A place-based view on Industry 4.0 in local productive systems[1]

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Abstract: A growing debate in academic fields and in broader contexts concerns nowadays the impending fourth technological revolution, and the emergence of digitally augmented productive processes and product-service systems. Those routes of application, often grouped under the umbrella-title of Industry 4.0 (I4.0), raise great challenges on manufacturing places in advanced economies. Some windows of opportunity for a "manufacturing renaissance" seem to open up. However, in some areas these challenges relate to further loss of old skilled jobs and crisis of small traditional firms that could be substituted just by low quality activities subservient to I4.0 systems led by big-tech monopolies. This paper illustrates reflections and cases on the possible relations between technological change and a manufacturing renaissance in local productive systems of economically advanced regions. According to an approach that we labelled "Industry 4.0 Plus" (I4.0+), new technologies should embed in organizational and social innovations at local and trans-local levels helping rerouting to models alternative to big-tech polarising solutions. The alternative models could trigger renewed bases for local manufacturing specialisations, cross over sectoral boundaries, and address societal and environmental problems.

Keywords: industry 4.0; local productive systems; SMEs; alternative models of technological and organizational change; manufacturing renaissance

JEL classifications*:* R12, L61, L67

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1. INTRODUCTION

A powerful tendency has emerged in the last two decades and has started to be felt more clearly in the last years. The pervasive penetration of digital technologies within production organisations, business models, and consumption models has strongly shaped the way we produce, consume, communicate, move, generate energy, and interact with one another. The socio-economic landscape will be fundamentally altered (OEDC, 2016).

In such a context, traditional productive organizations and territories are affected by both broad opportunities and many risks associated with earnings inequality and a polarisation of jobs in manufacturing industries from the low to the high pay scale (Breemersch et al., 2019). Not surprisingly, after the massive losses in the last decades with the delocalization of many labour-intensive activities to emerging countries, increasing debate is about the impact of these technological pull tendencies to a further hollowing out of manufacturing places and jobs in advanced economies.

Advanced economies have recorded a long-run period characterised by the reduction of jobs and value added directly related to manufacture. Many case studies point to a loss of skills and competences, a concentration of economic possibilities in big cities and away from deindustrialised suburbs, smaller cities, and industrial districts, a loss of control over the value chain, and finally a loss of identity for places whose manufacturing heritage was integral to their sense of self (Becattini, 2015). The Great Crisis blown up in 2007-2008 exacerbated indeed the difficulties of many weakened places and classes of workers (Dei Ottati, 2018).

According to a stream of research, some windows of opportunity for a "manufacturing renaissance" would open up (Pisano and Shi, 2012). On the other side, some scholars show a widespread concern on a further loss of old skilled jobs and a subservient role of many new jobs (OECD, 2015).

However, there are not enough studies exploring the various factors fostering local paths of manufacturing renaissance and there are still few case studies allowing a comprehensive exploration of this technological pull tendency. The wave of new technologies has for sure redefined the forces shaping the industry competition (Porter and Heppelmann, 2014), but it is not completely clear what new scenarios open up. Some uncertain signals come from a certain amount of flows of reshoring and near-shoring (Bailey and De Propris, 2014). It seems clear that changes are not only at a technological level, but also in governance systems and institutionalized structures (Geels, 2002; Butera, 2017).

This paper illustrates a few reflections and cases on the possible relations between technological pull changes and a possible manufacturing renaissance in local productive systems of economically advanced regions, under an approach that we label "Industry 4.0 Plus" (I4.0+).

According to the I4.0+ approach, new technologies should embed in organizational and social innovations at local and trans-local levels, and could trigger solutions that renew the bases of local manufacturing specializations, cross over sectoral boundaries, and address societal and environmental problems (OCSE, 2016).

Specifically, we focus on productive systems characterized by populations of specialized SMEs, such as industrial districts (Becattini, 1979, 2004; Dei Ottati, 2018), and consider four drivers of socio-technical models that could help reroute such systems towards local paths of manufacturing renaissance. Such models, impinging on digital transformations of labour and knowledge relations between firms and local community, are potentially alternative to top-down technocratic and monopolistic models of Industry 4.0 (Mosconi, 2016; Freddi and Rizzo, 2016; Feldmann et al., 2019). Decentralized bases of competences and tacit knowledge can combine with more codified and digital based knowledge as a non-casual source of exploration and exploitation of opportunities for rerouting (Asheim et al., 2017; Bellandi et al., 2018).

After some further general remarks in Section 2 on the technological pull tendencies, we will explore in Section 3 the four drivers of socio-technical models possibly allowing rerouting and triggering "manufacturing renaissance". The conclusive Section refers the discussion of the previous sections to a couple of more general reflections.

2. INDUSTRY 4.0: A BIG CHALLENGE FOR LABOUR, FIRMS AND TERRITORIES

The contemporary wave of technologies is associated with enabling distributed and cross-media digital technologies, cyber-physical systems, internet of things and services, additive manufacturing. These technologies branching out thousands of applications allow the emergence and stabilisation of new techno-economic paradigms (Bianchi and Labory, 2018) that are related to a completely new

production model inside the factory and between firms. These technologies have indeed strongly modified the manufacturing value chains, creating new production and business landscapes around the world. Many of these technologies have a digital basis or support, and they fall, directly or indirectly, within the fields of the so-called Industry 4.0 (I4.0), or Smart Manufacturing, or similar terms. Such transformation is the productive core of what is sometimes referred as 'the Fourth Industrial Revolution' (Schwab, 2016).

The introduction of an infrastructure of digitally enabled technologies impacts indeed the economic structures and societal habits through a myriad of channels, altering the productive organization of value chains and places, institutional frameworks, consumption models, as well as the distribution of wealth, income and jobs across regions and classes.

Inside factories, intelligent machines enhance both the productivity and the flexibility of productions that will deliver 'mass customised' products. Between firms, the use of sensors, actuators, and data communication technology integrated with physical objects allows the tracking, the coordination, and the control of machines within networks, enabling short-term and long-distance exchange of information and goods (Schwab, 2016). New pathways of value creation are in place where for example traditional manufacturing sectors ask knowledge intensive services to implement product-service systems (Cusumano, 2015).

Customers are looking for new solutions to enjoy the intrinsic function of manufacturing goods and to give away the ownership of the product itself. This is not a completely new proposition for the customer, but the extension to a wide set of goods thanks to the opportunities given by digital technologies and the rate of introduction of new offers require a fundamentally different business model for many manufacturing firms.

Moreover, some of the new technologies lend themselves to efficiently scaling down productions, opening up new opportunities for small producers that can tap into market niches for personalized and innovative products. The cheaper activation of closer interaction between innovators-manufacturers-customers might be translated into a more distributed manufacturing, whereby customers source or commission the-making-of-products locally.

The adoption of digital-related processes of innovation is also associated to job and income polarization between operative functions and knowledge intensive directive functions (Breemersch et al., 2016). Workers may move beyond their local labour markets, reducing the bargaining power of employers, but, at the same time, many employers can easily practise 'labour arbitrage'.

Finally, almost all new technologies can be deployed to enhance the environmental sustainability of production processes and consumption via energy saving, bio-based products and fuel, remanufacturing and reusing of components.

These transformations are deeply re-shaping the industrial landscape in advanced economies, and it becomes fundamentally important to explore windows of opportunities and possible threats for different populations of firms and for territories (OECD, 2017).

I4.0 solutions are entering territories featuring local productive systems (LPS) dominated by manufacturing SMEs. In many cases, these solutions are opening opportunities of a new centrality for old or post-industrialized regions and countries. Nevertheless, how this opportunity is grasped by manufacturing depends on how public, collective, private strategies at different levels coordinate also for managing related sets of risks. Therefore, it would be highly dangerous if technological changes were perceived just as entirely exogenous and autonomous shocks by firms, especially SMEs, and by manufacturing areas (Butera, 2017).

For example, in the debate over the interplay between I4.0 and local development, there is a palpable concern about the effect of digitalization and robotization on the labour-capital balance in productive processes. However, changes in the labour market would also call for new educational models that go beyond youth education, but also include job retraining and long life learning, to ensure constant upskilling (OECD, 2015; Freddi and Rizzo, 2016).

In general, the exploration of windows of opportunities and barriers or risks for LPS related to digital transformations, together with the identification of new industrial policies able to support such exploration, become more and more important.

3. LOCAL PRODUCTIVE SYSTEMS AND REROUTING TO I4.0 PATHS

Since breakthroughs in 'useful knowledge' are needed to build up new techniques selected by the market and exploited by socio-economic structures (Mokyr, 2002), it is important to consider firstly the issue of knowledge embeddedness in LPS.

Here, the ability to capture, decode, translate, integrate and leverage new 'useful knowledge' lies both in the internal specialized capabilities of firms and in the collective readiness of communities and territories, as well as in related local and extra local networks of knowledge circulation and collaboration (Chaminade et al., 2019). This ability includes the availability of sources of knowledge generation, the awareness of their possible access, and the effectiveness of sharing knowledge processes among the local actors (Malerba, 1992).

Studies on processes of learning in various types of socio-economic systems have investigated the relation between the exploration of new knowledge bases and the exploitation of a set of acquired knowledge (March, 1991; Gilsing and Nooteboom, 2006). For example, the early development phase of an LPS, as well as its de-maturing phase, may be characterized by a high degree of exploration, which includes search, experimentation, and discovery. Instead, maturity would be characterized by a more extensive phase of exploitation, with phenomena such as refinement, efficiency, implementation. LPS that focus on exploration suffer high costs of experimentation; while those focused on exploitation may be trapped in suboptimal stable equilibria. Therefore, in order to enjoy longevity, an LPS should be able to combine exploration and exploitation, and adapt appropriately their balance (Bellandi et al., 2019).

In particular, barriers in finding and introducing new knowledge tend to increase after a prolonged path of development, i.e. with maturity, because of the growing weight of the capital sunk in established business relations. Here, local institutions play a critical role to tilt the balance again towards exploration.

For example, in the last decades of the XX century, in many industrial districts across Europe, manufacturing SMEs have been the vehicle of processes of increasing specialization and differentiation characterizing part of the trajectories of post-Fordism, also thanks to place-based balances between cooperation and competition orchestrated by effective local institutions (Dei Ottati, 2009; Konzelmann and Wilkinson 2017). They have favoured, with the adjustment of local knowledge, the strengthening of business networks (vertical and horizontal), the up-grading of local skills with training activities, the building and working of multilevel innovation platforms, etc., and even the de-maturing and renewal of productive solutions along prolonged paths of development (Crevoisier and Jeannerat, 2009; Bellandi et al., 2019).

The radical changes in the industry competition and value creation processes related to the introduction of I4.0 technologies imply not only adaptation, but also important discontinuities within LPS, in particular those based on SMEs, concerning their socio-economic structures and place-based balances. The LPS have to find not just new routes but also "new forms" (Bellandi and De Propris, 2017).

Such changes invest LPS from many sides. One concerns the problems of fiscal sustainability, social welfare and inclusivity, participation and governance in the local society. Another is the increasing importance of transactions where value depends more and more on immaterial features. This also relates to the strength of models of I4.0 based on the technocratic and monopolistic control of standardized global platforms of digital based services of trade, finance, advertising, labour selection and training, enterprise resource planning and relationship management, collaborative knowledge and innovation networks, etc. (De Maggio et al. 2009). When LPS are not able to balance knowledge exploration and exploitation in a reproductive way, and their reaction to technological challenges is not strong enough, the risks of monopolistic submission increase.

Note that the returns of local SMEs may be squeezed further by the standardised quality of digital services provided by large platforms not able nor willing to customize with respect to the very specific and differentiated needs of a SMEs productive system. An even more important and real source of squeeze emerges when digital platforms are internalized by large manufacturing or trading companies that are big players in the SMEs' product or raw material markets. Consider a big player demanding small manufacturing suppliers/ customers, as a compulsory requisite for trading, to insert in a proprietary digital platform that manages, for example, resource planning, quality and ethical standards, cost controls and budgeting. This is perhaps an opportunity for the small suppliers/customers to upgrade and learn about digital solutions. The dark side is that crucial business information is acquired by the big player, via the platform, and is used easily for reducing partners' margins of profits and independent decision-making, or even for substituting them more easily (Feldmann et al., 2019).

Such risks expand when large digital platforms run by MNEs for managing their international value chains give them a crucial market power with respect to local SMEs trying to insert proactively within the same value-chains (OECDE, 2017).

Digitalization may indeed push them under the control of centralized technocratic system driven by large companies.

Concepts and experiences of "new makers" point out a possible route for navigating in-between such hurdles (Rullani and Rullani, 2018, chap. 11). Operative well-trained skills and competences are indeed still crucial in manufacturing phases and processes, such as matching of materials of variable quality and multi-purpose tools, quality control etc. On this basis, I4.0 technologies could be developed and used as complementary to professional/creative processes that meet customer-specific demand in highly personalized ways and favour down-scaling in manufacturing processes. This may be the basis of alternative models of I4.0, that we call I4.0+, fostering manufacturing renaissance in LPS of advanced economies.

4. SOCIO-TECHNICAL DRIVERS FOSTERING MANUFACTURING RENAISSANCE

Starting from the systematic development and exploitation of new makers' solutions, we consider in this Section four socio-technical drivers of local paths of manufacturing renaissance, focusing on LPS characterized by populations of specialized SMEs, such as industrial districts. In the next section, we will consider the intersection with contexts of multi-level policies of development.

4.1. S*mart micro-manufacturing models and new makers*

Let us consider first the production side of new makers' solutions in LPS. Digitalization can empower "smart micro-manufacturing" models, where flexibility and variety are coupled with the industrial efficiency of small plants and laboratories. Here, producers co-develop personalized and innovative products with customers, meeting in original ways clusters of social, economic and environmental needs (Bianchi and Labory, 2018). On the other side, the greater adoption of digital technologies throughout the production process is shaping new interdependencies between the different stages, inside and between factories and firms.

The producers who may expand the realm of micro-smart manufacturing models are precisely teams of new "makers" (Bettiol and Micelli, 2013). They bring together creativity, care to personal needs of various types of customers, and experience-based competences accrued on the job and needed to control and insert some phases, key to creative personalisation, within a frame of more automated production and trade phases. Examples of such key phases are the choice of materials of variable quality, the judgment on the appropriate use of multi-purpose tools (4.0 as well) in non-parameterised work contexts, or the quality control of highly customised products (Butera, 2017). This calls for an understanding of the future of work that sees a complementarity between analytical and codified knowledge, more and more incorporated in cyber-physical systems, and the synthetic, tacit and experience-based knowledge that is cumulated and embodied in tasks and roles of the teams of new makers (Barzotto and De Propris, 2018).

From this core, the new interdependencies may expand inside and between territories. A smart micro-manufacturing model is today a feasible model of growth for manufacturing SMEs and LPS, where the efficient size of production is scaling-

down, and specialised small firms can access international networks of designers, customers and suppliers. This would support a renewed enlargement of market niches for personalised, customised and innovative products. Lack of trained and motivated new makers, and poor communication infrastructures, weaken such opportunities, increasing the risk of submission to technocratic and monopolistic structures. Moreover, possible deficiencies on the side of business and customer services are dangerous as well.

4.2. *Territorial servitization*

The growing interrelation between manufacturing and digital-based services, possibly leading to short-term and long-distance deliver product-service solutions, needs the growth of digital capacities within manufacturing SMEs, as well as the embedding of populations of providers of knowledge intensive services.

IoT and IoS pull the "servitization" of manufacturing processes, as well as the development of smart connected products (Porter and Heppelman 2014, 2015), expanding the personalization of products and the relations between producers and customers through service functionalities (Cusmano et al. 2010). The increasing amount of sharable information leads to different ways of approaching the customer. For example, design or product related data may be digitally delivered from a product designer/producer in an exporting country for printing in a target market. The symbiosis between traditional manufacturing sectors and service activities is enriched also by the possibility of associating the value for the customer not to the ownership of the product itself but to the access to its intrinsic functions. In general, with blurring borders between manufacturing and services, LPS specialized in manufacturing tend as well to evolve in product-service systems. As pointed out by Lafuente et al. (2017, 25): "*Territorial Servitization can contribute to local competitiveness and employment creation through the virtuous cycle generated when a resilient local manufacturing base attracts or stimulates the creation of complementary knowledge intensive business services businesses, which in turn facilitates the creation of new manufacturers.*"

This implies the spawning of new nuclei of know-how within the local system and an appropriate governance of new classes of local transaction costs related to the increasing density of sharable, ambiguous and immaterial characteristics in product-service exchanges. Without a revamped support in terms of both entrepreneurial strength and institutional solutions and governance, territorial servitization will be weak (Bellandi & Santini, 2020).

4.3. *Place leadership and quadruple-helix governance of projects of development*

Contemporary disruptive dynamics in technological, societal and environmental spheres bring about even more complex interrelations between state and markets. They concern as well local/regional and national/international/global production, knowledge and social networks. Collaborative and reflective schemes are needed, but they cannot be based just on records of past success of single stakeholders and traditional governance solutions.

The complexity and the speed of change ask updated and augmented schemes of governance under the drive of an open and strong place leadership (Bailey et al., 2010; Sotarauta et al., 2017). The system conditions related to project of path transformation and rerouting under I4.0+ lines span all dimensions and actors of an LPS and its local society. They include classes of new specific public goods, such as training structures for digital-aware skills and business culture, digital infrastructure and intermediary platforms (online marketplaces, social media and creative content outlets, application distribution platforms, price comparison websites and collaborative economy platforms), whose access and functioning are specifically adapted to an LPS features (e.g. Mosconi, 2016; Vecciolini, 2019). They extend to cross-sectoral business and social innovation that, promoting participatory smart city and smart land solutions to unexpressed or underprovided communities' needs (Bonomi and Masiero, 2014; Morozov and Bria, 2018), can renew the bases of social capital and cohesion at the local level, together with the opening of new markets and investments' prospects (Cappellin et al., 2017).

The variety of actors that develop such projects can be elicited and coordinated by a governance that includes constellations of quadruple helix leaders (Carayannis et al., 2009). For examples, they are:

- Leaders of engaged developmental universities, driving the synergy between the university three missions and the collaboration between different disciplines and innovation intermediaries (Breznitz and Feldman, 2012; Freddi and Rizzo, 2016);
- Pro-active local/regional governments, able to implement appropriate use of public resources, being in touch with knowledge of local business and social networks, as well as autonomous from local oligarchies or external monopolies (Trigilia, 2001);
- Nuclei of innovative SMEs, boasting an open-network and innovation business culture (OECD, 2010), together with anchored entities of MNEs under non-predatory incentives and shared value strategies (Porter and Kramer, 2011);
- Civic actors, promoting new interpretations of local heritage and life (Becattini, 2015), together with non-local networks supporting local participatory actions under global experiences of social innovation (Aoyama and Parthasarathy, 2018).

4.4. *Evolving equilibria of I4.0+ between positive rerouting and dark sides*

The previous three sub-sections suggest that original ways to meet clusters of social, economic and environmental needs are surfacing, and the social embeddedness of manufacturing SMEs in LPS might be a competitive advantage for SMEs. The organisation of production may adapt at firm and system levels, together with consistent technological and scientific solutions, which Bianchi (2018, pp. 104-107) calls "techno-science for human and sustainable development". All this would open the way to positive prospects for rerouting LPS towards manufacturing renaissance with smart micro-manufacturing and new makers, product-service specializations, and

participatory smart city and smart land sustainable solutions. This is the I4.0+ perspective advocated in the Introduction of this paper.

However, difficulties of alignment of incentives between the different local actors cannot be underestimated. A local society lacking flexibility also risks to be locked in a regressive status quo of oligarchies worried by the extent of change, or else to be dominated by the marketing and cultural strategies of external agents who not always give an undemanding support to participatory actions at local level (Bellandi and Santini, 2020). Neither technological innovation nor economic growth have necessarily, in our world, long run positive effects on human, social and environmental capital (Lundvall, 2017; Cooke, 2019). The dominant technocratic and monopolistic models of I4.0 have nonetheless a great strength, which is positive if delimited to some fields and frontiers of technological development, dooming if it allows innervating the society and surmounting bottom-up sources of creativity, labour engagement, social innovation, etc.

Place-based multi-level public policies informed by ethical principles of equity, democracy and sustainable development are needed to make effective the potential of I4.0+.

5. PLACE-BASED POLICIES FOR THE DIGITAL TRANSFORMATION

The core of place-based multi-level industrial policies is represented by the provision of public goods specific to the development of LPS characterized by a division of labour among different manufacturing and service firms as well as among institutional stakeholders.

In terms of methods, we maintain that the elaboration, implementation and control of the new policies should be understood as step-wise processes, where expectations, plans, and investments adapt to the experimentation of partial and tentative solutions and to the monitoring of intermediate results (Rodrik, 2004).

In terms of policy contents, we would recall three classes of general building principles, related to the actor, sector, and territorial targets of new public goods, and to the necessity to face the disruptive nature of the technological tendencies discussed above (Butera, 2017; Bianchi and Labory, 2018).

a) The sets of beneficiaries of funds and access to services should reflect and amplify the heterogeneous composition of quadruple helix constellations suggested in sub-section 4.3, according to targeting strategies that respond to specific contextual compositions of levers and bottlenecks (Andreoni, 2017).
b) Supporting multi-disciplinary approaches and learning by monitoring within technological collaborations and platforms should be imperative as well, given the transverse nature of the new technologies and their intersection with the current societal and environmental challenges (Sabel and Zeitlin, 2004).
c) A multi-territorial coordination of policies is more necessary than ever. The local level is still fundamental, but also more intertwined with dynamics that take place on larger territorial scales of interaction across different local systems. Both localism and place-blind approaches should be avoided (Iammarino et al., 2019).

As an example of principle a), the promotion of a networking business culture among SMEs, together with good practices in innovative public funds, should target both product-service networks and innovative start-ups in new specializations, as a basis for developing a larger variety of related sectors within and among complementary LPS (Butera, 2017; Rullani and Rullani, 2018, chap. 10).

As regards principle b), for example, the access to technological platforms should be designed according to openness approaches, targeting both the reduction of local rents built on obsolete techno-organizational equilibria and the sheltering from new large-scale monopolistic power (Rullani and Rullani, 2018, chap. 9; Bellandi and Santini, 2020).

Principle c), i.e. multi-territoriality and multi-scalarity, is not a novelty when considering policies of local industrial development. However, the principle points out some specific qualifications that apply in face of current transitions. Here, we just recall three related questions.

Firstly, the higher urban nodes (metropolitan cities or city-regions) play specific but contradictory roles within multi-disciplinary, cross-sectoral, and fluid spaces of innovation (Camagni, 2017; Rullani and Rullani, 2018, chap. 12.5). They may be pivots of the development of wider and plural territories (together with large cities, also industrial districts and smaller cities, rural systems, etc.), without waiting the effects of implausible trickling down mechanisms (Magnaghi, 2017; Trullén-Thomas and Boix-Domenech, 2017). On the other side, new digital-based monopolies and their financial counterparts have clustered headquarters in "star-cities" that concentrate disproportionate mass of value and rents thanks to combinations of Marshallian external economies and global market power (Feldman et al., 2019). A coordination between regional and national innovation systems (Chaminade et al., 2019) would be crucial for giving robustness to plural territorial strategies. Such coordination could help as well place-based approaches to new regulations of international trade and investments.

Secondly, place-based multi-level policies that aim to support rerouting of LPS to I4.0+ and manufacturing renaissance should be resentful of the core of Giacomo Becattini's vision of local development. According to Becattini (2015), the decisive factor of resilience of reproductive LPS, such as many Italian industrial districts in the second half of the last century, has been the confidence of their people, enterprises and institutions. When able to preserve individually and collectively such self-confidence, they have constantly adapted and created new solutions faithfully to local evolving but authentic productive cores, cultural heritages, and social identities.

Finally, also impinging on principles a) and b), effective policies for LPS are necessarily both transversal, i.e. responding to a system-based view, and light, i.e. not pretending to shape deterministically the profound factors of local socio-economic dynamics (Caloffi, 2017). Currently and in perspective, such features should incorporate the increasing importance of trans-local and upper level relations of life in digitalised societies (Rullani and Rullani, chap. 12.6). For example, structures and skills for international mobility and digital communication should be targeted to help bridging across LPS for international collaborations and within wide cognitive

networks, through which places assert their identity and experiment novelties for wider adoption (Saxenian and Sabel, 2008).

6. CONCLUSION

In the I4.0+ perspective discussed above, where traditional local manufacturing systems of SMEs are becoming something else, it is not sure that synergies dominate the tensions looming at the local level. One main issue is how and if adjustments of the organization of production can support the combination between new local and non-local knowledge bases and part of the traditional local productive knowledge. New classes of asymmetries in information and competences emerge with the absorption of radical technological changes and raise transaction costs and market barriers against positive local dynamics. The presence of strong professional and entrepreneurial drivers and the constitution of platforms of innovation and training reduce possibly the barriers and foster a critical mass of experimental solutions.

The population of business, social, education & research, and institutional actors in an LPS hit by such challenges is in a state of constant flux. As in true innovation ecosystems (Carayannis, 2009), this populations oscillate between technocratic élites, progressive business, social and institutional entrepreneurs, and the many who resist change, try to conquer rent positions, or just wait and see (Rullani and Rullani, 2018, chap. 11).

Political and business leaderships aiming at progressive dynamics negotiate stepwise. Here, leaders in both the public and private sphere should help open access of innovation platforms, as referred before, pointing out the experimentation of new models of society, innovation, and labour. Evidence-based tools exploiting various types of digital technologies could help projects and implementation, meaning that policies for I4.0+ could be, in a sense, 4.0 integrated policies of sustainable development.

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