smart contracts (Morabito, 2017) which are crucial for the IPR issues:

P4. Blockchain has the potential to produce both IPRM and IPR-connected social benefits if some issues are solved.

The outputs of this paper are the classifications of IPR databases and patent offices according to Berners-Lee Open Data Plan, and IPR LOD map as connected to patents as well as classification of tools and techniques. A mixed methods approach has been used, every part diligently designed with methodological notes.

3. Methodology

We derive our analysis of potential benefits of new solutions for IPR and the potential of IPR tools from interviews with ten prominent IP experts. First, interviews with ten prominent IP experts were conducted. Seven out of the ten IP experts were head IP managers within their respective companies. The companies selected are positioned highly in terms of patent applications and quality rankings. Furthermore, they appear on top innovation listings, such as MIT's list of the 50 Smartest companies. All respondents are executives with years of experience; and one of the interviewees appeared twice in the 50 most influential people in IP, as listed by the *Managing Intellectual Property* magazine. Views expressed inside the interviews are their own and not the views of the companies they are affiliated with. Interviews were conducted either in person, via Skype or via similar VoIP during 2016 and with follow-ups in 2017. Transcripts were analysed using MAXQDA Analytics Pro 12 software. Interview questions were divided into three sections: IPRM (1), formalization (2) and optimisation of processes and gaps reduction (3)). In particular for this paper three topics and their related questions that were included in this semi-structured interview questionnaire are harnessed upon (pertaining to either part (1) or part (3): What is the missing information and/or resources?; Which software tools do you use inside your processes? What are their pros and cons?; What kind of (big) data analysis would be particularly interesting? Who can provide them?

The technologies section brings further methods. The classification of patent offices was done in the period January–February 2018 by conducting web searches and experimental searches with consequent search retrievals inside patent search machines either for full patent documents or at least bibliographical exports. The classification encompasses primarily EU Patent Offices as well as a selection of other relevant patent offices[1]. The framework for the patent map relies on The Linking Open Data cloud diagram, however, it has been significantly upgraded by including material gathered via web searches guided by discussions with various patent offices' staff members. Analysis of techniques is based on critical literature review. We also reviewed websites of 11 top IPR tools providers as identified by interviewees and/or the Hyperion MarketView™ Report (2016) and Capterra's review (2017). Analysis is based on reviews of websites (November, 2017) by Anaqua for Corporations, IP One (from CPA Global), InnovationQ (from ip.com), IPfolio, PatentSight, Unycom Enterprise, Wellspring's IP management software, Patricia (form Patrix), Alt Legal, Inteum, Dennemeyer's DIAMS iQ[2].

4. The potential social and IPRM benefits of new advances in the field of IPR
One of the biggest problems of IPR data usability is the rapid growth of number of IPR, especially patents. They are written in different languages and it has become increasingly challenging to understand the state of the art, this consequently causing duplication of research and increasing the number of invalid patents granted. Once errors can be corrected, it will be easier to identify inherently invalid patents previously granted, and consequently leading to a natural rise in the quality of IPR.

Governments have a large quantity of IPR-related data, which can be of economic and social value to society. European Patent Office (EPO) sees the advantages of its new LOD patent databases, one of the outlets of the new open data trend, as increased availability of data from different sources via one channel, less "data friction" when combining different data sets, more effective linking with business information and increased trust thanks to provenance (Kracker, 2017). The Korean Patent Office (KIPO) also saw its efforts in a similar manner (KIPO, 2016).

The growing importance of IPR Open (linked) data is connected to better transparency making it easier for companies to understand their value. However, if we could not only have exploitable open databases, but if these could also be combined with IPR techniques with AI functionality, and additionally, IPR tools which supported the handling of IPR data by integrating some AI functionalities, we could be seeing a new form of tacit knowledge, the "Artificial intelligence knowledge" creation (see Figure 1). Therefore, the often problematic issue of tacit knowledge inside the IPR field embodied in individuals (note that the usual way of gaining IPRM, exploitation and other connected IPR knowledge is through apprenticeship and that the rotation of individuals presents a serious problem for especially company IPR departments, Modic and Damij, 2018)) would be transformed into a latent explicit knowledge (knowledge available on recall as opposed to explicit knowledge, always available). Solutions, like IBM Watson, seem to also be a game changer in this area. Watson identified compounds on which the patent protection has already lapsed, and the pilot results suggest that Watson can accelerate identification of novel drug candidates and novel drug targets by harnessing the potential of patent (and connected) big data (Chen *et al.*, 2016). The IBM team believes the insights provided by Watson technology are to be used as a guide, i.e., as augmented intelligence – which is capable of ingesting, digesting, understanding and analysing data and can be harnessed in various elements of IPR processes: from evidence of use, to prior art, patent landscapes and portfolio analysis (Fleischman, 2018). If the technology was widely available with all its features, this could present a significant change, as it would enable smaller entities to access knowledge that is now tacit knowledge.

When discussing traceability, blockchain is one of the frequently debated issues. Several potential social benefits, as derived from the utilisation of blockchain in the field of IPR, are present. A tool for registration of IPRs could simplify registration and lower the costs (Vella *et al.*, 2018; Morabito, 2017) or could be an alternative to IPR registration, especially patents. Thus, it has a potential particularly for small entities (independent inventors, SMEs, non-profit organisations), as well as inventors and organisations from less developed countries, who are unable to access the current world patent system simply because it is too expensive for them.

Blockchain provides a robust and trustworthy method of establishing business ownership on intangible assets, including IPR (Morabito, 2017) and thus has the potential to enhance transparency of IPR transactions (Vella *et al.*, 2018). Not only does this have positive effects for individual companies, but it can also streamline the costs of operations for patent offices, and reduced options for litigation can lower court case numbers and reduce court backlogs. Furthermore, it also has the potential to enable half open licensing, when royalties start only when IPR-based income is generated by downstream users; meaning that without income generation, the half open licenses allow for IPR-based solutions to be spread in an open environment. Moreover, it would allow tracking commons' knowledge (under open licenses or not) incorporation into corporate IPR portfolios disallowing the privatisation of gains.

With regard to potential IPRM benefits, IPRM deals with managing IPR big data efficiently, and differently (Braganza *et al.*, 2017; Davenport *et al.*, 2012). McAfee and Brynjolfsson (2012) argue that companies will not reap the full benefits of the transition made in exploiting big data, unless they are able to manage change effectively.

Analysis of the interviews showed a clear trend that IP executives are aware of the growing importance of ICT, and their role in IPRM, however, they continue to struggle with defining how to integrate IPR tools to achieve best outcome. A Senior IP Counsel at a German multinational chemical manufacturing corporation stated that, "IT developments will have a big impact in the near future on IP development, because the more transparent you make the IP, the easier it is for management to understand its value".

Utilising the ICT in IPR processes is possible, however, doing it in the most efficient way to enable companies to achieve maximum benefits, is the ideal. Some companies use a range of different software tools connected to IPR and IPRM, whilst others try to find or develop software that integrates as many features and data sources as possible and are able to connect to other business processes and databases. Generally, the more comprehensive the tool, the less information is missing, and consequently, the higher the satisfaction level. Nonetheless, some experts, such as the Head of Legal Operations and IP Management at a European multinational pharmaceutical corporation, believe that IPR tools often promise more than they deliver. He states that they, "do not think there are any particularly good IP management tools on the market /…/the whole industry still lacks are real IP management tools, helping to relate to the business value more". IPR experts are seeking a tool that would, in addition to being a comprehensive docketing system and simple interface retrieval of data from public IPR databases, also encompass supplying or channelling invention disclosures to pertinent individuals, providing functionality for IPR valuation, evaluation and analysis.

The next chapter will provide more detail deal with regard to the technological dimension, providing an analysis on the current state of linked open databases, software tools for IPRM and techniques that support IPR data correction and analytics.

5. Technology
5.1 Databases and linked (open) data
Since the Venetian patent statute of 1474, IPR have retained their connection to the concept of openness and dissemination of ideas in exchange for limited time monopolies. There are various types of databases and online sources connected with IPR constituting Layer 1 in the framework in Table I. Public patent databases as the original sources allow raw data

retrieval and the use of interfaces by providing patent texts and some metadata. Related IPR databases include, for example, those related to patent disputes, patent citations. Business databases provide information on IPR owners, etc. Scientific databases provide us *inter alia* with data on inventors. Miscellaneous online data sources include less or more structured sources, e.g., business news, blogs-based IPR-related texts, information on IPR experts. Multi-source IPR databases provide broader information, e.g., on IPR quality and business connected data. Two examples of the latter are the data set linking the EPO and USPTO patent data to Amadeus business database and the Oxford Firm-Level IP Database (Thoma and Torrisi, 2007; Helmers *et al.*, 2011).

Linked open data (IPR LOD) databases are the latest evolution in IPR databases, although the concept of LOD goes back to 2006, when principles such as using uniform resource identifiers as names for things and including links were put forward (Berners-Lee, 2006). Linked data are data published on the web in a machine-readable format, which can be linked to or from external data (Bizer *et al.*, 2009). LOD is in essence a format allowing for efficient (multi-source) database utilisation as the term refers to a set of practices for publishing and interlinking structured data (Auer, 2014).

Combining this to ideas of open data, we get LOD, structured data made available for others to be reused (Mezaour *et al.*, 2014). The concept is connected to the Open Data movement to ensure public government data are accessible in non-proprietary formats (Bauer and Kaltenböck, 2012). However, LOD landscape includes databases provided by non-governmental entities. DBPedia, extracting structured knowledge from Wikipedia, is often seen as the "nucleus" of LOD (Auer *et al.*, 2007). Furthermore, patent data of individual patent offices are sometimes provided by outside providers, such as in the case of USPTO or (formally) the EPO.

Table I shows the classification of patent offices and their data according to the Berners-Lee Five Star Open Data Plan. More stars indicate data formats more conducive to open data policies, as they allow for easier export and import of data, and more streamlined merging and analysis. The category **** is redundant as there is no standalone RDF providing databases; and, we would suggest an introduction of the *****+ category, where the additional criteria is the existence of linkages with other data, signalling the real uptake of the raw data by users (see Table I). The Type indicates the most Open data friendly format, though patent offices often provide other formats simultaneously. They often also provide more than one database, and the degree of the export varies for bibliographical data (Swiss Patent Database offering up to 25 variables).

Five patent offices are leading in terms of IPR LOD; USPTO, EPO, KIPO, IPAustralia and IPO UK. Cooperation of national offices with Espacenet was also advantageous, as it produced the option of a limited bibliographic data download in .csv format (not taken into account above). However, most of the patent offices can still be categorised only as Type * or Type **, their data remaining in linkable open data unfriendly formats.

There are only a few databases that could be categorised as *****+, or that have shown other initiatives to make exporting, merging and analysing data easier. For example, KIPO has not only published the IPR LOD, but also included the owners' corporate registration number and the Australian Patent Office IPR database includes information about companies' size, technology and geographic location, making it easier for users to link data on patents to information on related business entities (KIPO, 2016; Man, 2014).

Currently, EPO's Linked open data is the newest of the few IPR LOD databases at users' disposal. It builds upon their previous work in connecting patent-related data, such as their Deep Linking service, allowing users to consult the EP document's legal status data. However, the IPR LOD database remains as a raw data product and without additional skills and resources cannot be fully utilised, which could potentially widen the gap between SMEs and IPR-savvy companies. For example, the linkage to DBPedia has also been carried out, but since then de-installed (Kracker, 2017). This year the EPO also included in their

Research grant call explicitly the field of linked open data and solutions therein, where at least one project will start end of this year linking EPO database with the Springer database (IP LodB, 2018). The current LOD IPR landscape shown below is based on the The Linking Open Data cloud diagram and upgraded[3].

Figure 2 shows patent LOD databases[4] we could call *****+, and their inbound and outbound links, as per The Linking Open Data cloud diagram (LOD cloud, 2018) – a complex LOD ecosystem currently listing 1,164 data sets. They are also linked to the most inbound and outbound link-rich LOD databases, namely, the Comprehensive KAN and DBPedia. The new EP LOD and KIPO databases have no data on linkages, even though some attempts were made as mentioned above. There are, however, several LOD databases that this patent data could be linked to; e.g. the recently published bibliographic LOD database by Springer Nature SciGraph or the older New York Times LOD.

When considering the traceability of IPR data, some patent offices offer centralised solutions, such as i-DEPOT, which allows to trace the date of inventions' creation. However, at the forefront of these debates is blockchain as a disruptive technology, due to its transparency, decentralisation and prevention of infringements and fraud. Blockchain is a chain of blocks of chronologically linked information, replicated in a distributed database. Information can be added, but never removed, changes are registered and validated. Individual blocks can be protected by cryptography, and only those authorised can access the information (McPhee and Ljutic, 2017). Blockchain application to IPR can be either inside the registration or exploitation phases (related to issues of licensing, proving authenticity and piracy) (Vella *et al.*, 2018; Morabito, 2017) as well as distribution. In case of licensing, the topic is connected to smart contracts, open licenses and IPR-based collaboration (Pilkington, 2016; Morabito, 2017). Smart contracts are computer codes that reside in the blockchain and are implemented if certain conditions are met, which is confirmable by a number of computers to ensure truthfulness (Morabito, 2017; Szabo, 1997). There are numerous potential applications of blockchain connected to IPR. Also, the Linked Data paradigm is evolving from an academic concept for addressing one of the biggest challenges in the area of information management
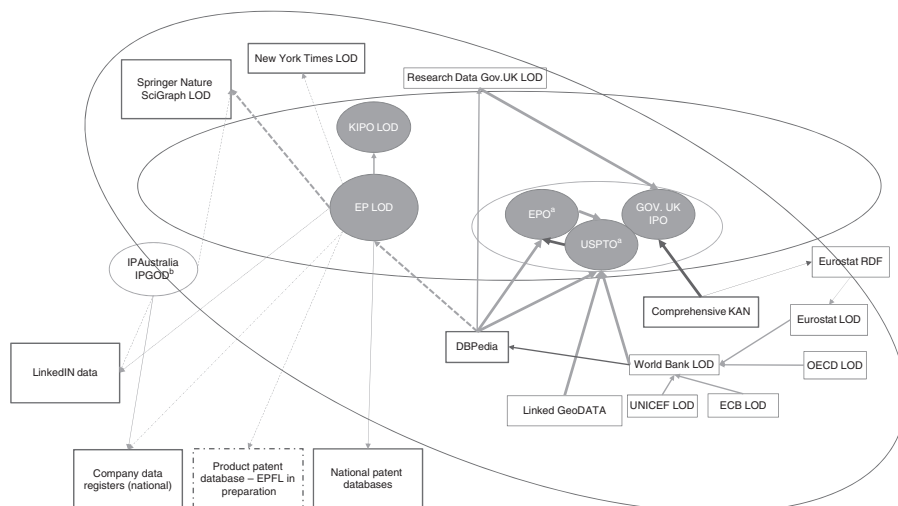

Figure 2.
Narrow IPR LOD landscape (patent databases)

Notes: Green arrows: ingoing links; red arrows: outgoing links; dashing blue lines: potential and planned or deconstructed (bolded). [a]Not provided by patent offices; [b]linked database, but not following LOD standards

the exploitation of the web as a platform for data and information integration; to practical applications in IPR field deriving from the transfer from the Web of Documents to a Web of Data. Yet, it is clear there is still much to be done, both in terms of the volume of IPR LOD-connected databases, as well as their functionality in linking to other LOD data sets as well as the real-life uptake of blockchain solutions.

5.2 Classification of tools and techniques
This chapter summarises the techniques and tools (technology Layers 2 and 3 as set out in Figure 1) that analyse large quantities of patent documents and other IPR data to provide useful information to various users.

The EPO's database, Espacenet, on its own, currently contains over 100m patent documents from 90 patent authorities worldwide. Whilst patent data are exceptionally important, it is also very difficult to extract some useful information from it as patents are mostly stored as images; written in different languages; countries have different patent requirements; no uniform structural requirements; some patent figures are drawn by hand, some on computer; some patent attorneys intentionally use misleading language; incomprehensible language and grammatical mistakes can be also used inadvertently. How to deal with these issues remains a challenge.

There are several possible taxonomies of IPR software. Considering their functionalities we see tools supporting different phases of the innovation cycle, those supporting financial management (record and estimate costs), archiving documents (IPR portfolio) and enabling communication between users and IPR offices. Some tools have functionality to integrate data from external databases, such as patent litigation information and patent citation indexes. In terms of intended user-base we have IPR tools for companies, for IPR experts and for technology transfer offices.

There is an upward trend in the creation of new IPRM software in recent years. However, after reviewing the websites of the 13 most important IPR tools providers by Hyperion MarketView™ Report (2016) it appears that these tools only modestly respond to the challenges raised, and largely look like any project management software. Bonino *et al.* (2010) was optimistic with regard to semantic-based solutions, however, some of the tools he describes are currently in poor condition or unavailable.

In terms of techniques utilised in semantic analysis, Abbas *et al.* (2014) made a taxonomy of proposed computer-assisted patent analysis techniques where they distinguish between text mining and visualisation approaches. These two categories are based on frequent use-cases, whilst the underlying methods are primarily inspired by IR and ML. This is not unreasonable, as patent documents are similar to other types of documents in that they contain textual and visual data as well as references to other documents.

As seen in Figure 3, a typical IR system consists of document pre-processing, feature extraction and feature analysis. Each of those steps can be based on heuristic rules or utilise machine learning methods. In the following paragraphs, we review the use of different techniques in the IPR research domain in the last decade, with a particular focus on the
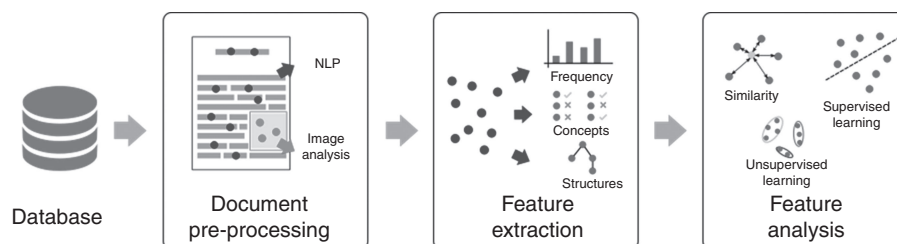

Figure 3.
A typical computer-assisted document analysis pipeline as IPR techniques classification framework

works referenced in recent literature reviews by Abbas *et al.* (2014) and Aristodemou and Tietze (2017). The list is by no means complete, it is only focussed on key examples illustrating the diversity and potential of such methods.

The patent document pre-processing step involves scanning the unstructured data (text and images) and extracting useful information from it.

Due to the nature of the patent data, the approaches mainly focus around text mining techniques; meaning using some kind of natural language processing (Wang *et al.*, 2015; Han *et al.*, 2017), such as subject–action–object analysis (Park, Kim, Choi and Yoon, 2013; Park, Ree and Kim, 2013), property–function analysis (Dewulf, 2013) or rule-based analysis to extract semantic primitives. Several authors have also proposed the utilisation of patent images and sketches in patent analysis, in order to determine similarities between patents (Bhatti and Handbury, 2013). In terms of pre-processing, image analysis challenges involve localisation of images and sub-images, categorisation of images and label recognition (Vrochidis *et al.*, 2010). The primary sources of inter-information are cross-patent citations (Altuntas *et al.*, 2015).

The feature extraction methods transform low-level semantic primitives into a document-wide representation. By involving projection of each document into a high-dimensional feature space we can determine bounds between classes or proximity of documents. When processing textual data, the semantic primitives can be frequency vectors (Chen and Yu-Ting, 2011), vectors of concepts that describe higher-level semantic information, or domain-specific hierarchical structures (Lee, 2013). In analysis of patent sketches, content is frequently encoded with shape or texture descriptors (Bhatti and Handbury, 2013) due to the line-art nature of visual information.

The method used in the feature analysis stage depends on the problem at hand, for example, retrieval of similar patents. In this case, IR techniques based on vector distances (Lee, 2013) are used to infer which documents are most similar. Another task is automatic classification of patents using ML methods. Scenarios include patent quality analysis (Wu *et al.*, 2016), patent categorisation (Vrochidis *et al.*, 2010) and determining the impact of patents on other aspect of companies (Chen *et al.*, 2013). Supervised learning methods, such as support vector machines (Wu *et al.*, 2016) or artificial neural networks (Chen *et al.*, 2013), are frequently used in such cases. In explorative analysis of the patent landscape for trend identification, people have also utilised unsupervised learning methods, like clustering (Atzmüller and Landl, 2009; Madani and Weber, 2016) and network analysis (Dotsika, 2017; Park, Kim, Choi and Yoon, 2013).

Despite the apparent contribution of IR methods in transforming access to information, they are harder to apply to semantic-sensitive fields, such as IPR analysis, with the same level of success. The crucial information in patent documents can be difficult to extract automatically because of objective (history, language) or subjective (intentional misuse of description) reasons. As noted by Lupu (2017), the level of research interest in this field has, after more than a decade of increasing optimism, decreased in the past years. This can be in part attributed to the realisation that extracting high-level semantic content from sophisticated unstructured text and images is very a challenging problem. The most successful working cognitive computing system is IBM Watson, who has already been analysing patent information in the past, with a particular emphasis in the pharmaceutical sector. However, this system is proprietary and accessible only to a limited number of influential clients.

6. Discussion

Over the last years, activities around IPR Open Data, merging of IPR data with related data, IPR Linked Data, IPR-linked open databases and the debates over utilising the Semantic Web opportunities have gained momentum. However, this should go hand in hand with organisations (both public and private) publishing structured data (complying also with linked data standards/principles), the advances in new techniques, as well as IPR tools and

their increased availability. Companies and other patent and IPR data users need to draw on those advanced technologies and tools in order to combine, query (and analyse) data as part of their business intelligence, as well as to improve their services and products.

In terms of the availability of data, the amount of IPR and IPR-connected data publically available is increasing. Responding to P1, the new trends towards formats supporting more export-ready, merge-ready and analysis-ready data are also real, although the amount of patent data available (e.g. as LOD) is still relatively low. LOD means the data are "linkable", not that it is already linked. This means that the uptake of these databases by the users can be slow and can even widen the gap between the IPR-savvy multinationals with sufficient resources and other smaller entities and individuals. The latter would defeat the purpose of publishing such databases, if the objective was to make IPR data more useful to more groups of users, especially also non-patent savvy users (data scientists, web developers, companies integrating IP into their products). Some steps are taken towards this, for example, IPNOVA (available at the moment as a beta version) which is the interface to the IPAustralia's IPGOD database. Another route (contrasting somewhat with developing interfaces) is through sufficient dissemination and training workshop accompanying the releases of databases in new formats. On the other hand, the authors remain hopeful as new entities – including private and NGO entities – provide more and more LOD databases, and with growth of potential links, allowing greater potential for IPR.

In response to P2, techniques that would support IPR data correction, and IPR data analytics and software tools, which support IPRM, are still not at a sufficient stage of development for IPR managers and other users dealing with IPR. The IPR tools remain primarily visualisation tools (P3); or project management and docketing tools, applied to the field of IPR. There are few true IPRM tools that also integrate variable (external and internal) data merges and harness new advances in IPR techniques, although some solutions have been integrated. This is perhaps because the existing techniques, which are suitable for many existing retrieval and analysis tasks, are frequently branded as "AI", a term that increases expectations about the capabilities which existing methods fail to fulfil. A complete AI system is perhaps the ultimate goal of automatic patent analysis, capable of high-level reasoning about the content of patent documents, comparing their underlying ideas and determining similarities. The current state is (far) removed from this goal. At present, it is primarily addressing very narrow domains, interpretable by data scientists and machine learning researchers. However, as also noted by Lupu (2017), recent breakthroughs in deep learning and artificial neural networks already address tasks such as machine translation and image analysis, which can be (and sometimes are) utilised in IPR analysis.

In response to P4, blockchain technology is now fairly widely discussed for its potential to change the nature of IPRs by simplifying registration, lowering costs, increasing transparency and enabling or improving licensing and other transfers of IPR. However, the technology has certain limitations and still needs significant time to develop. This is not only because of the influence that transnational companies have on policy makers, but also, the technology itself might have some weaknesses. It needs huge processing power and therefore for now requires high-volume electricity consumption. Second, field, such as the IPR field, has its own set of limitations connected to legal and judicial frameworks. Therefore, it is important to carefully determine fields where it would be used. "Despite the many interesting potential uses of blockchain technology, one of the most important skills in the developing industry is to see where it is and is not appropriate to use cryptocurrency and blockchain models" (Swan, 2015). Although there are various social and IPRM benefits of employing blockchain technologies in the field of IPR, caution must be applied.

To conclude, despite significant efforts in the last decades, in the field of information technology support to IPRs, and the more and more used buzzwords of augmented intelligence and augmented expertise also for IPR, there is more time needed before these progressive ideas will become (widespread) reality.

Notes

1. Missing from the list are the Latvian, Icelandic, Maltese and Cyprus Patent Office, as they only refer to Espacenet or there is a lack of sufficient information. The classification takes into account data that is (formally) provided by outside sources (e.g. for USPTO).

2. We have also taken into account a review of the available semantic solutions that was made by Bonino *et al.* (2010, p. 37, Table 9). However, these new technology enablers are currently in a less than ideal state (in poor condition or unavailable) and they (those which are at least available) look more like a scientific experiment than a final product that would support real patent analytics in companies. Though we sent some follow-up e-mails we did not receive much useful information so they were excluded from the paper.

3. Eito-Brun (2015) lists 31 LOD databases according to datahub.io related to patents, but they could be hardly classified as IPR databases.

4. The Linked Open Data Cloud diagram includes EPO reference, which was created and published by the research group AKSW.

References

Abbas, A., Zhang, L. and Khan, U.S. (2014), "A literature review on the state-of-the-art in patent analysis", *World Patent Information*, No. 37, pp. 3-13.

Altuntas, S., Dereli, T. and Kusiak, A. (2015), "Analysis of patent documents with weighted association rules", *Technological Forecasting and Social Change*, No. 92, pp. 249-262.

Aristodemou, L. and Tietze, F. (2017), "A literature review on the state-of-the-art on intellectual property analytics", Working Paper Series No. 2, Centre for Technology Management, Vol. 2017, Cambridge, pp. 1-13, available at: www.repository.cam.ac.uk/handle/1810/268007 (accessed 25 August 2018).

Atzmüller, P. and Landl, G. (2009), "Semantic enrichment and added metadata – examples of efficient usage in an industrial environment", *World Patent Information*, Vol. 31 No. 2, pp. 89-96.

Auer, S. (2014), "Introduction to LOD2", in Auer, S., Bryl, V. and Tramp, S. (Eds), *Linked Open Data – Creating Knowledge Out of Interlinked Data Results of the LOD2 Project*, Springer, Cham, Heidelberg, New York, NY, Dordrecht and London, pp. 1-20.

Auer, S., Bizer, C., Kobilarov, G., Lehmann, J., Cyganiak, R. and Ives, Z. (2007), "DBpedia: a nucleus for a web of open data", in Aberer, K. *et al.* (Eds), *ISWC/ASWC 2007*, Springer-Verlag, Berlin and Heidelberg, pp. 722-735.

Bauer, F. and Kaltenböck, M. (2012), *Linked Open Data: The Essentials – A Quick Start Guide for Decision Makers*, Edition mono/monochrom, Vienna.

Berners-Lee, T. (2006), "Linked data: a personal view note", available at: www.w3.org/DesignIssues/LinkedData.html (accessed 30 January 2018).

Bhatti, N. and Hanbury, A. (2013), "Image search in patents: a review", *International Journal on Document Analysis and Recognition*, Vol. 16 No. 4, pp. 309-329.

Bizer, C., Heath, T. and Berners-Lee, T. (2009), "Linked data – the story so far", *International Journal on Semantic Web and Information Systems*, Vol. 5 No. 3, pp. 1-22.

Bonino, D., Ciaramella, A. and Corno, F. (2010), "Review of the state-of-the-art in patent information and forthcoming evolutions in intelligent patent informatics", *World Patent Information*, No. 32, pp. 30-38.

Braganza, A., Brooks, L., Nepelski, D., Ali, M. and Moro, R. (2017), "Resource management in big data initiatives: processes and dynamic capabilities", *Journal of Business Research*, No. 70, pp. 328-337.

Capterra (2017), "Captera review", available at: www.capterra.com/ (accessed 10 December 2017).

Chen, Y. and Yu-Ting, C. (2011), "An IPC-based vector space model for patent retrieval", *Information Processing and Management*, Vol. 47 No. 3, pp. 309-322.

Chen, Y., Argentinis, E. and Weber, G. (2016), "IBM Watson: how cognitive computing can be applied to big data challenges in life sciences research", *Clinical Therapeutics*, Vol. 38 No. 4, pp. 688-701.

Chen, Y.S., Tien, W.P., Chen, Y.W., Lin, C.C. and Lee, Y.I. (2013), "Using artificial neural network (ANN) to explore the influences of number of inventors, average age of patents, and age of patenting activities on patent performance and corporate performance", *Proceedings – 2013 4th World Congress on Software Engineering*, pp. 136-139, available at: https://ieeexplore.ieee.org/document/6754276 (accessed 25 August 2018).

Ciccatelli, A. (2017), "The future of big data and intellectual property", available at: www.insidecounsel.com/2017/06/13/the-future-of-Big-Data-and-intellectual-property?&slreturn=1507773271 (accessed 15 May 2018).

Davenport, T.H., Barth, P. and Bean, R. (2012), "How 'Big Data' is different", *MIT Sloan Management Review*, Vol. 54 No. 1, pp. 43-46.

Dewulf, K. (2013), "Sustainable product innovation: the importance of the front end stage in the innovation process", in Coelho, D. (Ed), *Advances in Industrial Design Engineering*, Intech Open, Rijeka, pp. 139-166.

Dotsika, F. (2017), "Identifying potentially disruptive trends by means of keyword network analysis", *Technological Forecasting and Social Change*, No. 119, pp. 114-127.

Eito-Brun, R. (2015), "Patents, semantics and open innovation: the role of LOD in a business directory for knowledge intensive industries", Presentation at Dr Haxel Congress and Event Management GmbH, Nice, 20 October, available at: www.slideshare.net/Haxel/linked-open-data-in-the-world-of-patents (accessed 10 February 2018).

European Data Portal (2017), *Open Data Maturity in Europe 2017: Open Data for a European Data Economy*, Publications Office of the European Union, Luxembourg, available at: www.europeandataportal.eu/sites/default/files/edp_creating_value_through_open_data_0.pdf (accessed 14 February 2018).

Fleischman, T. (2018), "Augmented intelligence, intellectual property and IBM", Presentation at AI: Hype vs Reality and the Impact on the Patent Industry Clarivate Analytics Online Webinar.

Freeman, C. and Louca, F. (2002), *As Time Goes By: From the Industrial Revolution to the Information Revolution*, Oxford University Press, Oxford.

Han, Q., Heimerl, F., Codina-Filba, J., Lohmann, S., Wanner, L. and Ertl, T. (2017), "Visual patent trend analysis for informed decision making in technology management", *World Patent Information*, No. 49, pp. 34-42.

Helmers, C., Rogers, M. and Schautschick, P. (2011), "Intellectual property at the firm-level in the UK: the Oxford firm-level intellectual property database", Discussion Paper Series No. 546, Department of Economics, University of Oxford, Oxford, pp. 1-23, available at: www.economics.ox.ac.uk/materials/working_papers/paper546.pdf (accessed 14 February 2018).

Hyperion MarketView™ Report (2016), "Anaqua enterprise as featured in the Hyperion MarketView™ research program intellectual property management systems for corporation (2016)", available at: www.anaqua.com/anaqua-hyperion-report.html (accessed 25 February 2018).

IP LodB (2018), "Granted project proposal IP linked open data: building bridges (IP LodB)", IP LodB (forthcoming), Muenich, pp. 1-96.

KIPO (2016), "Korean Intellectual Property Office and Patent Information Expansion of providing public services (English title)", available at: www.kipo.go.kr/kpo/user.tdf?a=user.news. press1.BoardApp&board_id=press&c=1003&catmenu=m03_05_01&seq=15589 (accessed 13 February 2018).

Kracker, M. (2017), "New PI product: linked open EP data", *Presentation at IP Statistics for Decision Makers Conference*, Mexico City, 14–15 November.

Lee, S. (2013), "How to assess patent infringement risks: a semantic patent claim analysis using dependency relationships", *Journal Technology Analysis & Strategic Management*, Vol. 25 No. 1, pp. 23-38.

LOD cloud (2018), "The linked open data cloud", available at: https://lod-cloud.net/ (accessed 20 December 2018).

Lupu, M. (2017), "Information retrieval, machine learning, and natural language processing for intellectual property information", *World Patent Information*, Vol. 49, pp. A1-A3.

McAfee, A. and Brynolfsson, E. (2012), "Big data: the management revolution," *Harvard Business Review*, Vol. 90 No. 10, pp. 60-68.

McPhee, C. and Ljutic, A. (2017), "Editorial: blockchain", *Technology Innovation Management Review*, Vol. 7 No. 10, pp. 3-5.

Madani, F. and Weber, C. (2016), "The evolution of patent mining: applying bibliometrics analysis and keyword network analysis", *World Patent Information*, No. 46, pp. 32-48.

Man, B. (2014), "Overview of the intellectual property government open data", IP Australia Economic Research Paper No. 2, pp. 1-18, available at: www.ipaustralia.gov.au/about-us/reports/ economics_research_paper02 (accessed 14 February 2018).

Mezaour, A., van Nuffelen, B. and Blaschke, C. (2014), "Building enterprise ready applications using linked open data", in Auer, S., Bryl, V. and Tramp, S. (Eds), *Linked Open Data – Creating Knowledge Out of Interlinked Data Results of the LOD2 Project*, Springer, Cham, Heidelberg, New York, NY, Dordrecht and London, pp. 155-174.

Modic, D. (2017), "Intellectual property rights in the information sector: sociological perspective", in Rončević, B. and Tomšić, M. (Eds), *Information Society and Its Manifestations: Economy, Politics, Culture*, Peter Lang, Frankfurt am Main, pp. 55-70.

Modic, D. and Damij, N. (2018), *Towards Intellectual Property Management: Back Office and Front Office Perspectives*, Palgrave Macmillan, Cham.

Morabito, V. (2017), *Business Innovation through Blockchain: The B³ Perspective*, Springer Nature, Cham.

Park, H., Ree, J.J. and Kim, K. (2013), "Identification of promising patents for technology transfers using TRIZ evolution trends", *Expert Systems with Applications*, Vol. 40 No. 2, pp. 736-743.

Park, H., Kim, K., Choi, S. and Yoon, J. (2013), "A patent intelligence system for strategic technology planning", *Expert Systems with Applications*, Vol. 40 No. 7, pp. 2373-2390.

Pilkington, M. (2016), "Blockchain technology: principles and applications", in Olleros, X.F. and Zhengu, M. (Eds), *Research Handbook on Digital Transformations*, Edward Elgar Publishing, Cheltenham and Northampton, pp. 225-253.

Stading, T. (2017), "Using big data to make intellectual property a strategic weapon", available at: https:// dzone.com/articles/using-Big-Data-to-make-intellectual-property-a-str (accessed 10 February, 2018).

Swan, M. (2015), *Blockchain – Blueprint for a New Economy*, O'Reilly Media, Sebastopol, CA.

Szabo, N. (1997), "Formalizing and securing relationships on public networks", *First Monday*, Vol. 2 No. 9, pp. 1-8, available at: http://firstmonday.org/article/view/548/469 (accessed 29 January 2018).

Thoma, G. and Torrisi, S. (2007), "Creating powerful indicators for innovation studies with approximate matching algorithms: a test based on PATSTAT and Amadeus databases", Working Paper No. 211, CESPRI Bocconi University, Milan, available at: https://ideas.repec.org/p/cri/cespri/wp211.html (accessed 14 February 2019).

Vella, D., Falzon, M., Cassar, T. and Valenzia, A. (2018), "Blockchain's applicability to intellectual property management", *The Licensing Journal*, Vol. 38 No. 1, pp. 10-12.

Vrochidis, S., Papadopoulos, S., Moumtzidou, A., Sidiropoulos, P., Pianta, E. and Kompatsiaris, I. (2010), "Towards content-based patent image retrieval: a framework perspective", *World Patent Information*, Vol. 32 No. 2, pp. 94-106.

Wang, J., Lu, W.F. and Loh, H.T. (2015), "A two-level parser for patent claim parsing", *Advanced Engineering Informatics*, Vol. 29 No. 3, pp. 431-439.

White, E. (2018), "AI in patent research", Presentation at AI: Hype vs Reality and the Impact on the Patent Industry Clarivate Analytics Online Webinar.

Wu, J.L., Chang, P.C., Tsao, C.C. and Fand, C.Y. (2016), "A patent quality analysis and classification system using self-organizing maps with support vector machine", *Applied Soft Computing*, No. 41, pp. 305-316.

203

Further reading

Lee, S., Yoon, B., Lee, C. and Park, J. (2009), "Business planning based on technological capabilities: patent analysis for technology-driven roadmapping", *Technological Forecasting and Social Change*, Vol. 76 No. 6, pp. 769-786.

Corresponding author
Dolores Modic can be contacted at: dollymod@gmail.com