

KNOWLEDGE, NETWORK AND SOCIAL CAPITAL: DEVELOPPING COMPETITIVENESS THROUGH
GOVERNANCE IN PORTO DIGITAL

EXECUTIVE SUMMARY

After ten years of existence, Porto Digital has consolidated as a successful economic development policy in Brazil. Studies have showed that general technology-led development policies are not suitable for every country or region. The experience of Porto Digital demonstrates that existence of hybrid institutions (such as NGPD) can contribute to local economic development. This paper presents Porto Digital constitution as the result of the association between different actors, inside and outside the system, the conflicts, resolutions and negotiations between them. Also, presents how the process of stabilization and stimulation performed by the governance unit (NGPD) contributes to determinants of systemic competitiveness by the strengthening of social capital and knowledge flow.

1. INTRODUCTION

The experience of Porto Digital has shown that the existence of hybrid institutions (such as NGPD - the governance unit of Porto Digital), is essential to the development the determinants of systemic competitiveness in Science and Technology Parks (STP). This paper will present Porto Digital as a network and how the process of stabilization and stimulation performed by the governance unit (NGPD) contributes to the development of competitiveness by the strengthening of social capital and knowledge flow.

Knowledge has acquired a significant economic importance in the processes of wealth generation, economic growth and competitiveness of firms, industries, regions and countries. Several authors have addressed question such as 'what is knowledge', 'how knowledge produces its impacts on growth of firms, regions and countries' or 'through what mechanism knowledge improves welfare'¹. The changes in the means of production observed in the twentieth century, and especially in the last part of it, place knowledge at the centre of productive activities; these changes have also altered the way society itself is organized².

When addressing the competitiveness of firms and regions, knowledge is seen as an important input for innovative activities. External sources of knowledge are crucial for the innovative capacity of the firm. The ability to successfully exploit external sources of knowledge is a critical component of the innovative capabilities. Coupled with the ability of recognize external sources of valuable knowledge, it is necessary to be able to absorb this new knowledge and apply for it commercial use. Cohen and Levinthal³ refer to these abilities as "absorptive capabilities". They argue that absorptive capabilities are dependent of previous knowledge and cognitive structures inside the firms.

Absorptive capabilities can help explain why some firms - or science and technology parks, regions and nations -show differences in performance even when acting in similar contexts. The traditional

¹ Cf. Dasgupta, P., David, P. (1994) Towards new economics of science. *Research Policy*, 23, 5. 487-521; Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P., Trow, M. (1994) *The new production of knowledge: the dynamics of science and research in contemporary societies*. London: Sage Publications; Nelson, R., Winter, S. (1982) *An Evolutionary Theory of Economic Change*. Cambridge, MA: Harvard University Press.; Polanyi, M. (1962) *Personal Knowledge*, Chicago: The University of Chicago Press

² Castells, M. (1998) *The Information Age: Economy, Society and Culture. Volume 3: The End of Millennium*. Oxford: Blackwell; Drucker, P. (1993) *Post-Capitalist Society*. London: Harper Collins

³ Cohen, W., Levinthal, D. (1990) Absorptive Capacity: A New Perspective on Learning and Innovation. *Administrative Science Quarterly*, 35, 128-152.

economic approach to knowledge, which considers it to be not different from information, cannot properly explain those differences in performance. The explanation may reside in the tacit aspect of knowledge - frequently acknowledged to be sticky, localised, hard to transfer and exchange. The tacit nature of knowledge explains why the differences in perception and uncertainty, and consequently the path-dependent cognitive process that follows technical choices⁴. Tacit knowledge is a decisive component of the innovation process. So, the innovation process depends basically on the environment in which the companies are located and on the quality of the connections in the environment⁵.

Cohen and Levinthal report that the organisation's absorptive capabilities will derive from the capabilities of their workers⁶. It is not, however, simply the sum of the cognitive capabilities of their employees, but the capacity to exploit the knowledge. It depends on the transfer of knowledge from the exterior to the organisation and among the several sub-systems inside the firm. Social Networks can act as channels of knowledge from person to person, within and between companies.

Because knowledge is an increasingly important asset to the firms, and source of innovation and competitiveness, there have been some initiatives in fostering social networks in the firms. Various scholars have observed the knowledge dimension of networks and its link with competitive success⁷. Knowledge can be created within networks because of the enduring exchange relationship among members.

Networks provide firms and regions with access to new knowledge, markets, resources and technologies. The academic literature has identified several different types of networks, with their particular characteristics and advantages to organisations and clusters, spanning from consortia, alliances, associations to industrial districts, science and technology parks and regional innovation systems.

The nature of cluster and industrial parks already favours the knowledge pullovers among companies and people. As Marshall have noted, geographical proximity can stimulate the transfer of knowledge and generate competitive advantage to the companies. The main aspects that contributed to the formation of "localized industry", such as: i) natural resources; ii) political and governmental incentives; iii) specialized workforce; iv) communication and transportation infrastructure. These first efforts to explain the economic geography was based in attraction factors⁸. Porter, studying Japanese industry mechanics, verified the existence of a strong innovation power in clusters, whether technological or organizational, which play a relevant role in competition, due to effects, such: productivity raise, strategic alignment for innovation processes and foment the creation of new enterprises⁹.

However, as observed by Wolfe¹⁰, 'competitive advantage is not limited to the acquisition of codified knowledge and capital that are available worldwide; it is dependent on the institutional and social capital that fosters the acquisition and utilization of codified and tacit knowledge'.

⁴ Cf. Nelson, R., Winter, S. (1982); Pavitt, K. (1994), Patterns of Technical Change: Towards a Taxonomy and a Theory. *Research Policy*, 13, 343-373.

⁵ Porter, M. E. and Stern, S. (1999). The New Challenges to America's Prosperity: Findings from the Innovation Index. In: Porto Digital (2002) *Porto Digital: Um Ambiente de Empreendedorismo, Inovação e Negócios de Tecnologias da Informação e Comunicação*

⁶ Cohen, W., Levinthal, D. (1990) p.131

⁷ Dyer, J. H., Nobeoka, K. (2000). Creating and managing a high-performance knowledge-sharing network: The Toyota case. *Strategic Management Journal*, 21 (Special Issue) pp.345-367; Gupta, A. K., Govindarajan, V. (1991) Knowledge flows and the structure of control within multinational corporations. *Academy of Management Review*, 16: 768-792

⁸ Marshall, A. (1982) *Princípios de economia: tratado introdutório* Vol. I.

⁹ Porter, M. E. (1998). Clusters and the New Economics of Competition, *Harvard Business Review*.

¹⁰ Wolfe, D.A. (2000) Social Capital and Cluster Development in Learning Regions. In: *Knowledge, Clusters and Learning Regions*. Holbrook, A., Wolfe, D. A. Kingston: School of Policy Studies, Queens University.

The capacity of carrying and transferring knowledge through social relations is measured by Social Capital¹¹, which ‘consists of the stock of active connections among people; the trust, mutual understanding and shared values and behaviours that bind the members of human networks and communities and make cooperative action possible’. According to Portes¹², the first systematic analysis of social capital was from Bordieu¹³. It was defined as ‘the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance or recognition’¹⁴. After this, others have evolved the concept as a mechanism through which individuals can secure benefits by participating in social networks or social structures¹⁵. Knowledge acquisition has been indicated as a direct benefit from social capital¹⁶. From an organisational point of view, this benefit is basically the opportunity for acquiring knowledge from other members of the network.

Nahapiet and Ghoshal¹⁷ identify three aspects of social capital: structural, relational and cognitive. The structural dimension is related to the creation of informal networks in which the individuals can identify others who may be source of potential resources. In this dimension, it is analysed how the networks may have “strong ties” or “weak ties”. As observed by Granovetter (2005), strong ties are those with multiple contacts on a regular basis, and that act to reinforce cohesion, norms and values; on the other hand, weak ties are those occurring less frequently, but which have an important bridging role. Since information is more redundant within strong ties, weak ties tend to bring more diverse information and a greater source of potential benefits.

The importance of weak ties is very significant to the innovativeness of the network. It is through the weak ties that new knowledge flow, allowing firms and people to have insights and create new knowledge, new services and products.

The relational dimension addresses the issues of norms, values and culture. Nahapiet recognises that social capital tend to be increased when individuals expect that their actions will be appropriately reciprocated. The notion of trust is dealt with in this dimension.

The final dimension is the cognitive one. In order to build social capital, the individuals must have a common ground of understanding, or cognitive interaction. There are two main ways of building a common cognitive basis: (i) through common objects and artefacts, or (ii) through a common narrative (storytelling). By having shared goals, vision and culture, a network can build on social capital.

In the context of organisations and clusters, social capital can be understood as a stock of resources individuals in a community can draw upon in order to acquire benefits to themselves and to the organisation. Social Capital¹⁸ ‘enable[s] an organization to better manage its knowledge resources. Much like financial or human capital, social capital can be fostered and tapped as needed to enable individuals to perform their jobs more efficiently and effectively’. All these aspects of social

¹¹Cohen, D., Prusak, L. (2001) *In good company: how social capital makes organizations work*. Harvard Business School Press

¹² PORTES, A. (1998) Social Capital: Its Origins and Applications in Modern Sociology. *Annual Review of Sociology*, 24:1-2

¹³Bourdieu, P. (1986). The Forms of Capital. in J. Richardson, *Handbook of Theory and Research for the Sociology of Education*, New York, Greenwood Press

¹⁴ Bourdieu, P. (1986) p.248

¹⁵ e.g. Coleman, J. S. (1988): Social Capital in the Creation of Human Capital. *American Journal of Sociology*, 94, 95-120; Burt, R. (1992) *Structural Holes*. Cambridge, MA: Harvard University Press

¹⁶ Adler, P. S., Kwon, S.-W. (2002) Social capital: Prospect for a new concept. *Academy of Management Review*, 27: 17-40; Nahapiet, J., Ghoshal, S. (1998) Social Capital, Intellectual Capital and the organizational Advantage. *Academy of Management Review* (23:2), April, 1998, p. 243.

¹⁷ Nahapiet, J., Ghoshal, S. (1998)

¹⁸ Lesser, E., Prusak, L. (1999) *Communities of Practice, Social Capital and Organizational Knowledge*. Working Paper. IBM Institute of Knowledge Management. August.

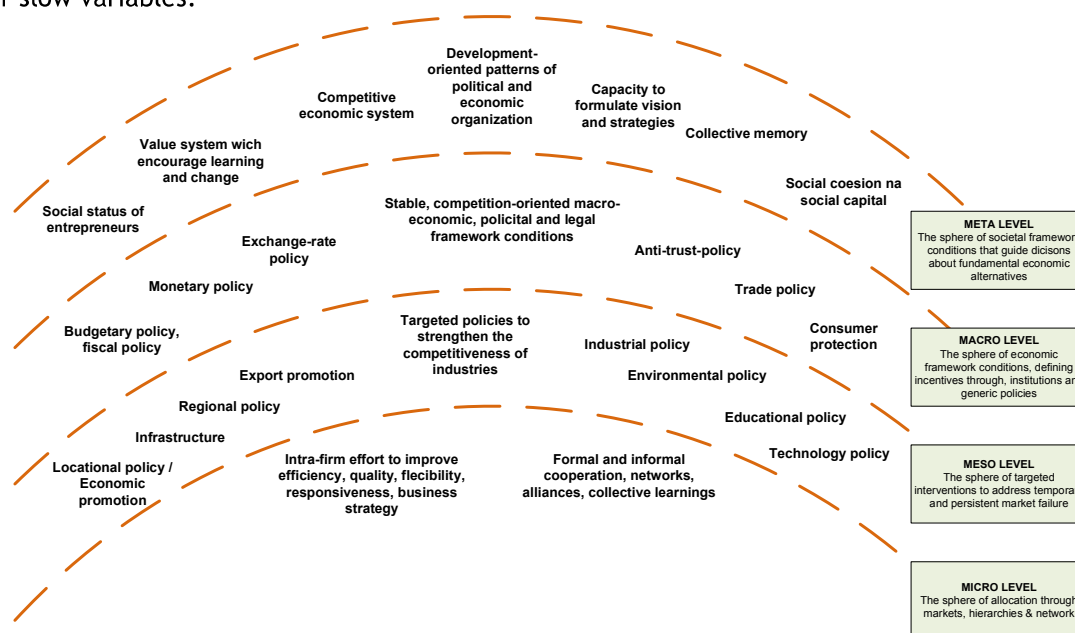
capital - norms, values, trust, reciprocity, common objects, common narratives - work toward the stabilization of the network, allowing knowledge to flow more freely through the links.

2. DETERMINANTS OF SYSTEMIC COMPETITIVENESS

The concept of Systemic Competitiveness, formulated by Meyer-Stamer¹⁹, allows us to undertake an analysis regarding specific strategies for local development, in particular, not based on the assumption of ideal conditions in terms of capacity and governance, but on the understanding of the existence of realistic amplitudes in terms of problem definition, formulation of proposals for action and implementation.

The concept also appointed some elements necessary for local economic development, namely: (i) favourable macroeconomic framework conditions, (ii) robust institutions and (iii) a predictable macroeconomic policy for economic development. Emphasizes, though, that a favourable macroeconomic environment is a necessary but not sufficient condition for sustained growth processes. Targeted interventions by government or other actors are crucial to address the market failures and network failures that stand in the way of modernization of existing industries and the emergence of new industries that are necessary to compete globally.

In order to analyze the complexity of factors driving the performance of a locality, the systemic competitiveness approach presents four analytical levels, which factors in each of these levels and how the factor levels are interrelated shape the ability of location to thrive in a global economy increasingly competitive. The levels are: (i) the microlevel where companies compete in competitive markets, but also in which networks and alliances of companies emerge to sustain their competitive efforts, (ii) the mesolevel of selective interventions to support companies' effort to shape a competitive advantage, (iii) the macrolevel of generic institutions, economic policies and framework conditions, and (iv) the metalevel of basic orientations in a given society as well as other slow variables.



Graphic 1 - Four levels and determinants of Systemic Competitiveness. Adapted from Meyer-Stamer (2008)

Therefore, analyzing the interrelationships among these levels, the concept of systemic competitiveness emphasizes the importance of the factors that determine the evolution of economic systems that are not viewed in a systemic macro and micro approaches by conventional

¹⁹ MEYER - STAMER, Jörg (2008). Systemic Competitiveness and Local Economic Development. Duisburg: Shamim Bodhanya.

economic. "Systemic" is not due to the ideas of systems theory. Indeed, "Systemic" refers to a distinct model of actors, institutions, organizations and policies that are interrelated through complex feedback mechanisms that together create a coherent and distinct entity, as a network, sometimes called the cluster or Science Technology Park.

3. DEVELOPPING COMPETITIVENESS THROUGH GOVERNANCE IN PORTO DIGITAL

3.1. PORTO DIGITAL

Porto Digital is a unique experience in technology-driven economic development, via information technology. It currently hosts 139 technology-based companies - most of them, small firms - as well as research and innovation centres and universities. In 2007 it was awarded by Anprotec - Brazilian Association of Science Parks and Incubators - as the best technology park / habitat for innovation in Brazil. Moreover, it is often cited as example for successful implementation of technology parks and strategies to promote innovative entrepreneurship. It was subject of Learning by Sharing vol.1 (2008), edited by IASP - International Association of Science Parks. More than 6,000 people work at Porto Digital, with average income three times higher than the average in the metropolitan area of Recife, capital of the state. After 10 years of existence, Porto Digital stands as an example for other parks and local productive clusters throughout the world, and was referred by specialists, such as Henry Etzkowitz, creator of the concept of Triple Helix, and Ignacy Sachs, polish economist high reputed in the conceptualization of productive clusters, among others.

Porto Digital is distinguished from other experiences in combining features of Technology Park and cluster. It was not born from within the University, in order to develop business up from its research products²⁰. Based on Gibbons' innovation 'mode 2'²¹ of knowledge production, Porto Digital was created to be an Information Technology cluster, closely integrated to university and research institutes but focusing on the market and the demands for technology products and services. Gibbons' mode 2 is related to the concept of the "Triple Helix". The Triple Helix model²² of innovation ecosystems is in the core approach to the creation of Porto Digital. Since its conception, it was possible to identify each one of the Triple Helix spheres: the local government, the university and private sectors related to the IT industry.

3.2. THE GOVERNANCE OF PORTO DIGITAL

To manage such complex system, an organization was created. It falls at the intersection of the three spheres of the Triple Helix - Government, University and Industry IT - acting as a hybrid mediator, which plays different roles depending on the need. Porto Digital Management Unit - NGPD - arises in a legal framework that allows the implementation of public policies to promote the structure and evolution of Porto Digital in an exclusively private way, combining innovation and the generation of new knowledge, but with the focus on market demand and industry development.

The role of mediation and translation played by NGPD in Porto Digital stabilization can be analyzed under the framework of the network-based innovation theories. Considering a Science and Technology Park (STP) as a network allows us to understand how the connections among actors and how the configuration of these links impact on the performance of the whole enterprise. The cluster constitution can be understood as the result of the association between different actors, inside or outside the system, the conflicts, resolutions and negotiations between them. These actors can be people, material artefacts or institutions that are related for a particular purpose. The social whole is nothing more than networks ordered and stabilized heterogeneous material²³.

²⁰ Porto Digital (2002)

²¹ Gibbons, M; et al. (1994)

²² Etzkowitz, H & Leydesdorff, L (2000) *The dynamics of innovation: from National Systems and "Mode 2" to a Triple Helix of university-industry-government relations*; Etzkowitz, H. (2009) *Hélice Tríplice: universidade-indústria-governo: inovação em ação*. Porto Alegre, Edipucrs.

²³ Callon, M., Law, J. and Rip, A. (Eds.) (1986) *Mapping the Dynamics of Science and Technology*, London: Macmillan Press.

The network is structured, then, by these actors. It is constantly dynamic and temporarily stabilized due to the convergence of the actors' interests within it. These actors continually build and rebuild the network, which can eventually expand, contract, and even disappear. The stabilization of the network does not reflect the existence of a priori structures. It reflects the effect of translation processes performed by the actors within it. As seen, social capital has a central role in such stabilization process.

3.3. BRIDGING ROLE

Networks naturally act as the most appropriate mechanism of coordination in contexts of innovation and knowledge intensive productive activities. In order to stimulate the knowledge transfer mechanism in the network, it is necessary to generate its basic element, as noted, social capital. Ramirez and Dickenson²⁴ noted that the processes of knowledge inside a network may be improved by intermediate actions from people or organisations. They noted the significance of "Creating effective bridges between the worlds inside and outside the firm".

In the experience of Porto Digital, it is possible to observe the role performed by NGPD in generating and strengthening social capital inside the cluster as a mechanism of stimulating the knowledge flow. Such role can be presented based on the three dimensions of social capital, as observed by Nahapiet and Ghoshal: structural, cognitive and relational.

(a) Structural Dimension of Social Capital

In order to increase the structural dimension of social capital within Porto Digital, the role of the governance is related to the strategic positioning in "structural holes", reinforcing the existent ties in the network and bridging distant nodes or sub-networks inside the park. As noted by Burt²⁵, such position in the structural holes of the network can provide the institution - working in the interests of the STP - benefits and opportunities for arbitrage and brokering knowledge gaps.

As emphasized by Granovetter²⁶, developing "bridging agents", as a mean to connect a wide range of "distant communities" may be beneficial to gaining access to broader sources of information through "weak ties". Most of the times, the social capital will be stronger among individuals than among companies. The creation of occasions and opportunities for workers and entrepreneurs to meet and build cohesion is a good start for the individual social capital (and existing social networks) to become organisational social capital and organisational networks.

With relation to the structural dimension of social capital, communities of practice provide the opportunity for individuals to develop a network of common interests. Through the communities of practices, it is possible to identify "who knows what", reinforcing this aspect of the social capital. Furthermore, it works as a mechanism of referencing, making it easier for the practitioners to identify sources of potential benefits and new knowledge.

(b) Cognitive dimension of social capital

The role of NGPD with regard to the cognitive dimension of social capital is in create diffuse and reinforce shared goals, shared culture, a common narrative, common objects and common spaces, by several strategies.

An example is the Strategic Plan 2010-2020 of Porto Digital. Result of integrating a series of inputs (interviews, surveys, benchmarking and conceptual review of the major economic issues and procedures relating to the park). This is not a project for NGPD. It is an action directed toward the environment. The intention is promote not only skills and strengthening the Porto Digital firms to

²⁴ Ramirez, M., Dickenson, P. (2010) Gatekeepers, Knowledge Brokers and Inter-Firm Knowledge Transfer in Beijing's Zhongguancun Science Park. *International Journal of Innovation Management* Vol. 14, No. 1 (Feb. 2010), p.94

²⁵ Burt, R. (1992)

²⁶ Granovetter, M (1973). The strength of weak ties. *American Journal of Sociology*, 78(6), 1360-1380

become more competitive, but also promote the integration of ICT sector to other productive chains so that together can promote local socioeconomic development.

(c) Relational Dimension of social capital

The last important area of actuation of NGPD in fostering social capital within Porto Digital is in building trust and reciprocity. It is essential that individuals and organisations develop an economy of “gift exchange”, in which each one gives in the expectation that its behaviour will be rewarded, even if they do not receive immediate retribution for what is given. Through the enduring interaction in a community, norms, values and the sense of trust can be strengthened. Individuals can exercise reciprocity in the context of knowledge sharing, “testing” the degree of commitment of other members.

A reinforcing element of the relational dimension of social capital of Porto Digital is fostering a culture of *coopetition* among companies in the park. An example is OjE - Olympics of Digital Games and Education, a virtual adventure developed in the form of a digital-game competition, which values the educational content and ability to work together. It is dedicated to students and teachers from public schools in the state, where the game is seen from an educational perspective, thus requiring the mediation experience of teachers. To build the required solution, NGPD promoted the interaction between the various components - firms and institutions - of the ICT cluster in the state. This action has taken into account the mission of NGPD, which is to generate synergy among the various actors, acting as articulator agent in the environment and stimulate innovation.

4. CONCLUSION

Several interesting findings and considerations regarding the roles of network, knowledge and social capital in developing the determinants of systemic competitiveness in STP arise from this study. The paper found that competitive advantage is not limited to the acquisition of codified knowledge and capital that are available worldwide; it is dependent on the institutional and social capital that fosters the acquisition and utilization of codified and tacit knowledge. Such capacity of carrying and transferring knowledge through social relations is measured by Social Capital.

A review on the concept the determinants of systemic competitiveness, which allowed us to understand specific strategies for local development, in particular by understanding the existence of realistic amplitudes in terms of definition the problem, formulating proposals for action and implementation present in the STP, showed that the replication of same models in different environments is almost unsuccessful.

Although, Science Technologic Parks could be explained as a technology based strategy for economic development, this is not its only distinctive feature. The paper presented Porto Digital constitution as the result of the association between different actors, inside or outside the system, the conflicts, resolutions and negotiations between them. These actors can be people, material artefacts or institutions that are related for a particular purpose. The process of stabilization and stimulation performed by the governance unit (NGPD) contributes to the development of determinants of systemic competitiveness by the strengthening of social capital and knowledge flow.

The paper has several limitations. The underlying theoretical framework was applied to a single case study. While it shows that the theoretical framework is sufficient for identification the role of network, knowledge and social capital in influencing STP performance, specific factors may vary from case to case and similar exercises. This is particularly challenging, since it is obvious that performance is not a dichotomous variable, but may vary both in magnitude and over time. A comparative study between several cases can be beneficial.