

An IT Infrastructure for Small- and Medium-sized Enterprises Willing to Compete in the Global Market

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Abstract: *Context:* Small and medium-sized enterprises (SMEs) are the backbone of the economy of most countries. There is large evidence in the literature that digitalisation improves the market performance of enterprises and, as a consequence, it helps the growth of their businesses. *Aims:* The present position paper sketches the authors' vision about an IT infrastructure for SMEs willing to compete in the global market. *Method:* A literature review is conducted on relevant topics concerning SMEs. In light of the published studies, two factors are essential for the survival of SMEs in the global market: (a) ally themselves with SMEs operating in the same market segment; (b) offer an amazing shopping experience to their customers. *Results:* The pillar of the proposal is the notion of Digital Network (DN), i.e., a network of collaborating SMEs physically distributed over a territory, which share the objective of selling goods and/or services to potential consumers through a digital platform. We envision the availability of a "generator" of DNs as the main pillar for helping SMEs. Each instance returned by the generator consists of two integrated portals: the SMEs Portal and the Customer portal. The present study provides preliminary findings that give substance to the soundness of the started project.

1 INTRODUCTION


"Small and medium-sized enterprises (SMEs) are the backbone of Europe's economy. They represent 99% of all businesses in the EU. They employ around 100 million people, account for more than half of Europe's GDP and play a key role in adding value in every sector of the economy."¹ In Italy, for example, there are about 3.7 million SMEs that employ 11.7 million persons². "SMEs are made up of enterprises which employ fewer than 250 persons and which have an annual turnover not exceeding EUR 50 million, and/or an annual balance sheet total not exceeding EUR 43 million."³

In our world of emergent and continuous changes, all companies today, and SMEs in particular, in order to be competitive must equip themselves with IT technologies and adopt new information processes capable of favoring the sharing of resources and the engagement of all corporate stakeholders, including their customers.

(Fletcher and Griffiths, 2020), in their opinion paper about digital transformation during lockdown, stated that: (a) organisations must improve their digital maturity, (b) less digitally mature organisations are more fragile and finally (c) organisations with higher levels of digital maturity are generally more flexible.

Unfortunately, implementing the digital transformation runs into multiple hostile factors, among which the multiplicity and complexity of the software solutions required for digitalization stand out. The development of different types of software applica-

(<https://ec.europa.eu/docsroom/documents/42921>).

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¹<https://ec.europa.eu/growth/smes/en>

²<https://ec.europa.eu/docsroom/documents/38662/attachments/16/translations/en/renditions/pdf>

³Definition based on Article 2 of the Annex to Commission Recommendation 2003/361/EC

tions often requires a team of analysts of the “business model” and a team of programmers who implement what the first modeled. The number of human resources to be involved is, in general, conspicuous and with a high professional profile, factors which translate into high costs. Costs that SMEs are unable to afford. In response to the conflicting intent of facilitating the Business-IT Alignment of companies without increasing the costs associated with the purchase, maintenance and management of the software, efforts are being multiplied towards the identification of innovative methods for the development of software solutions for implementing the digital transformation. The work (Sanchis et al., 2020) emphasizes the role of the *low-code paradigm* as an enabler of digital transformation in the Manufacturing Industry; while (Paolone et al., 2020) is a contribution about the low-code development of software solutions. “Low-code application platforms are expected to remain the largest component of the low-code development technology market through 2022, increasing nearly 30% from 2020 to reach \$5.8 billion in 2021.”⁴

This position paper summarises the authors’ opinion about (a) an IT organizational model thought to act as the engine of the digital transformation of SMEs towards the outside world and (b) an IT infrastructure that implements the organizational model. The latter implements the low-code paradigm.

The remaining part of the paper is structured as follows. Section 2 discusses the kind of relationship SMEs should establish with competing firms (i.e., with the SMEs operating in the same business area; e.g., agri-food, pharmaceutical, ...) and with the customers, in light of the relevant background studies. Moreover, the section recalls a recent published study about digital platforms, that is the interface between producers and consumers. Section 3 is about our vision; it is consistent with the state of the art on the background topics for the study. Conclusions and a look at the future work are the subject of Section 4.

2 BACKGROUND

Compared with other enterprises, SMEs are confronted with a unique set of issues when competing in the globalized market where operate, in a manner almost hegemonic, giants such as Amazon. Many studies agree on the need for SMEs to perform within a (*collaborative*) *network* to compensate their small

⁴Source: <https://www.gartner.com/en/newsroom/press-releases/2021-02-15-gartner-forecasts-worldwide-low-code-development-technologies-market-to-grow-23-percent-in-2021> (accessed on February 2021).

dimension and, hence, to overcome the issue, (e.g., (Fariselli et al., 1999; Rehman, 2016; Naeem et al., 2016; Zoia et al., 2018; O’Dwyer and Gilmore, 2018; Antoldi and Cerrato, 2020; Dhaundiyal and Coughlan, 2020; Benhayoun et al., 2020)).

The present section provides a closer look at the motivations behind the studies that have investigated the needs for SMEs to perform within networks. Moreover, the section recalls a recent published study about *digital platforms*. There is large evidence in the literature that digitalisation improves the market performance of enterprises and, as a consequence, it helps the growth of their businesses. The interface between producers and consumers is the digital platform.

In (Varadarajan and Cunningham, 1995), two types of alliances are described: “horizontal” and “vertical”. Within the framework of this paper, we keep the same names with the following meaning. *Horizontal* alliances involve two or more SMEs operating in the same business area (e.g., agri-food, pharmaceutical, ...) for achieving common goals (Figure 1); while *vertical* alliances concern the interactions between the SMEs, part of the network, and their suppliers and potential customers (Figure 2). The references to the state of the art is divided into two subsections. The first one concerns horizontal alliances among SMEs, while the second concerns e-commerce for the SMEs.

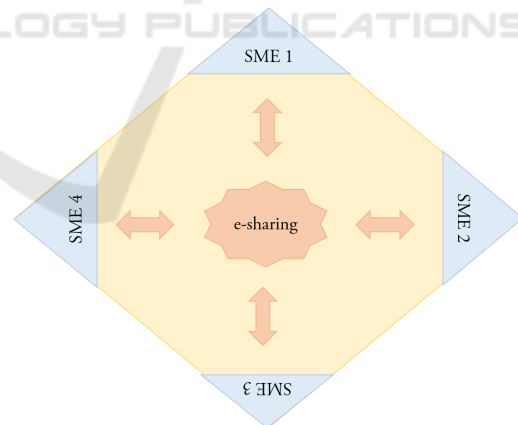


Figure 1: Sketch of the *horizontal* alliance among SMEs.

2.1 The Need for Horizontal Alliances

According to research findings, SMEs should enter alliances for a variety of reasons including the sharing of resources, skills and capabilities, access to new markets, reduced lead time for deliver, achieving economies of scale through joint purchase and reduced stocks, built joint information system, gain-

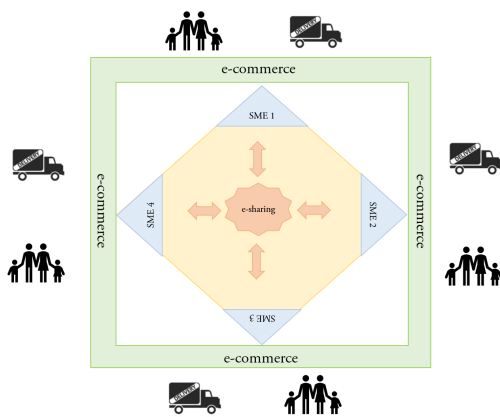


Figure 2: Sketch of the *vertical* alliance between SMEs, customers and suppliers.

ing legitimacy and mitigating risk. (Rehman, 2016), for example, says that SMEs' network alliances positively influence firms' labour productivity, innovation performance, and product/process innovation. (Naeem et al., 2016) have shown that the collaboration among enterprises improves the decision-making capability of the members of the collaborative network. The findings of (Majid et al., 2020) suggest that the network capability: (a) enhances SMEs' creativeness through synergetic actions with their partners; (b) is a unique and powerful predictor of the *strategic flexibility* of SMEs. The latter "refers to quick reformulation of strategies, alignment of product/services with market and introduction of advanced promotional campaigns."

2.2 The Need for Vertical Alliances

It wasn't too long ago when every business claimed that the key to winning customers was in the quality of the product or service they deliver. But, things have changed. Now, an even more important success factor has appeared: providing the best customer experience. (Batat, 2019) rephrased this point as follows: "today consumers increasingly buy *experiences* rather than goods or services". Coherently, Batat replaces the 7Ps of the old marketing (i.e., Product, Price, Promotion, Place, People, Process, and Physical evidence) with 7Es (Experience, Exchange, Extension, Emphasis, Empathy, Emotional touchpoints, Emic/Etic process), each one focused on thinking experientially. In other words, Batat suggests that the marketers change their approach to generating demand.

"Phygital" is the merging of the digital and the physical world. Implementing the *phygital metaphor* companies can design suitable, emotional, and profitable customer experiences including both offline and

online digital experiences; hence meeting users' expectations. Creating a highly personalized and engaging experience is a precondition in order to generate enduring customer loyalty.

2.2.1 Loyalty Programs

Loyalty reward programs are a proven way to attract new consumers and retain the existing ones. Moreover, there is evidence that loyalty programs allow to build longer, stronger and deeper relationships with customers, e.g., (Bolton et al., 2000). Another advantage of having loyal customers is that they play an active role in word-of-mouth communication, (Lacey and Morgan, 2008), a type of communication largely trusted by people, that very often take decisions based on the opinion of others who have already bought the same product. Through loyalty programs companies can create the database of their consumers and their purchasing behavior. Such a database is a precious intangible assets for them. In fact, querying it allows understanding the customer's needs and behavior. Such information helps drive sales by tailoring offerings and promotions to their expectations.

As pointed out by (Górajski and Machowska, 2019), "there is evidence that retaining current customers is much cheaper for a company than acquiring new ones". On the point, (Gallo, 2014) says that it is from 5 to 25 times cheaper to retain a customer than to acquire a new one, depending on the industry.

2.3 An IT-platform Conceptual Model

Digital platforms are a pervasive technology. Through digital platforms companies connect with people, improve awareness of their brands, influence consumer's attitudes, collect feedback from them, improve products and services on sale and, at last, increase their incomes. Last but not least, digital platforms are transforming the ways in which products and services are produced and consumed. As a consequence a large body of research has been devoted to this topic. (Tiwana, 2014; Sun et al., 2015; Parker et al., 2016; de Reuver et al., 2017; Asadullah et al., 2018; Hein et al., 2019; Hein et al., 2020) is an incomplete list of recent papers the reader may refer to. Scholars from various disciplines have adopted different perspectives about digital platforms. The consequence is the lack of a common understanding (both in research and industry) about the meaning of the term platform, even when it is related to a specific domain. This is the case, for instance, of the IT domain, as pointed out by (Sun et al., 2015).

Very recently, (DiValerio et al., 2020) investigated the current status of research related to dig-

ital platforms in order to identify their distinguishing “dimensions” and then, come up with a sound definition for the IT-platform concept. That study brought them to the selection of the IT-platform *conceptual model* given by (Sun et al., 2015) (Figure 3) together with the linked definition they proposed: “An IT-platform is defined as comprised of a *technological base* on which complementary *add-ons* can *interoperate*, following *standards* and allowing for *transactions* amongst stakeholders, within the *platform-centric ecosystem*.” The six concepts (called *dimensions* in (Sun et al., 2015)), part of the previous definition, are briefly recalled below.

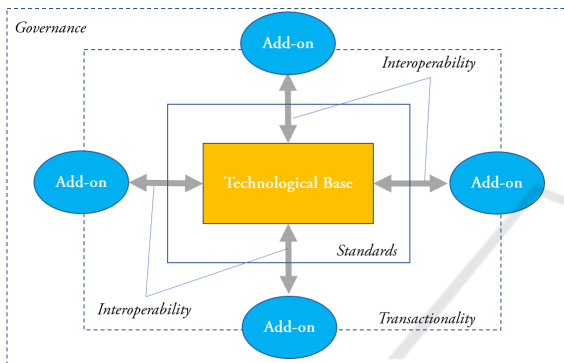


Figure 3: An IT-platform conceptual model (Sun et al., 2015).

The *technological base* is the foundation that allows the development of add-ons. A *standard* is a set of rules enabling developers to interact with the technological base. An *add-on* is a software module that connects to the technological base to add functionality. *Interoperability* allows the interaction between a technological base and the add-ons. *Transactions* denote the interactions within an IT-platform “ecosystem”. *Governance* concerns policies, structures, processes, and mechanisms involved in managing an IT-platform.

“Ecosystem” is a further concept developed around digital platforms (Tiwana, 2014). A *digital platform ecosystem* consists of two major elements: the platform and the complementary add-ons. The ecosystem comprises platform owners, developers, and consumers.

3 OUR VISION

In light of the studies mentioned in the previous section, two factors are essential for the survival of SMEs in the global market: (a) ally themselves with SMEs operating in the same market segment, (b) offer an

amazing shopping experience to their customers.

This section describes an IT infrastructure for SMEs based on the notion of “Digital Network” defined as follows. We call *Digital Network* (DN) a network of collaborating SMEs physically distributed over a territory (for instance, a region, a province or a state), which share the objective of selling goods (e.g., agri-food products, artefacts, etc.) and/or services to potential consumers through a digital platform. We claim that by implementing a DN, SMEs wishing to operate in the digital economy will be able to make their products/services known to a large number of customers and retaining them over time. Acquiring users (some of whom will become customers) has a cost, both in the digital and in the real economy, which can be very high. This aspect is particularly critical for SMEs, notoriously plagued by limited investment capacity.

Figure 4 shows our instantiation of the platform conceptual model of Figure 3. The Add-ons of the DN Technological Base are a Mobile App (Android and iOS) (below called DgNet), the e-Commerce subsystem, and the Customer Satisfaction component. Figure 5 shows the components of the Technological Base. Each component is a portal.

The *SMEs portal* offers support to SMEs for the activities related to the horizontal alliance, while the other portal offers support to the activities related to the vertical alliance. The SMEs portal is devoted to the internal communication among the SMEs and, hence, it supports the horizontal collaboration among them; while the *Customers portal* allows to establish a link with the external stakeholders, notably, the potential consumers. The latter portal exhibits the goods and/or services; moreover, it includes an e-Commerce engine integrated with the Amazon store. The database, shared by both portals, stores data about customers, the log of their transactions, and their reviews/comments over time.

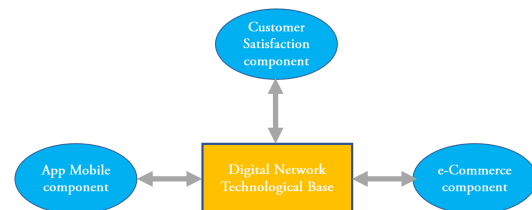


Figure 4: The conceptual model of the DN Technological platform.

In the following we assume the availability of a generator of DNs (let call it DNetGenerator) that implements the low-code paradigm. DNetGenerator constitutes a tangible help for the SMEs because it re-



Figure 5: The DN Technological Base.

duces the level of IT skills that SMEs must have to establish horizontal and vertical alliances.

Each DN instance returned by DNetGenerator consists of the two integrated portals of Figure 5.

3.1 About the SMEs Portal

Let us refer to an arbitrary number of SMEs, homogeneous with each other (i.e., firms operating in the same business area and, hence, direct competitors) which, by hypothesis, are interested in establishing a horizontal alliance to pursue common objectives. Each of those SMEs insists on a specific territory defined as the union of the geographical areas served by their (physical) *Point of Sales* (PSs), the latter meant as (physical) stores or professional studies. Each allied SME, using the instance returned by DNetGenerator, will be able to create its own *Virtual Showcase* through which it will describe itself, its PSs (a web page for each PS) and exhibit the products/services it wants to sell (one web page for each product/service). An integral part of the DN is the DgNet mobile app through which *all* the SMEs of the network and the virtual showcases of their PSs can be reached.

Each of the allied SMEs will have to undertake to inform the customers who visit one of their PSs (for this reason hereafter called *physical customers*), of the existence of the DN and, hence, of the possibility offered to them to buy products/services also online using DgNet. In the following, we call *digital customers* the latter category of consumers. This active role of the SMEs towards their physical customers is decisive in the promotion, without costs, of the DN, that is in expanding the audience of potential customers of their products/services to an audience equal to the sum of the physical customers of the various SMEs part of the alliance.

3.1.1 A Reward Policy

To overcome the distrust of SMEs to share their physical customers with the other SMEs of the DN, our idea is the following. Each PS (let say Q) of a generic SME (let say W) adhering to the DN is associated with a QR code. Each physical customer (let say C) of PS Q of SME W introduced to the DN by W remains associated with Q , and hence with W (briefly, W is the

owner of C), by linking he/she to the QR code of Q by means of a functionality of DgNet. In this way, customer C remains permanently linked to his/her owner regardless of *what* product/service he/she will buy online in future and *where* among the many virtual showcases exhibited by the SMEs of the DN. The delivery of what has been purchased online can take place at home or at any PS of one of the SMEs belonging to the DN, at any time.

A possible method on which to base the distribution of profits between the SMEs adhering to the DN for each product/service sold is illustrated below.

Legend of notations:

- m margin
- sP selling Price
- c (total) cost
- cN cost of DN
- cS cost of the Seller member (a SME)
- mPR margin of the Participating Retailer (a SME)
- $mOPC$ margin of the Owner of the Physical Customer
- pSP percentage of the sP withheld by the DN.

The cost of the DN (cN) comprises the cost of sustaining the network and the cost for campaigns of consumer loyalty.

The following equations hold:

$$\begin{aligned}
 m &= sP - c \\
 c &= cN + cS \\
 c &= cN + cS \\
 m &= mPR + mOPC \\
 cN &= pSP \times sP \\
 m &= sP \times (1 - pSP) - cS \\
 sP \times (1 - pSP) - cS &= mPR + mOPC \\
 mPR &= sP \times (1 - pSP) - cS - mOPC \\
 mOPC &= sP \times (1 - pSP) - cS - mPR
 \end{aligned}$$

From equations above, it follows that $mPR < m$, i.e., it is a margin lower than that provided by a direct sale. However, this margin comes from a digital customer that the allied SME would not have reached without the DN. Also $mOPC < m$, but in any case it is greater than zero for a transaction that did not involve it directly and for which the SME had no cost. In summary, we can notice that each SME adhering to the DN has two earning opportunities, mutually non-exclusive: one direct and the other indirect. This double potential advantage is the best guarantee that the collaboration between the SMEs adhering to the DN might be lasting.

3.2 About the Customers Portal

The virtual showcases of each PS of the SMEs part of the DN are *consistent* each other. From the customer point of view this is important because it pro-

vides them the same experience at each PS of the DN. IKEA is a relevant example. Visitors of any IKEA store around the world get the same experience. And the pay-off is huge. Not only IKEA is one of the most beloved companies in the world, but in the fiscal year 2019, the company generated a global revenue exceeding 41 billion Euros worldwide⁵.

A peculiarity of the customers portal is that of implementing the emerging phygital paradigm. Implementing the phygital paradigm allows SMEs to offer to their consumers the experience they are looking for.

No company is so perfect in the delivery of their products/services that dissatisfaction (the source of complaints) does not exist. In this context the well-known saying: “No news, good news” is not always true. So, the correct approach from SMEs that aim playing online lengthily is to implement a robust Customer service. Handling complaints includes the following three steps: (a) collecting them; (b) analyzing them, and (c) responding appropriately (i.e., overcoming the underlying issue).

In (Farnsworth et al., 2019), authors report that “for every complaint expressed, there are over 25 unregistered complaints. Many dissatisfied customers just quietly take their business elsewhere. [...] Furthermore, a customer with a complaint is likely to tell others about his complaint.” Organizations that are truly committed to delivering an effective customer service have to providing them opportunities to complain. The DgNet mobile app and the websites of the associated SMEs are the two channels that must be implemented within the DN to encourage (digital) customers to write their comments that, from these collecting point, can then automatically be redirected into the DN’s database (Figure 5).

Such a database is a precious intangible assets for the SMEs, since, by querying it, it is possible to extract customers complaints and take appropriate actions to reply to them. In addition, the availability of such kind of data allows the implementation of quantitative methods as an alternative to qualitative ones. In fact, by querying the database over long periods of time it is possible to build statistics useful to get a correct vision of what is going wrong with the offered products/services.

(DiFelice et al., 2021) proposes the structure of a NoSQL database about customer reviews and a set of ten useful query patterns. To implement an effective customer service it is highly recommendable that the underlying database is able to host unstructured data.

3.2.1 About the Loyalty Program

The loyalty scheme works as follows. The customers of the DN are rewarded with points or cash back, according to their preferences, as a percentage of their purchases. The number of transactions per month might also be taken into account. As a general rule, the loyalty program to be implemented must be simple, relevant and evolve over time.

- *Simplicity.* It is essential that SMEs’ users easily understand *how* the loyalty rewards are earned and redeemed, otherwise the program might fail.
- *Relevance.* If the rewards being offered are not genuinely appealing to customers, again the program might fail.
- *Evolution.* The program must evolve over time to keep up with evolving user needs and trends.

3.3 Discussion

Major Obstacles to the Success of Our Approach.

Resistance to the innovation is the first obstacle. Most of the SMEs that have been in business for years have consolidated business processes which guarantee them the economic sustainability. This category of companies are often reluctant to the digital transformation, since the introduction of IT in the firm leads to big changes to the existing business processes. Getting SMEs to understand the benefits of allying with competing firms is a fundamental preliminary step. Achieving this goal is facilitated by the level of the adoption of e-commerce by SMEs. Many studies have proved that the higher the level of e-commerce adoption by a SME the easier is to convince them to enhance their technology infrastructure and adapt their internal processes. Promoting initiatives to encourage the level of e-commerce adoption by SMEs might be very helpful. The perception by SMEs that resource sharing is a threat to them is the second obstacle to the success of our approach. Establishing alliances between SMEs through a DN presupposes horizontal and vertical cooperation. In this perspective, SMEs could consider that the sharing of resources represents a threat to their business, affecting their position in the reference market and, consequently, their economic performance. Such a conclusion by an SME would exclude a priori the adoption of the proposed approach.

Potential Risks for the SMEs. The first risk concerns the sharing of their physical customers. For an SME, pooling its physical customers with other SMEs

⁵source: <https://www.statista.com/topics/1961/ikea/>

on the digital channel could have the effect of favoring the conditions under which the latter can choose another supplier. The reward policy of Section 3.1.1 has been thought to overcome the distrust of SMEs to share their physical customers with the other SMEs of the DN. However, SMEs must resign themselves to the idea that this risk is inevitable, in light of the unstoppable diffusion of the digital technology in every area (business, social and economic). The second risk has connection with the economic investment. This risk materializes just in case an SME adheres to a DN but at a later stage it evaluates that choice as not advantageous, thus deciding to abandon the DN and sever the alliances in place: in such cases the investment made turn into an economic loss. Smaller is the license cost of the generator of DNs bigger is the probability that SMEs are encouraged to try such a digital transformation.

4 CONCLUSIONS

The assumption underlying the present paper is that the SMEs today willing to compete in the global market must perform within a collaborative network to compensate their small dimension. To collaborate in a coordinated fashion, they must align their business processes and the IT infrastructure. The present position paper sketched the authors' vision about a way to implement a shared IT infrastructure aiming at facilitating the achievement of a coordinated cooperation among SMEs. The pillar of the proposal is the DN. Through it, SMEs can reach the following further goals:

- establish a lasting cooperation with other SMEs by virtue of the Reward policy;
- expand the audience of potential digital customers for their products/services. In fact, for each SMEs part of the DN, the number of digital consumers is equal to the sum of the physical customers of *all* SMEs adhering to the network;
- offer (via DgNet) a consistent interaction to the (digital) customers at any PS;
- implement a robust Customer service, an indispensable prerequisite for retaining the digital customers as long as possible.

Methods for the assessment of the degree of the achievement of the shared goals will be part of the future research.

To the listed benefits, must be added all those mentioned in Section 2, they too induced by the decision of the SMEs to perform with other "sisters" within a horizontal alliance.

This study is part of an ongoing industrial research project that aims at developing a *generator* of DNs. Recently, the proponents of the project have released a tool (*xGenerator*) (Paolone et al., 2020) that performs the transformations across the levels of the Model Driven Architecture up to the Java code of business Web applications. Both projects implement the emerging low-code paradigm. In the case of the generator of DNs, by making recourse to the generator, interested SMEs are facilitated in the instantiation by themselves of the DN that best fits the needs of their businesses.

Once the IT infrastructure will be set up, the next steps will concern the definition of suitable information processes capable of favoring the sharing of resources among the SMEs and the engagement of all corporate stakeholders, including their customers. The new processes must facilitate the innovation of the technological, cultural, organizational, creative and managerial nature for the SMEs performing within the DN, thus extending the entire ecosystem that orbits around the DN and, hence contributing to the promotion of the development of the territory where those firms operate.

Many studies have pointed out that the use of IT is transformative and leads to big changes to the existing business processes. This general rule holds also in the case that a certain number of SMEs join a DN. Business-IT alignment refers to a condition in which the relationship between business and IT is optimized to maximize the business value of IT and to increase efficiency and effectiveness of organizational processes. Unfortunately, a long list of factors influence the alignment, as pointed out, for example, in (El-Mekawy et al., 2015; Wang and Rusu, 2018). In light of the findings in these papers, two relevant best practices to be adopted by the SMEs adhering to a DN are mentioned below. First of all a careful definition of responsibilities and roles between business and IT personnel is necessary. Then, a lot of attention has to be paid on the communication between business and IT managers in order to eliminate misunderstandings. The latter is a primary factor hindering business-IT alignment, as it has been proven in (Wang and Rusu, 2018). To tackle this barrier, in (El-Mekawy et al., 2015) authors report that: "a suggestion raised by several interviewees is to implement a set of rules to make it appealing to conduct communication more formally."

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