Endogenous Rerouting, Longevity in Systemic Organisations of Production, and Policies of Manufacturing Recovery in Europe

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Abstract

Contemporary challenges and shocks in global markets and the introduction of new digital technologies may lead to adjustments within resilient local systems based on small firms (LPS), such as cases of industrial districts (IDs) in Italy, and reroute them to new sustainable paths of development. Drawing on some concepts related to endogenous processes of innovation, this paper explores systemic mechanisms of longevity and long-term competitiveness in IDs and LPS. Gradual and non-gradual sources of instability together with related systemic adjustments bring about crises and changes. On the other hand, endogenous mechanisms of rerouting promote resilient responses, even if risks of lock-in, fragmentation and inertia cannot be underrated. The activation of latent mechanisms of rerouting re-combines embedded competences and useful knowledge to deliver path-breaking economic solutions that create new competitive advantages and allow longevity. Some initiatives of place-based integrated industrial policy work at the intersection between technologies, sectors and value chains, and support social inclusiveness and territorial sustainability along the new paths.

Key words: industrial districts; local productions systems; new wave of technological change; rerouting and longevity.

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Acknowledgements

This research was supported by the EU under H2020 Marie Skłodowska-Curie Actions project "MAKERS: Smart Manufacturing for EU Growth and Prosperity", grant agreement n.691192.

1. Introduction

In the last century, economic growth and competitiveness of many areas of industrialised countries emerged from local models of industrial organisation, in particular local production systems (LPS) based on small firms, such as the industrial districts (IDs) characterized by some main manufacturing specialization and a population of specialized small to medium-sized firms networking at the local level and quite independent from external control (see Becattini, 1990). The analyses of structural change in such systems spread across different research fields during the

1990s and early 2000s, aiming at understanding either their systemic capability to adjust in the face of gradual and abrupt changes, or instead situations of path dependency and lock-in (see Grabher, 1993; Bellandi, 1996). Various conditions shape local capabilities to face both gradual and rapid changes, generating multiple possibilities of transition (Bellandi & Santini, 2017).

One of such conditions is the interplay between positive and negative effects of local specialisation in terms of systemic learning and innovative activities (Visser & Boschma, 2004). The specialised learning and accumulation of knowledge over the time would either favour the adaptation of local structures as evolutionary systems, or weaken their adaptability in face of radical and rapid changes (see Becattini et al. 2009; Belussi and Sedita, 2012; Lombardi, 2003; Menzel & Fornahl, 2010). Indeed, the debate is still open on the relative merits of local specialisation (Storper et al., 2015) or related and un-related 'variety' (Frenken et al., 2007), as drivers of long term paths of development. Another set of conditions concerns the interplay of endogenous and exogenous components in "territorial knowledge dynamics" (Crevoisier and Jeannerat, 2009). A third set concerns the interplay between the inherited identity of an ID or a LPS as a place and the regional, national and global cultural and institutional levels in which it is included (Bellandi and Santini, 2017).

In this paper, we introduce the concept of *endogenous rerouting* to refer to structural transitions (or *traverses*) that ensure the longevity of socio-economic ecosystems such as IDs or LPS. We will refer ordinarily to situations of IDs. A positive outcome is characterised by the combination of many tendencies, internal and external, and the preservation of a strong local identity: "*the one in the many and the many in the one*" (the motto of Marshall, 1919).

In what follows, Section 2 introduces a classification of gradual and non-gradual sources of instability and related systemic adjustments that may justify crises and changes in IDs. Section 3 illustrates IDs' learning processes and the spawning of new know-how nuclei thanks to endogenous processes drawing on the concept of "useful knowledge". Section 4 applies this framework to outline endogenous rerouting processes. Some adapted forms of ID configurations (Mark 3) may be able to explore, absorb and exploit creatively the knowledge related to the new wave of technologies. Here, endogenous rerouting is supported by the local multiplicity of competences and know-how nuclei. Section 5 turns to look at the role of the institutional context combined with regional, national and global networks, and the constraints given by the inherited identity of the place. Section 6 argues that, without the previous qualifications, misleading interpretations of ID development paths - in terms of lock-in and decline, or rerouting and longevity - can be easily give; and concluding remarks suggests some lines for further researches.

2. Processes of generation of new know-how nuclei and learning in IDs

A seminal work by Grabher (1993) investigated the Ruhr area as a case of an industrial region that fell in deep lock-in conditions because of "the very socioeconomic conditions that once made these regions stand out against the rest" (p. 256). After that paper, a large stream of literature in evolutionary economic geography has highlighted the tension between positive and negative effects of the agglomeration of specialised industry, in particular looking at the adaptation and adaptability capacities of the system (see Ter Wal & Boschma, 2011; Hassink, 2017). Other authors have stressed the diversity and the complexity of the economic structure (e.g. Hausmann & Hidalgo, 2011), or the so called 'related variety' (Frenken et al., 2007), as crucial resources for regional economic development. According to Belussi and Sedita (2012), heterogeneous evolutionary patterns may follow from similar initial conditions of resource endowments and comparable opportunities. The systemic capability to adjust the economic structure depends on the number and size of local companies, as well as on the relations between them within the core industry, and on the heterogeneity and variability of processes of knowledge generation (Menzel & Fornahl, 2010). Such processes include the sourcing of new knowledge by means of different modes of innovation (Jensen et al., 2007), the sharing of new knowledge (see Granovetter, 1973; Burt, 2004), and its absorption over time (see Malerba, 1992). The concept of "useful knowledge" (Kuznets, 1965) helps in giving an integrated view of them. This concept concerns the manipulation of nature for human material gain throughout inventions and design of new techniques. As highlighted by Mokyr (2002), "useful knowledge" includes two types of knowledge: 'propositional knowledge' that is related to natural phenomena and regularities, and 'instructional or prescriptive knowledge' that includes instructions and techniques that can be executed. Propositional knowledge refers to what "we today would call 'science' (formalised knowledge)" (Mokyr, 2002, 5), in particular it concerns basic scientific researches, while prescriptive knowledge "consists of a monstrous book of blueprints, whether codified or tacit, of techniques that society could carry out if it wanted" (ibid. 5).

The agents rooted in an ID, with their competences, carry out in a distributed way a sub-set of specific prescriptive knowledge and the intersecting parts of easily transferable (codified, formalised) propositional knowledge. The selection of knowledge available within an ID, combined with the available competences, identifies the 'manifest entities of knowledge', which we refer also as the 'cognitive frame of an ID'. Therefore, following the Mokyr's framework, such frame is identified by a mix of propositional knowledge, prescriptive knowledge, and competences accumulated through time. Under a dynamical perspective, knowledge and competences, i.e. 'know-how', grow, hybridize, disseminate continuously and variously, and sometimes disappear.

This structuration is evolving together with the characters of the local division of labour, i.e. the set of specialised activities that may be run by similarly specialised firms, in particular within and around the durable field of the main industries of an ID. The know-how nuclei related to such field constitute the evolving 'cognitive core' of an ID, given the frequent opportunities of circulation of ideas associated to the exchanges of products, components, materials, services, as well as the sharing of specific (quasi-) public goods, such as joint structures (e.g. logistics, purifiers, fairs, etc.), collective experiences (e.g. education, associative life, etc.), and cultural heritage (e.g. prevailing business and policy sub-cultures, inherited identity related to historical, natural and built images and traditions of the place, etc.). The exploitation of 'useful knowledge' within and among the know-how nuclei of an ID leads to a bottom-up generation of new knowledge to be explored. However, without exploration spanning non-selected knowledge, the processes of bottom-up generation of new knowledge would have decreasing returns, as it is suggested by Antonelli (1999) in the model of "localised technological knowledge".

Therefore, the exploration activities lead the cognitive frame to a constant exposition to new knowledge. The new knowledge coming from the selected area is extracted from the endogenous processes; the other type, coming from the non-selected area, usually impinging also on exogenous sources, is accessed by gatekeepers and drawn inside one or more of the existing know-how nuclei, to generate new know-how and sometimes new know-how nuclei.

3. IDs' transition capacities: endogenous rerouting

The area of non-selected knowledge where explorations are conducted by competitive systems may change in waves, taking wide challenges and opportunities (Perez, 2009). For example, in the current century, an articulated set of new technologies and sectors is currently driving what could be seen as a fourth revolution (Schwab, 2016): ICT, electronics, robotics, sensoring, and artificial intelligence; nanotechnology, bioscience, green & renewables; 3D and autonomous vehicle technology; etc. The embryos of some of these new technologies can be traced back to the mid-1980s, but to witness their impact on production and sectors, we had to wait really until the turn of the century. This current wave is for example pushing to new production and organizational models inside and between firms, referred to as 'Industry 4.0', 'Manufacturing 4.0' or 'Smart manufacturing' (De Propris, 2016). Local systems of SMEs have here great potential opportunities to renew their manufacturing and artisan capacities, to enhance the quality of products and processes with an increasing insertion of digital based services (servitization), and to expand the network of specialized collaborations, both inside the local system and through trans-local and globalized actors.

Adjustments can demand, not only the incorporation of new knowledge and production solutions within the given productive and cognitive structure, but also a deeper restructuring: inclusion of new know-how nuclei and breakdown of old ones within the core and around it, as well as an adaptation in the local 'institutional frame'. This is constituted by both the set of material and immaterial specific public goods, and the set of collective and public bodies providing them or supporting their provision.

Inertial forces related to sunk costs and complexity of relations, and lack of entrepreneurial drive related to past success of the local business and policy sub-cultures, may lock-in the system within a restricted adaptation, that is just an extension of traditional solutions (Asheim & Isaksen, 2002). This would bring about not only loss of opportunities but also threats to the re-productive prospects of well-established, mature IDs (Becattini and Rullani, 2004, Bellandi, 2011), against the competitive challenges carried-out by external competitors. The width and depth of such challenges increase of course in case of waves of technological change, like the present one recalled just above, where big firms increase their flexibility and control of international production and cognitive networks, and new local systems of SMEs may enjoy more easily the support of non-local resources thanks to wide digital and logistic platforms.

What type of transition capacities and processes may intervene from within (well-established, mature) an ID, help restructuring its productive (production and trade), cognitive and institutional frame, and reroute it to a new high road of development (Sengenberger, 2009)? We distinguish here two levels. The first one concerns conditions that are latent in the processes of a well-established, mature ID: local secondary industries quite un-related to the old core provide levers complementary to the new nuclei in terms of demand or supply of goods and services; pools of workers, professional and entrepreneurs, made redundant by the restructuring of the old core, support the quantitative growth of the new nuclei; local experiences of leadership and participatory processes, applied to social and economic events outside the core, trigger plasticity in the local institutional frame and within multi-territorial networks when a need arises (Bellandi and Santini, 2017 for references).

The second level is more deliberate, and has to do with industrial policies that can be applied at various levels of government, with various degree of coordination (Bellandi & Caloffi, 2016). The next Section proposes some application related to restructuring and re-routing prospects for LPS, in particular IDs, facing the contemporary wave of technological change.

4. Policies supporting processes of endogenous rerouting

The disruptive introduction of new technologies reinforced by Industry 4.0 phenomena (see

Hermann et al., 2015; Duyin & Geissler, 2016) has enlarged much the importance of synergies between specialized manufacturing industries and new technologies. Current technological change impacts on three levels: the firms' internal capabilities; the functioning and dynamics of the local business and social relations; and the skills and knowledge able to renew the external economies. Endogenous rerouting is based on a new interpretation of the multiplicity of competences and know-how nuclei embedded into the ID area; the interpretation is supported and constrained by the cultural background of the place that virtuously combines with regional, national and global networks, together with. However, the embedding of new knowledge and competencies may be blocked by the local institutional context because of the dominance of strong ties presiding exploration and exploitation of useful knowledge. This would take to lock-in conditions, crisis, systemic fragmentation and decline. When the system is unable to give expression to the large variety of interconnected projects of life and the lively exchange of experiences which define the inherited identity of the place, the emergence and exploration of new external knowledge and innovation is prevented.

In this context, industrial policies are needed to promote investments and multi-actor platforms for experimental processes. They should aim at rerouting towards new high roads of local development that resonate the H2020 credo, i.e. smart, inclusive, sustainable. Feasible and "realistic" initiatives display a set of features. They should be:

- experimental, finding specific technology and organizational solutions for stable innovation partnerships (see Hausmann et al., 2008; Rullani 2014) and interactions between different know-how resources;
- system-based, that is directed to the construction of public goods specific to the both transition processes and convergence to new stable paths (Labory, 2012);
- place-based, that is rooted in the territories in which technical, human, and social capital is accumulated;
- included in multi-scale governance, between cities and districts, regional innovation systems, national and European contexts,
- evidence-based, being crucial to understand and verify empirically the key elements of endogenous rerouting, in particular in face of a new wave of technological change and their wide impacts.

Taking Italy as an example, different territorial policies began to incorporate more and more directly the concepts of local production system and industrial district since the 1990s, and to define strategies for providing support to the innovative processes rooted at the local level. An example is the policy related to the promotion of "technological districts", at the beginning of the current

century, which characterize more and more (albeit with different intensity) the industrial, innovation and territorial policies also in the other European countries (*poles de competitivité* in France, *skills centers* in Germany). They are aimed at concentrating public and private resources in particular sectoral and territorial contexts where there is a strong growth potential, and where the more dynamic areas are an important driving force for the regions and countries. These clusters operate in particular sectors, such as aerospace, agri-business, green chemistry, energy, intelligent transport and mobility systems, life sciences, home automation, technologies for smart communities (Bellandi and Caloffi, 2016). This feature tends to limit the adoption of 'cross-sectoral' perspectives and experimental processes characterized by the interaction between different sectors and value chains.

On the other hand, the promotion of networks of SMEs, or of networks between SMEs and large firms (e.g. through the law on network contracts, or regional incentives), and the support to innovative start-ups (e.g. recent regulations implemented by the Ministry of Economy) could help the growth of new know-how nuclei, in particular where intangible resources, digital technologies smart and connectivity services play an increasing role (Porter & Heppelmann, 2014).

Without the qualifications presented in this paper, misleading interpretations of ID development paths - in terms of lock-in and decline, or rerouting and longevity - can be easily given. To explore the processes of endogenous rerouting, empirical research needs to align 'place-based' and 'cross-sectoral' perspectives. In future, it will be crucial to understand and verify empirically the key elements of endogenous rerouting, in particular in face of the new wave of technological change.

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