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SUPPORTING PERVASIVE DIGITALIZATION IN ITALIAN SMES THROUGH AN OPEN INNOVATION PROCESS

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The year 2020 has started in a very unforeseeable way, and as the effects of coronavirus (COVID-19) rippled through the world, in most countries “non-essential businesses” were shut down and “social distancing” has been imposed to stop the spread of the virus. These measures are being put in place to minimize COVID-19, and we can observe how digitalization and increasing use of ICT solutions are important for all companies and especially for small and medium enterprises (SMEs). Indeed, during this time of social isolation, people are turning to their devices to work, entertain themselves, and stay connected to their families and friends. Companies able to rethink their business model by embracing digital transformation will have a competitive advantage in the near future, and however, all companies have been obliged to embrace a sort of digital transformation to adapt to the current situation.

This chapter aims at shedding a light on designing and implementing digital transformation and, in particular, on how to promote digital transformation initiatives in ways that benefit individuals and organizations as well as the broader society. The focus is on how Italian SMEs can handle the adoption of digital technologies given their resource constraints. Based on the outcomes of a 2019 project based on an action research initiative, we argue that using open innovation practices may accelerate digital transformation and increase innovation development, and thus help firms to establish new sustainable strategies. Based on within-case as well as cross-case pattern analysis, we find that the adoption of digital technologies in SMEs has to be guided to benefit all stakeholders. Moreover, we identify specific enablers (and

barriers) that accelerate (or impede) the advancement of the process of adopting digital technologies.

UNDERSTANDING DIGITAL TRANSFORMATION AND ITS IMPLEMENTATION

In the last two decades, the emergence of a diverse set of novel and powerful digital technologies, platforms and infrastructures has transformed both innovation and entrepreneurship in significant ways with broad organizational and policy implications (Nambisan, 2017; Nambisan et al., 2017; Yoo et al., 2010). Indeed, the phrase *digital transformation* has come into wide use in contemporary business media to signify the transformational or disruptive implications of digital technologies for businesses (e.g. Boutetiere et al., 2018), and more broadly, to indicate how existing companies may need to radically transform themselves to succeed in the emerging digital world (e.g., McAfee and Brynjolfsson, 2017; Rogers, 2016; Venkatraman, 2017).

Technological development is often recognized as a prerequisite for deploying innovation efficiently because it enhances inter-organizational collaboration, which better provides access to external resources and new markets, as well as a source of new knowledge, especially when referring to SMEs (Narula, 2004; Nooteboom, 1994).

Digital Transformation is an umbrella term that denotes a hodgepodge of technological trajectories, such as additive manufacturing, big data and analytics, collaborative robots, advanced simulation and augmented reality, Industrial Internet of Things (IoT), cybersecurity, and cloud computing (Gerbert et al., 2015). We refer to a bundle of heterogeneous technologies, which are associated with the ability to enable and accelerate the digital connection between products, processes, activities, and firms and that should lead manufacturing towards the so-called fourth industrial revolution, "Industry 4.0".

Despite the recognized benefits of digital transformation, it is unclear how firms handle the adoption of digital technologies, especially SMEs which have significant resource constraints. The investigation on the obstacles focused on single technologies in the extant literature. On the one hand, such fragmentation allows us to identify the mismatch between specific organizational factors and the logic of particular families of technologies. On the other hand, such fragmentation risks slowing down our understanding of digital transformation for two reasons: firstly SMEs might not be as granular as assumed by these studies but they might be recalcitrant towards digital as a whole; secondly, if the assumption that digital technologies break down functional silos in organizations and command integration among different firms in a supply chain and enable end-to-end production and circulation of information, a holistic approach and a systemic view, rather than a local and partial one, might be advisable.

In this fragmented literature, nonetheless, different categories of obstacles are found. Resource constraints are among the most cited factors in the literature. Moreover, given their size, SMEs are often “domain specialists” focusing on the essential operations to develop and manufacture discrete products and lack in general management and infrastructural functions such as IT. As a consequence, they tend to be less aware than larger-firms of new trends and transformations and tend to show conservatism behaviors towards new technologies, processes, and ways of doing things. They face mismatches in the search for specialized skills in the labor market, since large and more structured firms signal better, and thus attract, their propensity to invest in new technological advancements (for a synthesis of the literature addressing the gaps, see i.e. Coleman et al., 2016).

According to Gabrielli and Balboni (2010), the human capital of SMEs’ entrepreneurs and managers play a crucial role (e.g.: the more entrepreneurs, managers, and skills are familiar with digital technologies per se, the more they are prone towards their adoption in their organizations). Conversely, not only organizational factors influence the adoption of digital

technologies by SMEs. Given their conservative way of thinking and the impossibility to dedicate scarce resources to the experimentation of novel ways of doing things, these firms tend to mimic the practices and strategies of competitors and other firms in the same industry or strategic group (Karjaluoto, Huhtamaki, 2010). Signals are given within the organizations, then, are crucial in giving the whole firm momentum and in creating widespread commitment towards the adoption of digital technology and the subsequent change in how firms do business (Bharadwaj, Soni, 2007). Immersed as they are in the operational minutiae of the firm both for human resource scarcity and for their technical and operational experience, entrepreneurs and managers in small firms might be not entirely convinced or able to frame how digital tools might be used to improve their firms' efficiency or efficacy and might be suspicious of the effects of digital transformation.

The open innovation literature has focused on the sharing and flow of knowledge and technological assets across organizational boundaries in pursuit of innovation and entrepreneurship (e.g., Chesbrough, 2003; Dahlander and Gann, 2010; West and Bogers, 2017). Empirical work conceptualizing Open Innovation in SMEs reports a broad range of approaches to external technological collaborations and a huge variety of partners involved (Brunswicker and Vanhaverbeke, 2015; Nieto and Santamaria, 2010; Parida et al., 2012). Innovating SMEs extensively rely on external networking to access new relevant knowledge and missing innovation assets, while customer involvement is the most common OI practice for external technology exploitation (van de Vrande et al., 2009). Open innovation practices range from outside-in and inside out to coupled processes that involve "co-creation with (mainly) complementary partners" (Enket et al., 2009). Besides the collaboration, co-creation initiatives span with many external actors (West et al., 2014) as universities, government bodies, intermediaries, and citizens. These actors, in innovation processes, are resource integrators, extremely valuable especially for SMEs (Narula, 2004). A similar approach is found in the

Triple Helix theory able to interpret the upcoming events of the fourth industrial revolution, which is bringing subversive dimensions for any kind of socio-economic organizations (businesses or universities or governments) and where the firm is playing a core role (Ryan et al. 2018).

THE MULTISTAKEHOLDER DIGITAZION PROCESS IN VENICE

Understanding the reasons behind the delay of SMEs in the adoption of digital technologies is crucial in countries such as Italy. According to the Digital Economy and Society Index (European Commission, 2019), Italy has a long way to go as it ranks 23th out of the 28 EU Members, thus it is still below the EU average. The data about the use of e-commerce and Internet service, recourse to ICT specialists, fast broadband and cloud computing services show low investments in digital technologies. Istat (2019) data confirm that Italian firms are not highly digitized: only 3% have completed the digital transformation. These firms are mainly medium-sized or large firms that account heavily for added value (25%) and workers (13%), however, they cannot sustain the whole national economy.

This chapter presents the findings of a project aiming at supporting the digital transformation of small and medium-sized (with an emphasis on micro-) firms, financed and co-managed by the Chamber of Commerce of Venice (in partnership with Ca' Foscari University of Venice) within the framework of the Italian governmental strategy on digital transformation and industry 4.0. The purpose of the 2019 project was to introduce and walked through two waves of approximately 40 SMEs towards digital transformation providing mentoring, knowledge, and facilitating networking activities.

The project was designed as an action research because of its distinctive character to address the twin tasks of bringing about change in organizations and in generating robust, actionable knowledge (Lusher & Lewis, 2008). As such it is an evolving process that is undertaken in a spirit of collaboration and coinquiry, whereby research is constructed and conducted with

members of a social system, rather than on or for them (Coghlan & Shani, 2018; Shani & Pasmore, 1985).

Therefore, an 8 months' co-creation process was structured to promote digital transformation, following open innovation practices, inspired by Design Thinking mainly for three reasons. First, the process is characterized by continuous interactions among different actors, namely the SMEs, five researchers from two different university departments (Computer science and Management), 20 digital promoters (equally distributed in the two departments/areas and selected by the University researchers), a University Foundation (4 project managers) and the Chamber of Commerce (3 members). This orientation toward co-creation introduces a distinctly social focus, and emphasis on collaboration that other methods lacked. The second essential element of design thinking relates to the role of empathy (Patnaik, 2009). Empathy goes beyond mere recognition of the subjectivity of the design domain; virtually all current descriptions of the process emphasize design thinking as human-centered and user-driven as a core value. The third element builds on the design's strong emphasis on the concrete and the visual to emphasize specifically the key role of prototyping. Certainly, prototyping has long been a central feature in fields such as architecture and product development, but design thinking's view of prototyping diverges from the kind of sophisticated 3D prototypes and models traditionally seen in these fields: its function is to drive real-world experimentation in service to learning rather than to display, persuade, or sell; these prototypes act as "playgrounds" rather than "dress rehearsals" (Schrage, 1999).

The initiator was the Chamber of Commerce who opened the first call in December 2018: from an initial group of 45 firms, we got a final sample of 38 firms located in the Venetian area. In terms of firm size, the sample was mainly made up of small firms (49%), whilst micro-firms accounted for 38% and medium-sized for 13% (2.31 employees on average). Most firms were B2C (42%), and some were simultaneously active on both segments B2C and B2B (21%).

Based on a self-assessment questionnaire each firm positions itself on a continuum from newcomers to champions: our sample firms were mainly divided into two very different groups, namely apprentices (33%) and specialists (47%). In general, they were very keen on investing in digital (95%) and digital training (60%).

Each SME has been assigned to a small team of digital promoters (in each team we ensured a mixed knowledge about management and technologies) who fully accessed the digital maturity of the organization. Then, all SMEs were invited to participate to 2 full days of hands-on training around technology 4.0, and soon after the digital promoters visited the assigned SME to gain a deeper understanding of their situation in terms of digitalization, resources, corporate organization and strategy. This phase culminated in June 2019 with the selection of five SMEs, in each enterprise we ran a tailor-made co-creation workshop focusing on the main problem encountered. In July each group suggested an actionable roadmap toward digital transformation indicating the different steps, based on a deeper understanding of each scenario/situation. The full process is presented in figure 1.

Figure 1: Project Timeline



Our action research protocol identifies two cycles. The first cycle aimed at diffusing knowledge on new technologies among participant firms and gain insights from them, working on reducing hidden costs. The output was the identification of the organization complexities faced by our

sample SMEs and of the most critical areas where adopting digital technologies. The second cycle, inspired by the design thinking approach, focused on five selected SMEs. The aim was to uncover, generate, and analyze interesting insights emerging mainly from their customers. In particular, the first cycle generated a collaborative understanding of SMEs opportunities to adopt 4.0 digital. Therefore, this cycle ended with semi-structured interviews to explore the business model and identify which possible technology could be adopted to develop more fitting strategies.

The second cycle lasted 3 months and aimed at challenging a technology-driven approach in favor of a strategic decision making one, promoting a human-centered and user-driven vision as a core value instead. In other words, the trigger of the process was not the potential of technologies, but a focus on the strategy of firms and the interests and perspectives of individual members. After identifying potential strategic evolutions and re-design of firms' business models, technologies were considered and selected as enablers of these transformations.

This phase was inspired by Design Thinking, and involved the five selected SMEs, to maximize the diversity of contexts in which digital transformation can be implemented. According to Yin's scope of research efficacy (Yin, 2009), case selection was also based on companies' willingness to provide data and detailed information on the crucial innovation project (through which the main strategic change occurred). This choice allowed us to collect and compare grounded empirical information on the challenges faced by the SMEs. (Du et al., 2014; van de Vrande et al., 2009).

The research team jointly with the SMEs uncover, generate, and analyze interesting insights emerging mainly from the analysis of their customers to complement their previous inner view on their digital maturity. In June 2019, SMEs' customers were interviewed to assess their experience. Then, in July 2019, during a one-day co-creation workshop run by interdisciplinary teams, new concepts for their future roadmaps emerged so that the firms could rethink their

business model highlighted by their customers' point of views. Subsequently, all actors prototyped one of the concepts generated during the workshops and discussed how to implement the digital transformation process.

THE PROJECT DATA

Throughout the research process, the teams designed and implemented the different phases, protocols, and tools and engaged in collaborative sense-making and sense-giving activities. We follow an abductive approach to data analysis and we constantly moved back and forth between data and theory. Next, we described how the concepts, categories, and their relationships surfaced. Our analysis commenced by reading the empirical material and arranging the events into increasingly coherent narratives. The distinctly evolutionary phases (digital starting point of SMEs, education in industry 4.0 technology, inspiration phase, ideation through co-design, reflection and implementation roadmap) afforded constant comparison among the SMEs and the process involvement (see figure 1).

During the grounded sensemaking, the co-authors conceptual understanding of the walk-through process on digitalization played an integral role in categorization. We reviewed the literature to generate ideas and theories to read the initiative's evolution. Leveraging our notes and our observations, we coded the data into categories that clustered into three overarching constructs: governance mechanisms, technology attitude, organizational structure. Our sources are shown in table 1.

Table 1: Project data

Data Source	Data Type	Analytical Use
Questionnaires	45 self-assessment (SEIFI 4.0)	Point of departure- Gathering data regarding SMEs digital readiness
	38 In details on digital capabilities and knowledge with the help of digital promoters (ZOOM 4.0)	Collecting key understanding for each contest, richer and more specific on digital technologies than the self-assessment
	Additional demographic data for the 38 SMEs	Detection of differences in sectors and resources
Interviews	Semi-structured interviews (38) - face to face with CEOs, each lasting about two hours - 76 hours (audio)	Gaining familiarity with the process of each SMEs and the framing used around digital technology. Collecting qualitative information about each contest and the client firms' aims.
	Internal meetings with the team project team (6). Each meeting lasts 3 hours	Meetings were organized to decide, verify, and gathering feedback with the team on data, interpretations, and themes emerging from the authors' coding, by an iterative process.
	Focus on 5 selected interviews transcribed (171 pages) of the SMEs who were selected to obtain the tailor-made co-creation workshop	In-depth qualitative analysis To trace back and triangulate all the process accomplished by each of these SMEs since the beginning.
Reports	38 Reports	Triangulation of context information. All the reports were presented to the SMEs and we gather feedback on the solutions indicate
Workshop co-creation outputs	5 co-creation sessions - each tailor-made for the selected SME. Per workshops, we collected the outputs: 4 or 5 concepts per session.	Detection of differences from the report to the WS outputs Triangulation of contest information about selections criteria confirmation and performances assigned by the platform

EMPIRICAL FINDINGS AND DISCUSSION

Innovation literature suggests that being able to innovate is the result of specific strategic decisions carried out by firms. These decisions are influenced by several variables, including size (De Jong and Vermeulen, 2006), institutional frameworks (Blind et al., 2017), entrepreneurial culture (Shan et al., 2016), the amount of resources dedicated to R&D (Baumann and Kritikos, 2016), public financing (Szczygielski et al., 2017) and abilities in creating and nurturing networks and collaborations with third parties (Schøtt and Jensen, 2016). Our research action allows us to verify that the adoption of digital technologies in SMEs has to be guided and external actors must act as "mentors" and gatekeepers for SMEs to benefit both individuals and organizations. As a result, policy interventions should move from a subsidizing

logic (i.e. tax deductions for Industry 4.0-related investments or loans) towards a network model (as the Triple Helix Model) oriented to relations and processes: SMEs should interact more effectively and share information in a process governed by a public agency/actor. Indeed, firm-specific innovation and acceleration processes were developed toward digital transformation based on open innovation strategy and design thinking approach. To conclude, we can identify specific enablers and barriers that accelerate or impede the advancement of the process of adopting digital technologies.

ENABLERS

Design workshops enabled the observed SMEs to move forward, managing conflicts between opposing frames, typically being held by different generations within firms: younger generations pushing for new business conceptions and strategies collided with older leaders preserving traditional industry recipes and strategic templates. The neutralization of this tension was obtained through the introduction of a different and external point of view, able to ignite a rethinking process.

Design workshops help in “framing” the problems that entrepreneurs were facing in different ways: external interpretive schemes, categories, language, and perspectives are useful in subtracting entrepreneurs from their inertial behavior and cognitive traps due to past experiences, and "tunnel vision", that is the posture according to which an entrepreneur or a manager frames problems relying on previous successful approaches. In particular, design workshops allow them to connect their daily routines with the customer experience, which gives leaders the possibility to move the discussion from features and functionality on another level, not just on. The integration of customer experience into their roadmaps allowed them to better understand how to choose technology strategies which will allow the organization to deliver a

certain customer experience. An experience that could be designed by capturing core customer and user needs, and identifying appropriate product features and technology choices.

The second enabler was the possibility to "try something" without commitments. Indeed, the possibility to test a concept instead of committing to a specific technology was a way to better understand how to enrich and complement their current provided service for customers and how to evolve it. Prototyping had a huge impact on enlarging the range of possibilities, but also in considering a lot of different technologies. Thus, what our research suggests is that in advising SMEs in efforts of digital transformation might benefit from the use of design thinking methods since these allow the firm to focus not on the technology but on systemic and holistic transformations of their ways of doing business. Thus, technologies become more intelligible within a larger frame, rather than unintelligible sets of gadgets and devices whose business function might be obscure or perceived as "not adequate" to the specificities of small and micro-enterprises.

BARRIERS

We observed that small companies are often trapped in their daily routine, with no resources to spend on innovation activities and no time to embrace digital literacy (inertia). Despite literature, which often suggests that SMEs are more suitable for innovation projects because they can be more flexible in their routines (Christensen et al., 2005), we found that they are stuck in their daily duties and a lot of different tasks are often accomplished by the same resource, which has no time to embrace the knowledge on new technologies. Therefore, the decision-making process on digital transformation, and more in general on innovation activities, relies on the intuitions of few resources which already play a huge role in the daily activities and have no time to embrace "bigger pictures". Indeed, digital transformation is not only a

technological process and requires personal transformation, managerial cognition renewal as well.

We identify a possible moment of breakthrough for the adoption of new technology: the transaction to new leadership, or better, the facilitation of the emergence of new leaders, and thus new values and perspectives, in the organization. Specifically, in several cases, we noticed that whenever a process of generational handover (father/son, father-in-law/son-in-law) was taking place, the propensity and the interest to acknowledge new technologies and possible networking activities were growing. The newly appointed leaders demonstrated an open attitude to embrace new views into the organization and to consider new ways of working. The intervention of university researchers, external consultants, and personnel of the chamber of commerce, in these cases, was not just beneficial in terms of the specialized content they brought in the process of digital transformation. Rather, these external and recognized actors projected their credibility and legitimacy on the evolutionary trajectories imagined and proposed by young incoming leaders that previously struggled to obtain attention and recognition from the extant leadership in the firm. In other words, open innovation, involving universities and institutions devoted to the support of the digital transformation, works as both a source of ideas and competences but also as a provider of symbolic capital for incoming young firm leaders that should otherwise struggle with a "*liability of youth*" that would feed organizational inertia. Moreover, the attitude toward planning, to fit into their new roles, felt for these appointed leaders as a need to better evaluate their future directions. That is to say that the intervention of universities and institutions requires new firm leaders to upgrade their skills in planning and presenting their intended courses of actions, since the language of these institutional actors puts a prize on structured means-ends chains that might then be assessed through rigorous and objective measures (such as budget, expected results and returns on the investment, and the feasibility). In other words, open innovation involving firms, university

researchers, and institutional personnel contributes more than just providing ideas or skills: it creates a shared language, a set of categories and ways of thinking, talking, and presenting that provide the innovation process with structure. However, during the moment of transaction, we also witness many communication conflicts between the two generations, therefore sometimes we notice an even bigger difficulty to move forward.

The main takeaway of our experience is that firms need to be supported and mentored in the development of adaptive capabilities for continuous experimentation aimed at testing traditional assumptions lying at the core of their way of doing business. Fast and low-cost prototyping as a way to devise and strategize according to different future scenarios will be fundamental in preparing firms to be adaptable enough to deploy digital technologies when the imagined changes materialize.

This project reveals a peculiar manifestation of the effects of the triple helix model. While aimed at solving discrete needs and demands—specifically, the need to understand and then deploy specific digital technologies in SMEs—the collaboration among institutions, universities, and firms generated "byproducts" that are, ultimately, crucial in digital transformation. One of these byproducts is the creation of informal relations among small firms. Thick networks of relation among SMEs, we suggest, are not solely conduits for the collaborative development of discrete solutions through the pooling of ideas and knowledge. They rather produce a sense of identity and cohesion that helps these firms to first and foremost make sense of the challenges and to develop a sense of community that enables the subsequent search for solutions.

A final remark for further research is to consider the strategy transition from a focus on products to one that emphasizes services or rethinks a firms' offering in terms of bundles of products and services. As often stated, digital technologies, with their potential to generate, accumulate and store data at every step of the value chain, allow firms to provide clients with sophisticated

bundles of products and services, especially when they move towards smart products. The transition for SMEs is easier said than done: packing products with services, requires firms to abandon a focus on products and production processes, while triggering design efforts and the conception of ecosystems of products and services with the immersion and in-depth understanding of customer experiences. Anchoring strategic planning in customer experiences generates in these firms still fierce resistance. This is an area where open innovation approaches as those illustrated in this chapter might be beneficial.

REFERENCES

- Bharadwaj, P.N. and Soni, R.G., (2007). E-commerce usage and perception of e-commerce issues among small firms: Results and implications from an empirical study. *Journal of Small Business Management*, 45(4), pp. 501-521.
- Baumann, J., & Kritikos, A. S. 2016. The link between R&D, innovation and productivity: Are micro firms different? *Research Policy*. <https://doi.org/10.1016/j.respol.2016.03.008>.
- Blind, K., Petersen, S. S., & Riillo, C. A. F. 2017. The impact of standards and regulation on innovation in uncertain markets. *Research Policy*. <https://doi.org/10.1016/j.respol.2016.11.003>.
- Boutetière, H., Montagner, A., & Reich, A. 2018. Unlocking success in digital transformations. *McKinsey & Company*. <https://www.mckinsey.com/business-functions/organization/our-insights/unlocking-success-in-digital-transformations.%0A>.
- Brunswick, S., & Vanhaverbeke, W. 2015. Open Innovation in Small and Medium-Sized Enterprises (SMEs): External Knowledge Sourcing Strategies and Internal Organizational Facilitators. *Journal of Small Business Management*, 53(4): 1241–1263.
- Chesbrough, H. W. 2003. The new imperative for creating and profiting from technology. *Harvard Business Publishing*. <https://doi.org/10.1111/j.1467-8691.2008.00502.x>.
- Christensen, J. F., Olesen, M. H., & Kjær, J. S. 2005. The industrial dynamics of Open Innovation—Evidence from the transformation of consumer electronics. *Research Policy*, 34(10): 1533–1549.
- Coghlan, D., & Shani, A. B. R. 2018. *Conducting action research for business and management students*. Sage.
- Coleman, S., Göb, R., Manco, G., Pievatolo, A., Tort-Martorell, X., & Reis, M. S. 2016. How can SMEs benefit from big data? Challenges and a path forward. *Quality and Reliability Engineering International*, 32(6), 2151-2164.
- Dahlander, L., & Gann, D. M. 2010. How open is innovation? *Research Policy*. <https://doi.org/10.1016/j.respol.2010.01.013>.
- De Jong, P. J., & Vermeulen, P. A. M. 2006. Determinants of product innovation in small firms: A comparison across industries. *International Small Business Journal*. <https://doi.org/10.1177/0266242606069268>.
- Du, J., Leten, B., & Vanhaverbeke, W. 2014. Managing open innovation projects with science-based and market-based partners. *Research Policy*. <https://doi.org/10.1016/j.respol.2013.12.008>.

- European Commission. 2019. Digital Economy and Society Index (DESI). https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=59897
- Gabrielli, V. and Balboni, B., (2010). SME practice towards integrated marketing communications. *Marketing Intelligence and Planning*. 28(3), pp. 275-290.
- Gerbert, P., Rübmann, M., Lorenz, M., Waldner, M., Justus, J., et al. 2015. Industry 4.0: The Future of Productivity and Growth in Manufacturing Industries. *Boston Consulting*. <https://doi.org/10.1007/s12599-014-0334-4>.
- ISTAT. 2019. CITTADINI, IMPRESE E ICT. https://www.istat.it/it/files/2019/01/Report-ICT-cittadini-e-imprese_2018_PC.pdf
- Karjaluoto, H., Huhtamäki, M. (2010). The role of electronic channels in micro-sized brick and-mortar firms. *Journal of Small Business and Entrepreneurship*. Vol. 23(1), pp.17-38.
- McAfee, A., & Brynjolfsson, E. 2017. *Machine, platform, crowd: Harnessing our digital future*. WW Norton & Company.
- Nambisan, S., Lyytinen, K., Majchrzak, A., & Song, M. 2017. *Digital Innovation Management : Reinventing*, 41(1): 223–238.
- Nambisan, S. 2017. Digital Entrepreneurship: Toward a Digital Technology Perspective of Entrepreneurship. *Entrepreneurship: Theory and Practice*. <https://doi.org/10.1111/etap.12254>.
- Narula, R. 2004. R&D collaboration by SMEs: New opportunities and limitations in the face of globalisation. *Technovation*. [https://doi.org/10.1016/S0166-4972\(02\)00045-7](https://doi.org/10.1016/S0166-4972(02)00045-7).
- Nieto, M. J., & Santamaría, L. 2010. Technological collaboration: Bridging the innovation gap between small and large firms. *Journal of Small Business Management*. <https://doi.org/10.1111/j.1540-627X.2009.00286.x>.
- Nooteboom, B. 1994. Innovation and diffusion in small firms: Theory and evidence. *Small Business Economics*. <https://doi.org/10.1007/BF01065137>.
- Parida, V., Westerberg, M., & Frishammar, J. 2012. Inbound Open Innovation Activities in High-Tech SMEs: The Impact on Innovation Performance. *Journal of Small Business Management*. <https://doi.org/10.1111/j.1540-627X.2012.00354.x>.
- Patnaik, D. 2009. Wired to Care. *Pearson Education, Inc.* <https://doi.org/10.1017/CBO9781107415324.004>.
- Rogers, D. L. 2016. *The digital transformation playbook: Rethink your business for the digital age*. Columbia University Press.
- Ryan, P., Geoghegan, W., & Hilliard, R. 2018. The microfoundations of firms' explorative innovation capabilities within the triple helix framework. *Technovation*. <https://doi.org/10.1016/j.technovation.2018.02.016>.
- Schött, T., & Jensen, K. W. 2016. Firms' innovation benefiting from networking and institutional support: A global analysis of national and firm effects. *Research Policy*. <https://doi.org/10.1016/j.respol.2016.03.006>.
- Schrage, M. 1999. *Serious play: How the world's best companies simulate to innovate*. Harvard Business Press.
- Shan, P., Song, M., & Ju, X. 2016. Entrepreneurial orientation and performance: Is innovation speed a missing link? *Journal of Business Research*, 69(2): 683–690.
- Shani, A. B., & Pasmore, W. A. 1985. Organization inquiry: Towards a new model of the action research process. *Contemporary Organization Development: Current Thinking and Applications*, Scott, Foresman, Glenview, IL, 438–448.

- Szczygielski, K., Grabowski, W., Pamukcu, M. T., & Tandogan, V. S. 2017. Does government support for private innovation matter? Firm-level evidence from two catching-up countries. *Research Policy*. <https://doi.org/10.1016/j.respol.2016.10.009>.
- van de Vrande, V., de Jong, J. P. J., Vanhaverbeke, W., & de Rochemont, M. 2009. Open innovation in SMEs: Trends, motives and management challenges. *Technovation*. <https://doi.org/10.1016/j.technovation.2008.10.001>.
- Venkatraman, V. 2017. *The digital matrix: new rules for business transformation through technology*. Greystone Books.
- West, J., & Bogers, M. 2017. Open innovation: current status and research opportunities. *Innovation: Management, Policy and Practice*. <https://doi.org/10.1080/14479338.2016.1258995>.
- West, J., Salter, A., Vanhaverbeke, W., & Chesbrough, H. 2014. Open innovation: The next decade. *Research Policy*, 43(5): 805–811.
- Yin, R. K. 2009. Case Study Research: Design and Methods. *Essential guide to qualitative methods in organizational research*. <https://doi.org/10.1097/FCH.0b013e31822dda9e>.
- Yoo, Y., Henfridsson, O., & Lyytinen, K. 2010. The new organizing logic of digital innovation: An agenda for information systems research. *Information Systems Research*. <https://doi.org/10.1287/isre.1100.0322>.