
Guest editorial: Creativity management and manufacturing firms' performance

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1. The importance of creativity in manufacturing

Creativity has been the subject of research by numerous scholars in different fields who investigated it in its individual, group and organizational levels, mainly following the *organism-in-its-(social and physical) environment* paradigm (Maturana and Varela, 1980). In this case, individual/group/organizational inner characteristics, cognitive styles, abilities, affective states, knowledge, experience and motivation are responsible for the creative output, together with group processes and contextual factors that can work as an enhancer or constrainer (Amabile, 1996; Breslin, 2019; Dobson *et al.*, 2013; Ekvall, 1996; Stacey, 1996; Woodman *et al.*, 1993). This allows for the emersion of distinct types of creativity (Unsworth, 2001). In brief, creativity has been widely assumed to be the product of behaviors-context interplay, a cognitive “effective action that will enable a living being to continue its existence in a definite environment as it brings forth its world” (Maturana and Varela, 1987, pp. 29–30).

By following the above paradigm, creativity has been specifically defined in the organizational context as, “the creation of a valuable, useful [i.e. novel and effective to some organizational goals; Amabile, 2012; Runco and Jaeger, 2012; Sternberg, 2006] new product, service, idea, procedure, or process by individuals working together in a complex social system” (Woodman *et al.*, 1993, p. 293). This substantiates, *de facto*, creativity as the antecedent of innovation (Amabile, 1983, 1996; Anderson *et al.*, 2014; Caniels *et al.*, 2014; Chaubey and Sahoo, 2021; Im *et al.*, 2013; Lee *et al.*, 2020), also including the adaptation of already existing products or processes.

Within the business setting, most of the research on the role of creativity has focused on service firms, as these are assumed more conducive to fostering creative processes (Bettini *et al.*, 2012; Giannopoulou *et al.*, 2014; Sigala and Kyriakidou, 2015). For this reason, scientific investigation on the role of creativity in manufacturing firms has been scarce (e.g. Cristofaro *et al.*, 2021) and mainly concerned with creative working (Rodgers, 2015), creativity in product innovation teams (Hülshager *et al.*, 2009; Im *et al.*, 2013), creativity impact on product performance (Chang *et al.*, 2014; Im and Workman, 2004; Sethi and Sethi, 2009), the influence of creativity-related conflict on employees' performance (Janssen and Giebels, 2013) and business models (Palo *et al.*, 2019), the determinants of the adoption of creativity methods and practices (Chassagnon *et al.*, 2016; Manresa *et al.*, 2019) and the effects of cultural and organizational structure on creativity (Mehri, 2006).

On the above premises, there is a need of further understanding about *the role of creativity in manufacturing firms*. In this regard, research development is valuable from a practical point of view due to the fierce competition faced by manufacturing firms (World Manufacturing Foundation, 2021) in keeping abreast of new developments and applications in technology (e.g. Industry 4.0). Indeed, behind these new developments and applications there is always a *creative process*, namely new useful ideas and experiential insights that have been generated, screened/assessed, implemented and reconsidered after feedbacks (Chirumalla, 2013, 2016).

In brief, also in light with the current pandemic that has dramatically influenced supply chains and traditional production systems (see the conversion operated by many companies to the mass production of WHO-identified personal protection and other medical equipment;



Okorie *et al.*, 2020), exploring the role of creativity in manufacturing is relevant for allowing more and more companies to realize the real value and profitability in a new and more sustainable way of doing business. Alternatively, creativity may be seen as pivotal at least for *surviving* the new business manufacturing landscape (different from service ones; Castro *et al.*, 2011) – featured by advanced technology and business models shifts (Leoni, 2015, 2019) such as, electrification, connectivity, autonomous transport and the circular economy (Panetto and Molina, 2008; Garetti and Taisch, 2012).

In this regard, we advanced this special issue (SI) to better understand how creativity impacts manufacturing firms and related performance. In particular, the ambition with this SI is to bring further knowledge on the relationships between different means of organizing, managing or way of working with creativity in manufacturing firms and their associated effects on performance. In summary, this SI aims to explore (1) the creative process, (2) the creative product, (3) the creative person/group, (4) the creative context and (5) the way in which all these elements mutually interact, with regard to manufacturing firms' performance.

Accordingly, some important questions posed to potential authors of this SI – among which some have been answered – were as follows:

- (1) How creativity may help manufacturing firms to overcome different challenges (e.g. improving internal production processes, strengthening customer relationships, increasing labor productivity, increasing demand responsiveness, meeting customer demands for product customization, improving product and service quality, improving labor flexibility, enhancing supply chain collaboration, optimizing supply chain performance, allowing faster and more frequent new product releases and launches) and, as a consequence, improve their performance?
- (2) What are the manufacturing firms' resources and capabilities that can enhance/limit creativity?
- (3) How do digitalization technology and its use influence the creativity management in manufacturing firms?
- (4) Under which conditions the manufacturing environment can enhance/limit creativity?
- (5) How individual/group/organizational inner characteristics influence creativity management in organizations and how such relations affect the manufacturing firms' performance?
- (6) What are key success factors for effective creativity management in enhancing manufacturing firms' performance?

In the following section, we will introduce some descriptive data of the articles and authors of this SI together with an explanation of how the articles in this SI approached the questions posed above. The last section is then focused on the future research that have not been fulfilled or that have been opened by articles of this SI.

2. Selected papers: what do they bring to light?

The SI has received particular attention from numerous authors: more than 50 original articles were submitted to the SI and, of these, nine have been accepted for publication. Corresponding authors of the nine selected papers represent a wide geographic spread (i.e. China, Cyprus, Germany, Hong Kong, Italy, Norway, Spain and Thailand), confirming that the theme of creativity in manufacturing arouses interest on a global level. Each of the nine selected articles contributes in a different way to the knowledge development on the subject of creativity in manufacturing contexts. All the papers are based on empirical research: eight

of them are survey based and adopt a quantitative analysis approach, while one presents a longitudinal case study and then qualitatively analyzed.

According to the nine selected papers, six crucial elements may be interpreted – shown in [Figure 1](#) – that manufacturers need to consider in order to approach creativity in a way that it may positively impact firms’ performance: (1) leadership styles and employees’ creativity, (2) organizational agility (OA) and organizational flexibility (OF), (3) organizational creativity types, (4) Industry 4.0 technologies, (5) sustainability orientation and (6) context dynamism.

2.1 Leadership styles and employees’ creativity

The impact that creativity can have in terms of the manufacturing firm performance is certainly primarily determined by how this creativity is perceived and used by leaders and employees of the firm itself. In this vein, the article *Achieving green product and process innovation through green leadership and creative engagement in manufacturing*, by [Begum et al. \(2021\)](#), addresses transformational leadership in relation to creative process engagement, green product innovation, and green process innovation. The study is a quantitative analysis using structural equation modeling (SEM) based upon a survey questionnaire from 291 middle and lower-level managers and employees. A simple random sampling approach was conducted with four high-tech manufacturing industries situated in Beijing, Shanghai and Shenzhen in China. The need to focus manufacturing innovation efforts in order to reduce pollution, recycle waste and conserve energy is 21st century imperatives. The implications outlined here are that leadership may be seen as one of the most important factors for environmental management in enterprises and as such a new leadership paradigm is needed to fully address green product and process innovation.

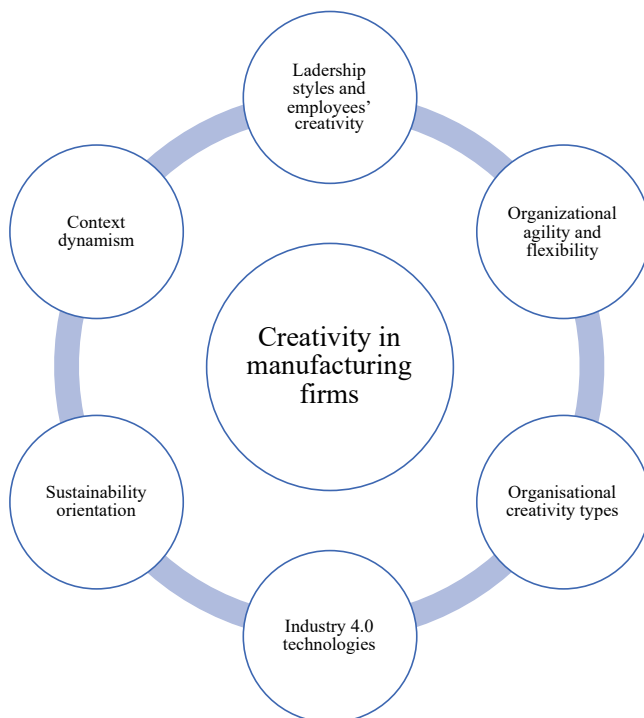


Figure 1.
Emerging elements shaping creativity in manufacturing firms’ performance

The article *Cognitive biases' influence on employees' product creativity and product performance: evidences from Italian manufacturing technology firms*, by Cristofaro Matteo, Leoni Luna and Giardino Pier Luigi, aims to provide more evidence on creativity in manufacturing firms by investigating the relationship between employees' cognitive biases and creativity, considering the manufacturing technology setting. The study developed and tested five hypotheses through a survey administered to 555 research & development employees and their direct managers that are, respectively, involved and responsible for the proposal of manufacturing technology products. Data analysis has been carried out through correlation analysis, hierarchical regression, mediation analysis and SEM. Results of the study show that the presence of employees with high-implicit creative personality and teams with high shared leadership lead to the occurrence of cognitive biases that positively influence employees' product creative processes and related performance.

Leadership and management also provide the context for the article *The impact of management support on individual learning opportunity and creativity performance in Hong Kong manufacturing companies*, by Sun *et al.* (2021). In this article, the level of managerial support for staff in manufacturing firms is analyzed in relation to staff creativity and learning opportunities. The research involves survey data collection from 266 employees working in Hong Kong-based manufacturing firms and analyzed using variance-based SEM. Creativity and learning, both individual and organizational, are highlighted as important characteristics to support innovation processes which help maintain firm competitiveness. A relevant and dynamic role for managers in creating positive environments for risk-taking is also highlighted in this article. The emphasis is not necessarily on creative exploration in active manufacturing processes but in the approach to continued individual and organizational learning.

2.2 Organizational agility and flexibility

Agility and flexibility capacities are fundamental for firms in order to properly adapt to the changing environment as they stimulate creativity that, in turn, affect new product development. In this regard, the article *Untangling Service Design Routines for Digital Servitization: Empirical insights of smart PSS in maritime industry*, by Solem *et al.* (2021), explores how the application of creative design principles in a manufacturing company in the maritime industry. Digital servitization business models are an important context for this work and are described as requiring a shift in organizational innovation activities and routines. The authors choose to investigate service design as an effective approach to enable businesses in this sector to innovate. This is a creative, human-centered and iterative approach to innovation driven by strong customer–employee engagement. The research presented in this empirical study is conducted as a longitudinal case study of a marine solution provider using a qualitative action research approach over a three and a half-year period. Rich data sources are collected data through in-depth interviews and informal conversations involving senior managers, project members and customer representatives.

In the contribution *Cultivating product innovation performance through creativity: the impact of organization agility and flexibility under technological turbulence*, by Puriwat and Hoonsopon (2021), OA and OF in relation to radical vs incremental product innovation is explored. This empirical article is based on quantitative survey data collected from 431 managers overseeing new product development in the food and beverage, chemical and engineering industries. Regression analysis is used to test the hypotheses. The five constructs used for these OA, OF, technological turbulence (TT), NPD performance (PER) and degree of innovation (INN). The capacity for organizations to adopt agile and flexible approaches to resource and project management are offered as important for product innovation, enabling firms to not only withstand, but take advantage of the opportunities afforded by TT.

2.3 Organizational creativity types

Research on relations between the specific types of creativity and specific innovation forms are still lacking. The study *Linking Incremental and Radical Creativity to Product and Process Innovation with Organisational Knowledge*, by Bulut *et al.* (2022), aims to shed light on this under-researched area between organizational creativity types (i.e. incremental- or radical-creativity) and forms of innovation (i.e. product- or process-innovation) by considering the moderating roles of knowledge-sharing practices in both service and manufacturing firms. The research was drawn from over 250 employees in service and manufacturing firms operating in Pakistan. The study conducted principal component analyses and multiple regression analyses to test the research hypotheses. The research found that both forms of innovation have significant effects on firm performance, and both types of creativity predict the success of innovation. However, the research found sector-specific differences in these relations. In service firms, radical creativity is more potent than incremental creativity in influencing product and process innovation. On the other hand, in manufacturing firms, incremental creativity is significantly correlated to product innovation, whereas process innovation has a stronger association with radical creativity. Moreover, knowledge *intensity* found to be more essential for service firms, while knowledge *quality* was found to be more meaningful for manufacturing firms.

2.4 Industry 4.0 technologies

Global Value Chains (GVCs) are platforms for knowledge flow and inter-firm collaboration and thereby important sources to transfer and access external knowledge. By drawing on organizational learning theories, the article *Global Value Chain breadth and firm productivity: The enhancing effect of Industry 4.0*, by Opazo-Basáez *et al.* (2021), argues that the relationship between GVC breadth and firm productivity follows an inverted U-shaped pattern that can be explained by the interplay between external knowledge access and the coordination costs associated with GVC breadth. Further, authors argue that digital technologies under the umbrella of Industry 4.0 have the potential to influence both GVC configuration and geographical dispersion. The study tested these predictions using a purpose-built survey among a sample of 426 medium- and large-sized enterprises (MLEs) working in the manufacturing sector. The study results indicate the adoption of Industry 4.0 technologies widens GVC breadth and thus knowledge access sources and performance configurations. The study reveals that organizations adopting traditional manufacturing systems reach their productivity peak when implicating in GVC relationships of 11 linkages. Conversely, those organizations operating under the Industry 4.0 paradigm reach their productivity optimum when becoming involved in GVC relationships of 131 linkages, which is 12 times more breadth. The empirical results confirmed the theoretical prediction of an inverted U-shaped pattern. Moreover, the study demonstrates that in complex environments, Industry 4.0 enhances knowledge acquisition and creativity in a form that boosts firm's capacity to operate in complex production networks, responding to recent calls for more research on the benefits of Industry 4.0 within technology management.

2.5 Sustainability orientation

Sustainability orientation is integrated into organizational creativity and sustainability-oriented innovation encompasses innovation and sustainability in all its breadth that will contribute to a feasible organizational development. In this regard, the article *Organizational creativity and sustainability-oriented innovation as drivers of sustainable development: overcoming firms' economic, environmental, and social sustainability challenges*, by Souto (2021), aims to analyze the links between organizational creativity (which integrates sustainability orientation), sustainability-oriented innovation and the multidimensionality of

firms' sustainability performance. The study focuses on an SME context since sustainability studies of SMEs are still scarce, especially the link between creativity and SMEs performance has received less attention. The study was based on 417 responses collected through an online questionnaire from manufacturing SMEs in UK, Germany, Spain and Italy. The study used PLS-SEM statistical technique for the hypothesis testing. Research found that organizational creativity and sustainability-oriented innovation are positively associated with economic, environmental and social sustainability performance; sustainability-oriented innovation has a partial mediation effect on the relationship between organizational creativity and economic, environmental and social sustainability performance; and organizational creativity has a positive effect on sustainability-oriented innovation. The results show that managers must integrate the three sustainability dimensions in the generation and implementation of organizational creativity, while reconfiguring creative and innovation processes to effectively impact economic, social and environmental sustainability performance simultaneously. The study proposes three major basic recommendations for SMEs and their managers, namely integration, alignment, and linkage. Integration, alignment and linkage turn creativity and innovation into an engine for sustainability development of the organization.

2.6 Context dynamism

Manufacturing firms' organizational support for creativity can help them to remain competitive in dynamic contexts. Although the general importance of organizational creativity for market success is undeniable, few studies on manufacturing firms have provided a nuanced view of how this relationship is affected by firm-external factors (e.g. different levels of market dynamism) and whether and how this leads to greater market success. The article *The Effect of Organizational Support for Creativity on Innovation and Market Performance: The Moderating Role of Market Dynamism*, by [Baccarella et al. \(2021\)](#), addresses this research gap by providing a deeper understanding of the role of organizational support for creativity in driving strong market performance in highly dynamic markets. The overall aim of this research was to examine whether and how organizational support for creativity helps manufacturing firms remain competitive in environments with different levels of market dynamism. The study was based on survey data from 255 chief executive officers (CEOs) and top managers of manufacturing firms in Germany. The study performed different regression analyses to test for direct, mediation, moderation and moderated mediation effects. The results show that, in highly dynamic markets, organizational support for creativity indeed helps manufacturing firms to remain competitive by positively influencing firms' innovation performance, which subsequently results in improved market performance. By contrast, in markets with low dynamism, organizational support for creativity has no impact on firms' innovation and market performance. The study provides novel insights into creativity research by offering a more nuanced understanding of how organizational support for creativity in manufacturing firms relates to market success and introduces market dynamism as an important moderating factor. In particular, findings add to knowledge on the interplay between creativity-enhancing mechanisms within organizations and firms' market performance, especially in markets with varying levels of dynamism.

3. Moving towards the future for the creativity in manufacturing firms

Based on the nine published papers in this SI, six elements – i.e. (1) leadership styles and employees' creativity, (2) OA and OF, (3) organizational creativity types, (4) Industry 4.0 technologies, (5) sustainability dimensions and (6) context dynamism – emerged as critical to organize and manage creativity to positively impact manufacturing firms' performance.

Stemming from them and from the research avenues pointed out in published papers, four main future research avenues can be drawn, see [Figure 2](#).

First, we encourage researchers to identify, map and test the correlation, inter-dependencies and even trade-offs between these six elements, considering diverse company contexts (e.g. start-ups, SMEs and large manufacturing companies). Yet, researchers are encouraged to understand the role played by diverse cultures as well as the differences between emerging or developed economies in terms of creativity practices within firms at different levels (individual, team and organizational). This would push further the theorization of some concepts (e.g. green leadership) as well as generalize their results. *Second*, it emerged a need of investigating how firms might organize product development teams to handle the potential of Industry 4.0 (i.e. TT) and uncertainty and also how teams might improve performance for different types of product innovation. *Third*, creativity should be increasingly looked at in a systemic way. In this vein, researchers may concentrate their efforts in investigating how different firm-internal factors (e.g. sustainability-oriented leadership and entrepreneurship) and firm-external factors (e.g. context dynamism and stakeholder interaction) together interact with and influence individual/team/organizational creativity. This pushes, *de facto*, to a co-evolutionary approach of creativity ([Drazin et al., 1999](#)) that should pass from a renewed view of the sense-making perspective that considers how cognitive and affective variables interact and form new (creative) mental models ([Cristofaro, 2021](#)). By doing so, it will be possible to better understand and to advance knowledge on how creativity can provide novel and better ways for enhancing manufacturing firms' performance, especially in the context of multi-actors or cross-organizational teams and in line with the UN Sustainable Development Goals – especially the SDG 12 on sustainable and responsible consumption and production patterns. *Fourth*, the increasingly stronger integration between manufacturing and service companies is likely to present an important area of work, mainly due to the fact that exploitation of creativity is thought to improve product-service integration (i.e. servitization) processes ([Leoni, 2015, 2019](#)).

According to the practical implications of published articles of this SI, they together push toward a managers' mindset change, especially of those in manufacturing technology firms interested in ameliorating the firm's overall performance. In particular, managers are called upon to give particular importance to their leadership style and to subordinates' creativity. In fact, the

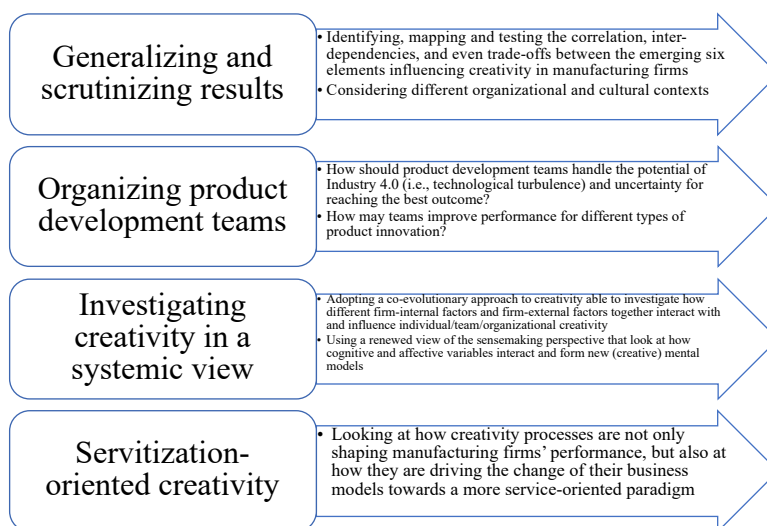


Figure 2. Main research avenues for investigating creativity in firms' manufacturing

correlation between management support and individual creativity is relevant and influential and practitioners are, therefore, suggested to consider shifting their organizational climate toward a more agile and flexible structure as to involve more and more heterogeneous minds in the creative process of manufacturing firms. Implementing this change would shift the framing of competition from a “blood and fight” paradigm (Porter, 1979) to a cooperative one (Dagnino and Rocco, 2009). In particular, this would facilitate the increasingly important role of *circular economy* approaches by manufacturers; indeed, “this kind of innovation constitutes the core of what it means to be human: enabling wealth creation and success but with respect for the planet, supporting its survival for future generations” (World Manufacturing Foundation, 2021, p. 9). In fact, more cooperative processes enabled by collective intra-firm and inter-firm creativity would allow new ideas for reusing, recycling, remanufacturing and redesigning circular products and materials to be put into practice – globally impacting every part of the manufacturing value chain. This, of course, could benefit from data sharing among stakeholders and the savvy use of technology developments (e.g. Internet of Things, Blockchain, artificial intelligence, 3D printing and clean technologies), such as finding the way to adopt tracking technology for taking back and refurbishing goods for a second life cycle or creatively developing new sophisticated printing technologies able to answer the need of large volumes of primary raw materials – which should increasingly be “self-healing” and “shape-shifting” as to prolong their shelf life. However, it is true that this orientation – in which creativity and the behavior of people is at the center – faces significant challenges, such as quality issues in recycled materials, supply chain complexities, the disassembly of products and coordination problems between companies. Notwithstanding, we think that creatively overcoming these manufacturing challenges could have positive social/health implications, foster economic growth and create more and better jobs.

Finally, we – as guest editors – would like to thank all those who have allowed the realization of this SI: the authors, whose papers ended up in this SI; the numerous reviewers, who through their precious advice and constructive feedback have contributed to ameliorate the value of the selected manuscripts and the Editorial Team of the *Journal of Manufacturing Technology Management*, particularly the Editor-in-Chief, Prof. Harm-Jan Steenhuis and the Editorial Assistant, Ms. Anna Rosello Campmany for their trust and support throughout the development of this SI. Finally, we hope that all researchers and practitioners embarking upon a creativity research pathway might draw interest and inspiration from this SI and find utility for their specific areas of interest.

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