

# Stimulating local and global social capital: the role of institutions

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## Abstract

The aim of the paper is to investigate the role that institutions can play in improving the level of social capital for economic development. Social capital is considered as one of the factors of economic development, which increases economic efficiency through supporting cooperation and lowering transaction costs, even in the global marketplace. Empirically, it has been shown that regions and countries with relatively high stocks of social capital seem to achieve higher levels of innovation and growth with respect to the others. Social capital is not, as generally suggested by the socio-economic literature, an individual attitude towards something which does not imply privately appropriable economic benefits, as it is for a pure public good. Social capital should be interpreted as an impure public good, since agents face private incentives to create and preserve it, but such behaviour generates externalities. Agents could not have sufficient incentive to increase its investment in social capital, since this investment strictly depends on the economic convenience of investing in the impure public good. Starting from this point of view, we underline the importance of investing public resources (funds, time, effort, rules, etc.) for the development of the social capital. Particularly globalization requires global social capital among countries, and formal institutions that could stimulate it. The paper is organized as follows. In section two, we describe some of the main results of the recent literature about the effect of social capital on the economic ground, both at local and global level. In section three, the role that institutions can play in the provision of social capital as public component of an impure public good is discussed. Section four reviews the literature about social capital and its measurement. Section five presents the main results of a multidimensional data analysis and section six provides conclusions.

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## 1. Introduction

Large body of research in the social sciences in the past decade underlined a positive relationship between social capital and economic success. Particularly, social capital may be the primary and leading key to the successful performance of a Country. Social capital, however, is frequently depicted as an impure public good, since agents face private incentives to create and preserve it, but such behaviour generates externalities. Therefore, institutions can play an important role in the solution to the problem of free riding.

In order to put forward this idea, it is important to clarify what social capital represents.

In the last years, social capital has become a widely used concept within the social sciences. The roots of the idea of social capital have been traced back to the thought of Durkheim and Marx (Carrol and Stanfield 2003, p. 397). Social capital has been also noted in economics for decades. Woolcock (2001, p. 66) talks about Hirschman (1958) and Adelman and Morris (1967) as pioneers in the field of economics. Actually, scholars continue to debate its existence, nature, measurement and impact as a conceptual framework. There is little consensus about what it is, how it is observed and measured, which outcomes it supports or not. Social capital is usually associated with all that is good about human and social relations. Such a view lacks concrete referents and makes it extremely difficult to study this variable and its economic effects.

First of all, it is important, therefore, to clarify exactly what one implies while referring to social capital before dealing with any other question. Social capital has been defined in a number of different ways, but scholars generally refer to the ideas of Putnam (1995) and Coleman (1988).

Putnam (1995, pp. 664-665) defines social capital as a community-level characteristic involving *“features of social life – networks, norms, and trust – that enable participants to act together more effectively to pursue shared objectives”*. In Putnam’s view, social capital refers to the quality of human relations within some well-defined group that enables its members to act in cooperation with one another for achieving mutual benefits.

A wider definition is given by Coleman (1988, p. 598), who describes social capital as *“a variety of different entities, with two elements in common: they all consist of some aspect of social structure, and they facilitate certain actions of actors – whether personal or corporate actors – within the structure”*. This concept is wider since it includes associations as well as the behaviour among other entities such as firms. Social capital, just like other forms of capital, is productive and facilitates the attainment of goals that otherwise would not be possible. Accordingly, high stock of social capital increases individuals’ and groups’ ability and willingness to cooperate, improves monitoring and enforcement of contracts, and reduces free-riding and information asymmetry.

Social capital therefore reduces transaction costs, encourages innovation and dissemination of technology and thus leads to better economic outcomes.

The most encompassing view – the one that has attracted plenty of interest among economists – also includes “*the social and political environment that enables norms to develop and shapes social structure*” (Serageldin and Grootaert 1997, p. 13). This broadest definition includes not only the largely informal relationships, but also the more formalised institutions such as the government, the political regime, the rule of law, the court system, and civil and political liberties. This article is based upon this last definition.

Moreover, it is important to remember the concepts of bonding, bridging and linking social capital characterizing the multiple dimensions of social identities and relations at the community level. Bonding social capital refers to strong ties between people who know each other well, such as family members, close friends, neighbours and members of primary groups. Bonding social capital connects individuals who are similar in terms of socio-financial status and demographic characteristics; groups defined by these kind of relations thus have a high degree of homogeneity. Bonding social capital is also considered a foundation from which to establish bridging and linking ties to other groups. Particularly, bridging social capital implies ties between people who are not similar demographically, but have broadly alike financial position. Bridging, in this sense, may be considered as a metaphor for horizontal connections that link different social groups or communities. Bridging relations typically include casual friends, work colleagues and members of secondary associations. The main utility of bridging ties is access to a larger set of resources, information and opportunities than is available within the group. The third type of social capital consists of ties between groups and people in positions of authority or influence. Basically, whereas bonding and bridging refer to horizontal relationships, linking social capital represents the vertical dimension. Linking ties may include civil society organizations, government agencies, representatives of the public and the private sector. This kind of global social capital is valuable in terms of increased access to key resources outside the community. These ties facilitate global connections with other people and different resources, and generate greater opportunities to benefit from skills quite different from our own at places farther and farther from our homes. As people have taken advantage of opportunities to benefit from global comparative advantages, local markets have been transformed into global ones, and exchanges between neighbours have been replaced with exchanges between trading partners separated by greater geographic and social distances. According to this view, linking social capital may be essential for the well-being and long-term economic development. This paper will mainly focus on this kind of global social capital.

Inkeles (2000, p. 247), moreover, states that “*what makes the study of social capital compelling is the assumption of added value [...] it permits communities to do what they could not do [...]*”

*without the addition of social capital. By contrast, studies focused on the individual generally say nothing about added value, and concentrate rather on competitive advantage in the gaining of shares from a fixed pie. They almost invariably deal with a win-lose situation. It is a much more attractive proposition for humankind if we can establish that adding social capital at the communal level is a win-win situation for both the individual and the community at large”.*

We argue it is essential to move away from “*associative*” based concepts of social capital as presented by Putnam (1993), toward frameworks where social capital is considered as an intangible capital stock with some public good-like properties<sup>1</sup>.

The paper is organized as follows. In section two, we describe some of the main results of the recent literature about the effect of social capital on the economic ground, both at micro and macro level. In section three, the role that institutions can play in the provision of social capital is discussed. Section four reviews the literature about social capital and its measurement. In section five, the dynamics and the determinants of social capital in EU over the last years are evaluated, by performing a non-linear clustering with Self-Organizing Map (SOM) neural networks. Section six provides conclusions.

## **2. Social capital and economic performances**

Economics and regional science literature make a strong case that “*non-economic*” factors influence economic growth and development. Many authors argue that increased levels of social capital can create better chances for economic development than markets and political institutions. Scholars have attempted to document the various ways in which social capital can improve the performance of economic systems (see, for example, Putnam 1993 and 2000, Fukuyama 1995, Levi 1998 and Cook 2000). The idea of social capital has been used to explain phenomena varying from technology adoption to the formation of informal institutions.

At the micro-level, studies of the effect of social capital have focused on household income, financial transactions, and the knowledge exchange between venture capitalists and new firms. Wilson (2000) and Rauch (2001) demonstrate that social capital improve the competitiveness of firms by reducing transitional costs and uncertainty, and increasing information sharing. Narayan and Pritchett (1999) show that village social capital stocks contribute more to household income than does own-household social capital stock. Schmid and Robison (1995) demonstrate how social

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<sup>1</sup> Note, however, that according to some authors, social capital lodged in collectivities or groups is a dubious idea. Following Lin (2001), for example, social capital could have been considered as resources fixed within social networks that are used by individuals to facilitate particular actions, i. e., social capital could have been seen as an individual-level and not a group-level asset.

capital affects the probability of receiving a loan, the sale price of assets, and the willingness to share risk. Maula, Autio and Murray (2003) show that social capital between a corporate venture capitalist and a new firm increases the knowledge exchange between the two organizations, especially when they are in complementary industries. Cainelli, Mancinelli and Mazzanti (2007) examine firm level research and find evidence that social capital predispose firms to engage in innovative activity, although it is not a sufficient condition. Bigsten *et al.* (2000) and Fafchamps and Minten (2002) both confirm that social capital has a strong role when property rights and courts are working imperfectly.

Social capital has been also used to explain economic phenomena at aggregated levels, such as regions or nations. Kraybill and Weber (1995), Castle (1998), Barkley (1998) and Rainey *et al.* (2003) underline the important role that social capital can play in the development of rural places in the US. Rupasingha, Goetz and Freshwater (2000, 2002) demonstrate that social capital increases the growth rate of US counties. Particularly, they created a social capital index linked to organizations at the county level, and estimated a significant positive effect of the index on the growth rate of per capita income. Knack and Keefer (1997) found that social capital variables have a strong and significant relationship with economic growth. Rupasingha and Goetz (2007) demonstrate that social capital reduces county-level poverty rates. Helliwell and Putnam (1995) show that in regions with a higher level of social capital, per capita GDP convergence is faster and equilibrium levels of income are higher. Temple and Johnson (1998) demonstrate a strong correlation (0.60) between social development and growth rate for more than 45 countries between 1960 and 1985. Zak and Knack (2001) regress economic growth on both levels of interpersonal trust (from World Value Surveys) and on an index of formal institutional strength in a cross-section of 41 countries, most of which are industrialized. The authors find that trust is positively and significantly related to growth when holding formal institutions constant. However, they do not explore the possibility of non-linear effects of trust that depend on different levels of formal institutions. Beugelsdijk, de Groot and van Schaik (2004) find that the results are in general fairly robust, even when including some institutions-related measures (such as religion and political instability), but that the marginal impact of trust is greater in low-trust countries. Similarly, Tabellini (2006) finds a positive effect of interpersonal trust on growth in European regions using an instrumental variable approach.

Even though social capital has not been measured in any satisfactory way yet, but often in an ad hoc manner (Paldam and Svendsen 2004), the above mentioned studies strongly suggest that social capital significantly influences economic development. Our analysis moves from these studies by treating the relationship between social capital and institutions in the economic development process of a Country.

### 3. Investment in social capital: the role of institutions

Many economists argue that social capital should be described as an impure public good, since agents face private incentives to create and preserve social capital but such behaviour generates public benefits, or externalities<sup>2</sup>.

Collier (1998) was among the first to apply microeconomic theory in the analysis of social capital with an emphasis on the external benefits of social interaction. He states that “[...] *social capital is “social” because it generates externalities arising from social interaction. Both the initiation of social interaction and its consequences generate effects which are not internalized into the decision calculus of each agent*” (Collier 1998, p. viii). Social interactions may generate different kinds of positive externalities<sup>3</sup>. They facilitate the transmission of information about the behaviour of other agents and this reduces the problem of opportunism. They facilitate the transmission of knowledge about technology and markets and this reduces market failures in information. So the presence of high level of social capital reduces information and transaction costs. When such costs are reduced, less risk is involved and more exchange takes place, thus enlarging the scope of transactions and interactions. Conversely, a lack of social capital results demand for more external controls such as tougher law enforcement, security systems, monitoring and enforcement (Rupasingha, Goetz and Freshwater 2000). Moreover social capital reduces the problem of free-riding and this facilitates joint action. The provision of public goods is subject to free riding if most users do not participate in collective actions to make the provision of public good a success. Conventional theories of collective action have concluded that individuals will resort to strategic behaviour by refusing to contribute toward the public good in order to obtain a benefit far greater than the cost they have to pay. When social capital is present, externalities are internalized, which has the effect of eliminating or reducing the free rider problem (Rupasingha, Goetz and Freshwater 2000).

Because it generates externalities, social capital may be under-provided since, despite the civic culture, agents have not sufficient incentive to increase their investment in social capital, because

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<sup>2</sup> In the economic literature, an impure public good is a good which gives both private and public benefits. For example, the acquisition of certain types of education is often asserted to have benefits for society at large, in addition to purely private benefits generated for students (Cornes and Sandler 1986).

<sup>3</sup> Social capital may generate also negative externalities. It is possible that what is regarded as a benefit by group members might constitute a loss for society at large (Rose 1999). Members of a criminal organization, for example, can have high social capital, which enables them to achieve and share large benefits from criminal activities that damage the overall good of society.

this investment strictly depends on the economic convenience of investing in the impure public good. The government's main policy could be to improve its provision.

For instance, suppose that a firm in an industrial district may invest in R&D activities that require a cooperative effort. In this case, innovations are only partially owned by the firm and the investment may be thought of as one in an impure public good, that is each unit of investment produces both private and public benefits. The district benefits from positive network externalities, but the intentional production of joint social benefits is costly and public incentives may be crucial.

Actual demonstrations of the effectiveness of investment strategies in social capital are rare. As Fernandez and Castilla argue, "*if the term 'social capital' is to mean anything more than 'networks have value', then we will need to demonstrate key features of the analogy to 'real' capital. If 'social' capital is like 'real' capital, we should be able to isolate the value of the investment, the rates of return, and the means by which returns are realized*" (Fernandez and Castilla, 2001, p. 85). Anyway, institutions can play an important role against certain kinds of opportunism and remove the source of insecurity in such relationships and allow agents to cooperate with each other more efficiently.

#### **4. Measurement of social capital**

If social capital is the set of social interactions that generate externalities and persist over time (Collier 1998), the stock of social capital may be thought as a function of the quantity and quality of social interactions engaged in by the agents. A change in the quantity or quality of interaction will lead to a change in the amount of social capital. The implication is that one proxy for investment in social capital is measuring the opportunities one has for social interaction (e. g., the amount of time one spends interacting with neighbours). This concept is useful for identifying proxies for social capital in empirical analysis. Empirical debates about social capital seem to be characterized by a lack of consensus about its meaning, by conceptual ambiguity and by a muddling up of outcomes and indicators.

Much has been written attempting to rigorously identify proxies for its measurement (Chamlee-Wright, 2008; Durlauf, 2002; Glaeser et al., 2000; Paldam, 2000; Robison et al., 2002; Schmid, 2003; Wallis et al., 2004). Since the literature tends to attach different labels to social capital (see par. 1), there are different empirical measures of generalized social capital. The most popular are the following ones:

- *Civic participation*, or membership in voluntary organizations. This measure was introduced by Putnam (1993) in his seminal work on Italian regions. Through membership in voluntary

organizations, one learns to interact with other people in a cooperative manner to achieve a shared objective.

- *Trust*. Introduced by Fukuyama (1995), this kind of concept has become the most commonly used empirical measure of social capital. Its empirical popularity is largely due to the availability of extensive cross-country survey data on generalized trust (such as those collected within the framework of the World Value Surveys program). Typically, trust is defined as the extent to which people find strangers trustworthy.
- *Density of networks*. This is a measure of ties between agents. Network-based ties can be formal or informal. In formal networks, ties between agents take the form of joint presence at a formal event or membership in an organization. Informal networks, on the other hand, consist of relations among friends, members of (extended) family, colleagues, etc.
- *Philanthropic generosity (i. e., altruism)*. This measure is based on Putnam's (2001) finding that the frequency of charitable contributions in the US over time. It has been highly correlated with membership in voluntary organizations. This measure is problematic however, because individual-level altruism may depend on the generosity of the welfare state.

The main obstacle in using the above mentioned measures of social capital for a Country is that social capital characteristics are usually non-market and non-accounted in a dataset. In general, anything that facilitates cooperation between individuals can be conceptualized as social capital.

In particular, the measurement of trust seems to be closely connected to the use of survey methods. Roberts and Roche remark that is difficult to “*conceive of any non-survey data source which might represent an adequate proxy for trust*” (2001, p. 22). Other researchers stress the function of social capital to promote social cohesion and consider the consequences of a lack of cooperation as inverse measures of social capital. In other words, it is expected to deal with a wide variety of social and political ‘ills’ such as declining feelings of solidarity and community, declining confidence in democracy, deteriorating neighbourhoods, decreasing educational attainments, increasing risk of social exclusion, a rise in different forms of criminality, the spread of corruption, etc.

The rapid rise and spread of the concept of social capital and its uses in very divergent fields raises serious questions about its measurement. Divergent methods and measures for social capital may lead to different results about its latent structure. At the operational level there exists a wide number of different aspects, characteristics, measures, outcomes, factors, indicators and dimensions of social capital, which is a direct consequence of the lack of conceptual clarity: “*where such a diversity of definition exists it is inevitable that an equivalent heterogeneity of measures is used*” (Schuller, Baron, and Field 2000, p. 26).

## 5. Social capital determinants: a neural network analysis

This empirical study investigates the dynamics and the determinants of social capital in EU over the last years, using empirical data from Eurostat. Methodologically, we perform a non-linear clustering with SOM neural networks, that are among the most important and widely used neural network architectures. They were developed by Kohonen (2001). For a collection of state-of-the-art applications to geographical analysis see Agarwal and Skupin (2008).

As said before, the measurement of social capital requires strong assumptions about its proxies. In particular, the use of aggregated indicators of social capital might lead to ambiguities at the operational level, because they can be used in macro-level interpretations as well as in micro-level explanations of social capital conceptualized as a collective good. In the latter case social capital is considered to be an attribute of networks (or societies, regions, countries, etc.) and information is presented in the form of, for instance, the density of voluntary organizations, legal protection, etc. (for other example, see Salamon et al., 1999 and Putnam, 2000). Distinguishing among the different conceptualizations of social capital – particularly individual vs. collective depictions – is important because it implies the selection of quite different research strategies and proxies. In particular, the measurement of trust seems to be closely connected to the use of polling methods, even if other researchers stress the function of social capital to promote social cohesion and consider the consequences of a lack of cooperation as inverse measures of social capital (OECD, 2001). Following this approach, the “Crimes recorded by the police x 1000 people (2008-12)” (variable: Crimes), the “Prison population per 100,000 people (2008-12)” (variable: Prison population) and the “People at risk of poverty or social exclusion (2009-13) (variable: Social exclusion) crime are used as inverse indicators for social capital.

Many previous analysis on social capital determinants at individual level are complemented by country-level indicators, in order to find out whether this contextual factors affect the individual level of social capital. The selection of country-level indicator is based mainly on theoretical assumptions and on the availability of data for the Countries of interest.

Firstly, economic variables seem to be influential factors of social capital. Empirical evidence shows that higher levels of income coincide with a higher probability for network membership and interpersonal trust (Knack and Keefer 1997, Denny 2003, Helliwell and Putnam 1995, Paldam 2000, and others). However, the exact causal mechanism behind this relationship is not clearly explained in the literature. Previous empirical research (Costa and Kahn, 2003; Ferragina, 2010; Gorz, 1992; Knack and Keefer, 1997; O’Connel, 2003) suggests that income inequality, labour market participation, and economic development should explain a large amount of social capital variation across countries. Following these suggestions, the “GDP per capita in PPS Index (EU28 =

100) (2009-13)” (variable: GDP), the “Gini coefficient of equivalised disposable income (2009-13)” (variable: Gini coefficient) and the “Unemployment rate (2010-14)” (variable: Unemployment rate) are chosen as indicators for the economic development level of a Country.

Information and communication technologies (ICT) impacts on the communities in which we live and the way individuals, business, government and civil society interact and develop. Simultaneously, all sectors have shown increased interest in the concept of social capital and the role it can play in building stronger communities, increasing economic productivity. As the use and impact of ICT increases, so does the prospect that ICT can play a role in shaping the nature of community development and contributing to the building of social capital. Nowadays communities exist both within and outside of geographic boundaries and that the development of social capital within these communities may depend on several core elements; particularly, the availability, capacity, reliability and effective use of bandwidth connectivity – together with attention to issues of online trust and confidence – will determine the quality and frequency of interactions. Many agents and organisations use ICT to extend their services and reach. Increased communication capabilities reinforce existing relationships and form and extend new ones. Based on these ideas, the “Households having access to the adsl (2010-14)” (variable: Adsl), the “e-government usage by individuals (2006-10)” (variable: e-government) and the “Individuals regularly using the internet (% of individuals aged 16 to 74) (2010-14)” (variable: Internet use) are chosen as indicators of the ICT diffusion level in a Country.

Many studies dealing with social capital have found that education is a powerful predictor of trust. Some authors see education as a form of social status, similar to income. Higher status people have more trust (see Putnam 1995; Patterson 1999). Education, especially at the university level, extends one’s perspective on the world and brings one into contact with a wider variety of people. Education plays a key role for setting moral standards and equipping students with an essential sense of morality. Schooling experiences expand the horizon of individuals on economic and social change. Higher educated individuals are more open-minded to accept others from heterogeneous groups, and they will have a higher level of trust in people in general, those they know and those they do not know (Putnam. 1995, 2000). Guiso, Sapienza and Zingales (2004) support this idea and show that trust is not simply an equilibrium outcome of a society where non-legal mechanisms force people to behave cooperatively but also an inherited component, imprinted with education. Following these approaches, the “Lifelong learning (2010-14)” (variable: Lifelong learning), the “Public expenditure on education (% of GDP) (2007-11)” (variable: Expenditure on education) and the “Pupil/teacher ratio in primary education (2008-12)” (variable: Pupil/teacher) are used in the analysis as indicators for the education level of a Country.

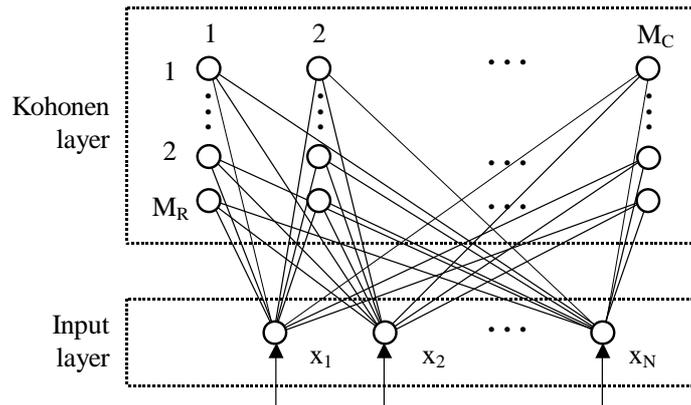
Finally, social capital describes the advantage that individuals and communities can gain from social interaction, mutual assistance and trust. Socially disadvantaged groups can lack social capital and public transport can provide mobility for these groups and, in doing so, provide a greater opportunity to create and maintain social networks. Although these concepts are abstract, public transport by definition involves travelling with others and hence provides opportunities for social interaction while travelling. The links between social capital and travel present an opportunity to understand how public transport acts to address social disadvantage through the provision of mobility to disadvantaged communities. Existing studies of transport and its impact on economic field focus largely on its role in the process of economic growth, by increasing the productive capacity and market accessibility. From the social capital point of view, access to social networks is important in creating opportunities for learning and exchange of information on new opportunities. Mobility is essential to the sustainability of social networks, both in enabling access to cognitive and structural social capital, and in creating opportunities for networking. Therefore an adequate transport system should help in reducing the risk of social exclusion. Bourdieu (1997) explains that the volume of social capital possessed by an agent depends on the size of the network of personal connections he can effectively mobilise, and is hence related directly to the proximity in physical and geographical space of such a network. On this basis, mobility is required for both the generation and maintenance of social capital networks. Following these ideas, the “Air transport of passengers (million per million inhabitants) (2009-13)” (variable: Air transport), the “Motorisation rate (Cars per 1000 inhabitants) (2008-12)” (variable: Motorisation) and the “Volume of passenger transport relative to GDP (index 2000=100) (2008-12) (variable: Volume of transport) are chosen as indicators of the transport capability of a Country.

Note that all the considered indicators may be heavily influenced directly or indirectly by the institutions, since governments, by operating on these variables, could play an important role in stimulating the formation of social capital.

The dataset to train the SOM algorithm is obtained from a matrix  $X$ , whose generic element  $x_{ijt}$  is the value assumed by the  $i$ -Country for the  $j$ -variable at the  $t$ -time. This allows us to analyze the dynamic of the phenomenon in the last years, based on the available data. Data were normalized within each considered variable, in order to avoid possible distortions due to different ranges and magnitudes. The key element of a SOM network is the Kohonen Layer (KL), which is made up of spatially ordered Processing Elements (PE). The global state of the layer evolves during the learning process, identifying each PE as a representative pattern of the input data, through an unsupervised learning technique. A vector is associated with the generic PE in the KL, whose elements are the weights relative to the patterns identified. The weight vector associated with the generic  $PE_r$  in the KL is indicated by  $W_r = (wr_1, wr_2, \dots, wr_N)$ . ‘Closeness’ of vectors can be

expressed in terms of several different possible metrics. Although several definitions of a neighbourhood are available, a convenient metric is based on the Euclidean distance  $d$  between the PE on the KL<sup>4</sup>. For each given PE in the KL, there is a set of items (input data), which, if submitted iteratively to the SOM during the learning process, make the given PE the most representative pattern of them. These items define a region over the KL: near-by input data tend to map onto the same PE, or more generally within the same neighbourhood of PE (see Fig. 1).

**Fig. 1 – Input Layer and Kohonen Layer**

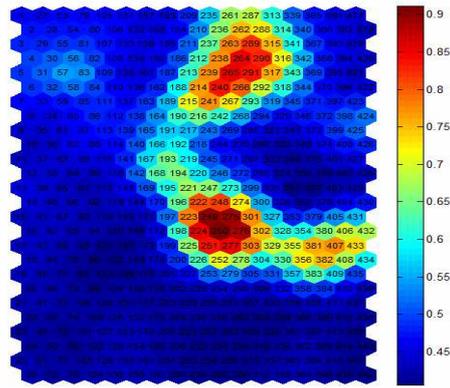


Source: our representation

Neighbourhood is defined in the two dimensional space of the PE of the KL, whatever the dimensionality of the input space. The learning criterion, therefore, cannot be geometrically invariant with respect to the dimensionality of the input space. The clustering with SOM keeps the relations of similarities across the observed objects, defining a continuous space differently populated in terms of frequency of the original objects. The training of SOM neural network produces one Feature Map for each variable, similar to that depicted in Figure 2.

<sup>4</sup> Basically, the function  $h(d)$ , describes how the generic PE will update starting from the associated weights array  $W_r$  (and from the size of the error  $X - W_r$ ):  $\Delta W(d) = h(d) \cdot (X - W_r)$ .

Fig. 2 – Feature map example



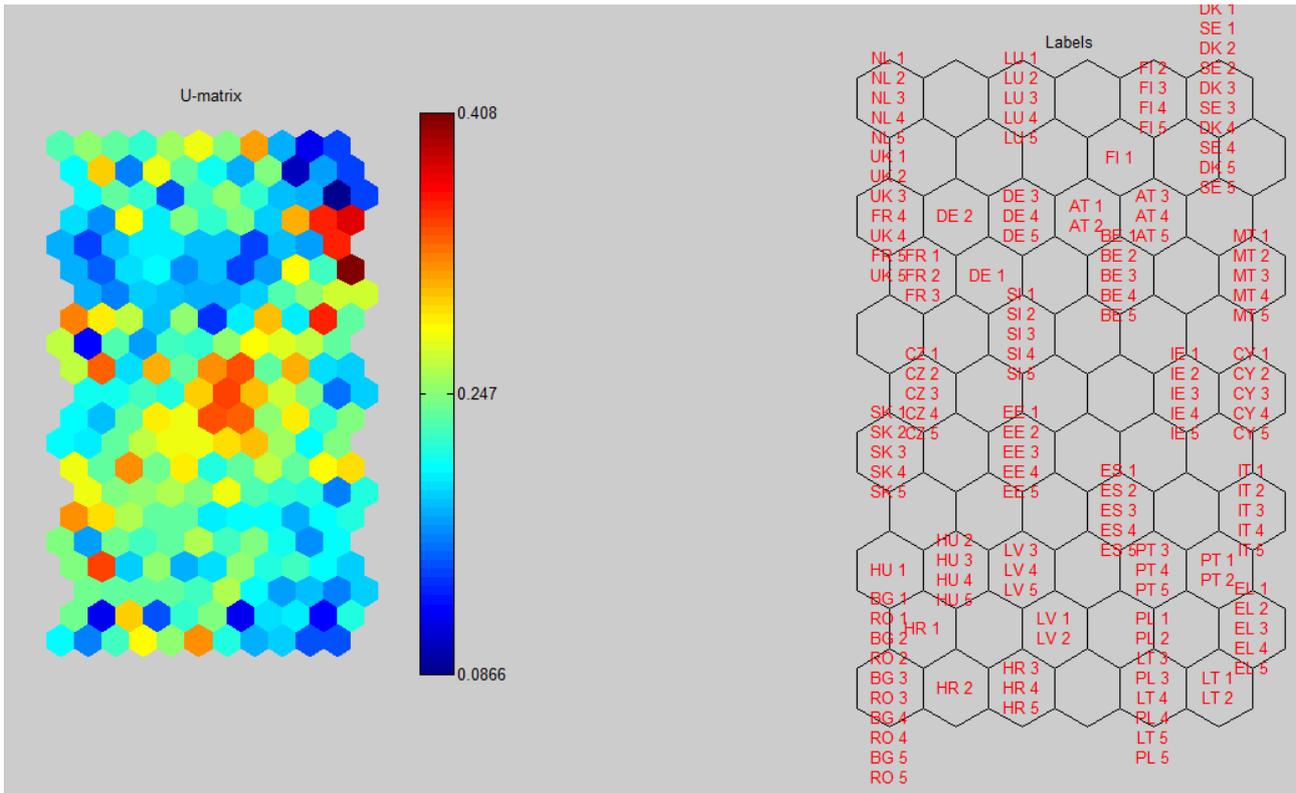
Source: our representation

Contrary to what is achieved through a multidimensional analysis, we obtain a threefold result characterized by:

- a) A new measure of feature's relevance for a definite cluster.
- b) A new relation between levels of presence for one or more features and the multidimensional similarity for the countries in terms of socio-economic profiling (the neighbourhood above the KL);
- c) A definition for the agglomeration of countries, in terms of presence in the same neighbourhood of the KL (SOM codebooks).

The unified distance matrix (U-matrix), which is a representation of the results of the SOM neural network analysis, provides interesting outcome. Firstly, the position of Countries on the map seems to be stable over the considered period. Secondly, it is possible to point out three main groups of Countries having in common geographical and socio-economic characteristics (see Fig. 3).

Fig. 3 – U-matrix



Source: our computation and representation based on Eurostat data

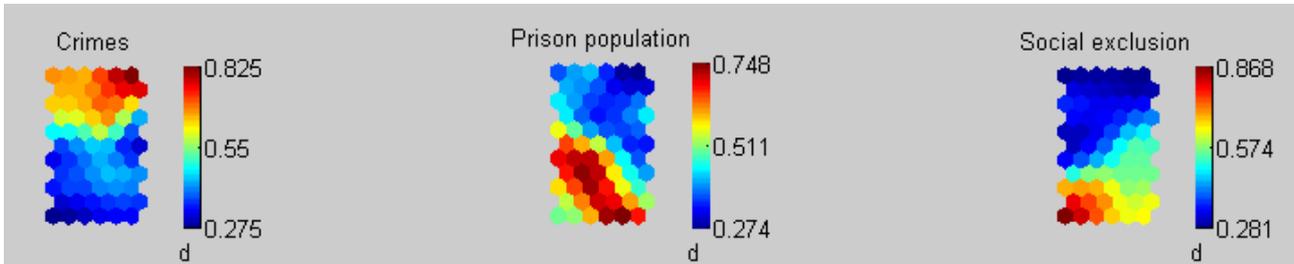
The colour of the cells in the map represents the intra-cluster homogeneity degree: the cold colours reveal high intra-cluster homogeneity, to the contrary warm colours represent low intra-cluster homogeneity. Based on the cells colour and the position of the cluster in the map, the distance among countries, in terms of multidimensional similarity, is rather wide. The first group in the Figure 3 is situated in the upper part of the map: it includes mainly Northern and Central European Countries (Cluster A). The second group, represented in the hexagonal cells of the lower part on the right of the map, consists of countries of Southern and Eastern Europe (Cluster B). Finally, another group including Romania, Bulgaria and Hungary, lies bottom left of the chart (Cluster C), even if the homogeneity degree among these Countries does not appear so strong.

The countries belonging to the first cluster are very far from countries of the other clusters: it comes out by the high number of warm colours cells among the clusters, representing an increase of distance between the cells of the Kohonen layer containing the Countries.

The analysis of feature mappings related to the three groups of considered indicators shows, in general terms, the leadership of the Central and Northern European Countries. The colour of the cells in the feature mappings represents the value of indicators: low value in correspondence of cold colours and high values to warm colours. The position of the Countries in Kohonen layer is preserved in feature mappings.

The first set of considered indicators summarize a low level of social capital especially in the last two clusters, at the bottom of the map (see Fig. 4). Cluster A shows a higher number of crimes recorded by the police (it is probably due to a higher efficiency level of the security systems), while Cluster C is characterized by the highest level of social exclusion.

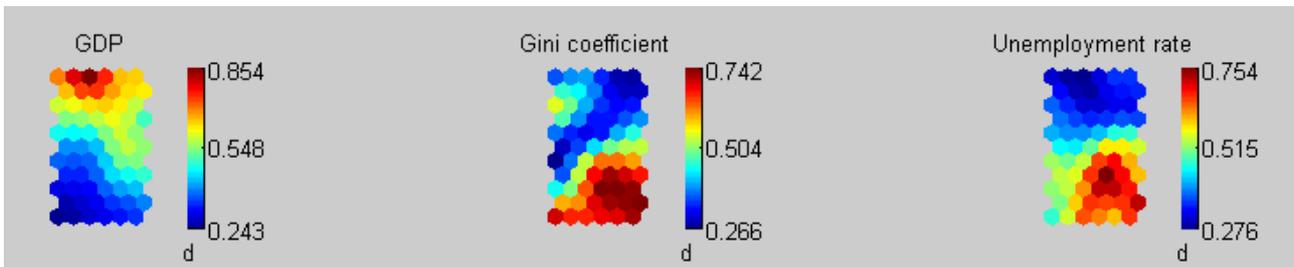
**Fig. 4 – Feature mapping for Social capital indicators**



Source: our computation and representation based on Eurostat data

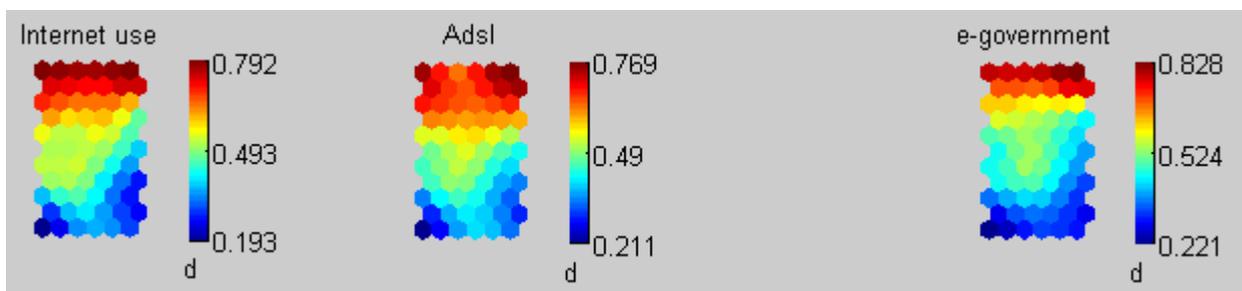
A general correspondence emerges among the variables summarizing the level of social capital and the indicators related to economic development and ICT diffusion (see Fig. 5 and Fig. 6).

**Fig. 5 – Feature mapping for Economic development indicators**



Source: our computation and representation based on Eurostat data

**Fig. 6 – Feature mapping for ICT indicators**

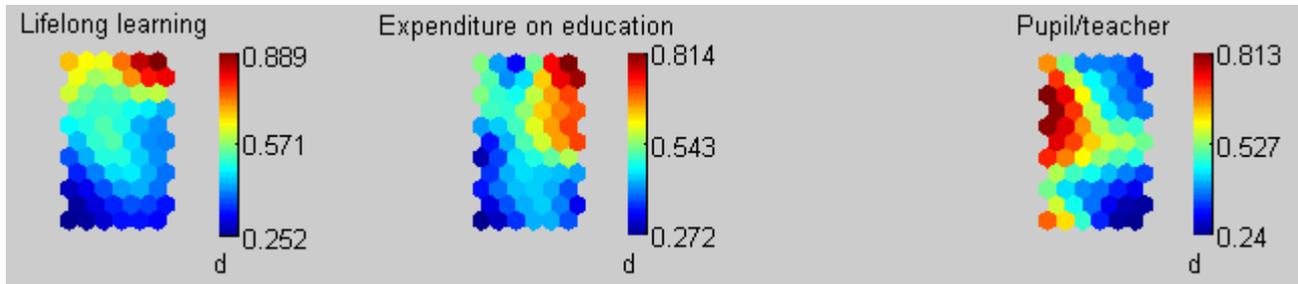


Source: our computation and representation based on Eurostat data

However, a perfect overlapping is not shown with respect to the other variables: this seems to indicate the presence of non-linear relationships among social capital and some presumed key-factors in the European Countries over the considered period. Particularly, with respect to the

“Lifelong learning” and the “Expenditure on education”, only the Countries at the top right of the map show relatively high value (see Fig. 7); the same Countries and those belonging to Cluster 2 highlight a low ratio between pupils and teacher (this aspect is generally related to a better education quality).

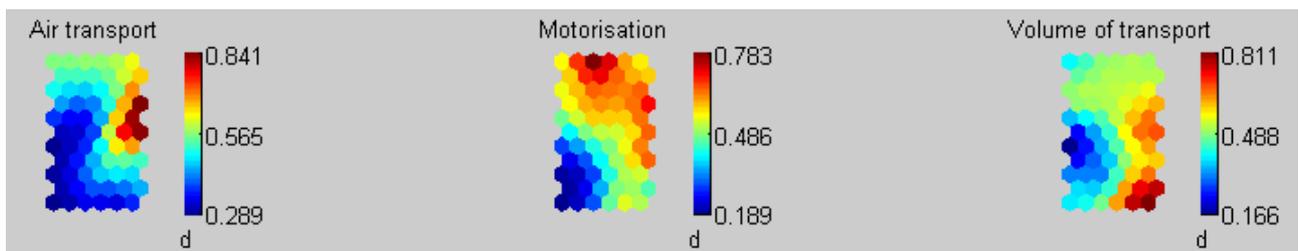
**Fig. 7 – Feature mapping for educational indicators**



Source: our computation and representation based on Eurostat data

Finally, the variables summarizing the quality of the transport system of a Country have only a feature in common: a very low level reached in the Cluster C (see Fig. 8).

**Fig. 8 – Feature mapping for transport indicators**



Source: our computation and representation based on Eurostat data

## 6. Conclusions

Social capital is usually thought as a functional concept: it may decrease transaction costs and facilitates coordination and cooperation between agents for mutual benefits. In this way, the utilization of social capital provides a way out of the typical collective good problem confronted by rational agents. Governments should consider social capital as an instrument that, in complement with other resources, can facilitate the achievement of specific policy aims, such as the participation of individuals in the social and economic life of their community. The economic development as well as the integration in the labour market, the ICT diffusion, the acquisition of a good degree of human capital, the presence an adequate transport system seem to be important preconditions for creating such opportunities. Developing these resources helps to build people’s capabilities to fully participate in the social and economic life of their Country.

Considering the role of institutions in shaping a positive/negative context for the social capital formation at macro-level, the paper investigates the dynamics and the determinants of social capital in EU over the last years, by performing a non-linear clustering with SOM neural networks. In a substantially stationary context, results seem to confirm that economic development and ICT diffusion are vital for social capital diffusion. Non-linear relationships emerge among social capital indicators and the variables summarizing education level and transport system adequacy.

## References

- Adelman I., Morris C. T. (1967), *Society, Politics, and Economic Development: A Quantitative Approach*, Johns Hopkins University Press, Baltimore, MD.
- Barkley D. (1998), *Communities left behind: can nonviable places become smart?*, Review of Regional Studies, 28, 1-17.
- Beugelsdijk S., de Groot H., van Schaik A. (2004), *Trust and economic growth: a robustness analysis*, Oxford Economic Papers, 56, 118-134.
- Bigsten A., Collier P., Dercon S., Fafchamps M., Gauthier B., Gunning J. W., Oduro A., Oostendorp R., Patillo C., Söderbom M., Teal F., Zeufack A. (2000), *Contract flexibility and dispute resolution in African manufacturing*, Journal of Development Studies, 36, 1-37.
- Bourdieu P. (1997), *The forms of capital*, in Halsey A. H., Lauder H., Brown P., Wells A. S. (Eds), *Education: Culture, Economy and Society*, Oxford University Press, New York, 46–58.
- Cainelli G., Mancinelli S., Mazzanti M. (2007), Social capital and innovation dynamics in district-based local systems, Journal of Socio-Economics, 36, 932-948.
- Carroll M. C., Stanfield J. R. (2003). *Social capital, Karl Polanyi, and American Social and Institutional Economics*, Journal of Economic Issues, 37(2), 397-404.
- Castle E. N. (1998), *A conceptual framework for the study of rural places*, American Journal of Agricultural Economics, 80, 621-631.
- Centola D., Macy M. (2007), *Complex contagions and the weakness of long ties*, American Journal of Sociology, 113(3), 702-734.
- Chamlee-Wright E. (2008), *The structure of social capital: An Austrian perspective on its nature and development*, Review of Political Economy, 20, 41-58.
- Cook K. (ed. ) (2000), *Trust in Society*, Russell Sage, New York.
- Coleman J. (1988), *Social capital in the creation of human capital*, American Journal of Sociology, 94, supplement, 95-120.
- Collier, P., 1998. Social capital and poverty. The World Bank, Working Paper, Washington, DC.

- Cornes R., Sandler T. (1986), *The Theory of Externalities, Public Goods, and Club Goods*, Cambridge University Press, Cambridge, MA.
- Costa D. E., Kahn M. E. (2003), Understanding the American decline in social capital, 1952-1998, *Kylos*, 56(1), 17-46.
- Durlauf S. (2002), *On the empirics of social capital*, *Economic Journal*, 112, 459-479.
- Etzioni A. (1995), *The Spirit of Community*, Fontana, London.
- Fafchamps M., Minten B. (2002), *Returns to social network capital among traders*, *Oxford Economic Papers*, 54, 173-206.
- Fernandez R. M., Castilla E. (2001), *How much is that net work worth? Social capital in employee referral networks*, in Lin N., Cook K., Burt R. S. (Eds. ), *Social Capital: Theory and Research*, Aldine de Gruyter, New York, 85-104.
- Ferragina E. (2010), *Social capital and equality*, *The Tocqueville Review*, XXXI(1), 73-98
- Fukuyama F. (1995), *Trust: The Social Virtues and the Creation of Prosperity*, Hamish Hamilton, London.
- Glaeser E. L., Laibson D. I., Scheinkman J. A., Soutter, C. L. (2000), *Measuring trust*, *Quarterly Journal of Economics*, 115, 811-846.
- Gorz A. (1992), *On the difference between society and community*, In Van Parijs P. (ed.), *Arguing for Basic Income*, Verso, London, 178-184.
- Guiso L., Sapienza P., Zingales L. (2004), *The Role of Social Capital in Financial Development*, *The American Economic Review*, 94, 526-556.
- Helliwell J. F., Putnam R. D. (1995), *Social capital and economic growth in Italy*, *East Economic Journal*, 21, 295-307.
- Hirschman A. O. (1958), *The Strategy of Economic Development*, Yale University Press, New Haven.
- Inkeles A. (2000), *Measuring social capital and its consequences*, *Policy Sciences*, 33(3/4), 245-268.
- Knack S., Keefer P. (1997), *Does social capital have an economic payoff? A cross-country investigation*, *Quarterly Journal of Economics*, 112, 1251-1288.
- Kohonen T. (2001), *Self-Organizing Maps*, Springer Verlag, Berlin, Heidelberg.
- Kraybill D., Weber B. (1995), *Institutional change and economic development in rural America*, *American Journal of Agricultural Economics*, 77, 1265-1270.
- Levi M. (1998), *A State of Trust*, in Braithwaite V., Levi M. (eds. ), *Trust and Governance*, Russell Sage, New York, 77-101.
- Lin N. (2001), *Social Capital: A Theory of Social Structure and Action*, Cambridge University Press, Cambridge, UK.

- Maula M., Autio E., Murray G. (2003), *Prerequisites for the creation of social capital and subsequent knowledge acquisition in corporate venture capital*, *Venture Capital*, 5, 117-134.
- Narayan D., Pritchett L. (1999), *Cents and sociability: household income and social capital in rural Tanzania*, *Economic Development and Cultural Change*, 47, 871-897.
- O'Connell M. (2003), *Anti 'social capital'*, *European Sociological Review*, 19(3), 241-248.
- OECD (2001), *The Well-being of Nations: The Role of Human and Social Capital*, Paris, OECD Publications.
- Paldam M. (2000), *Social capital: one or many? Definition and measurement*, *Journal of Economic Surveys*, 14, 629-653.
- Paldam M., Svendsen G. T. (Eds.) (2004), *Trust, social capital and economic growth: An international comparison*, Edward Elgar, Cheltenham.
- Patterson O. (1999), *Liberty against the Democratic State: On the Historical and Contemporary Sources of American Distrust*, in Warren M. (ed.), *Democracy and Trust*, New York: Cambridge University Press, 151-207.
- Putnam R. D., Leonardi R., Nanetti R. (1993), *Making Democracy Work*. Princeton University Press, Princeton.
- Putnam R. D. (2000), *Bowling Alone: The Collapse and Revival of American Community*, Simon and Schuster, New York.
- Putnam R. D. (1995), *Bowling Alone: America's Declining Social Capital*, *Journal of Democracy*, 6, 65-78.
- Rainey D. V., Robinson K. L., Allen I., Christy R. D. (2003), *Essential forms of capital for sustainable community development*, *American Journal of Agricultural Economics*, 85, 708-715.
- Rauch J. E. (2001), *Business and social networks in international trade*, *Journal of Economic Literature*, 49, 1177-1203.
- Roberts M., Roche M. (2001), *Quantifying Social Capital: Measuring the Intangible in the Local Policy Context*, *Radical Statistics*, 76/1, p. 15-28.
- Robison L. J., Schmid A. A., Siles M. E. (2002), *Is social capital really capital?*, *Review of Social Economy*, 60, 1-21.
- Rose R. (1999), *Getting things done in an anti-modern society: social capital and networks in Russia*, The World Bank, Working Paper, Washington, DC.
- Rothstein B. (2001), *Social capital in the social democratic welfare state*, *Politics and Society* 29(2), 206-240.
- Rupasingha A., Goetz S. J. (2007), *Social and political forces as determinants of poverty: a spatial analysis*, *Journal of Socio-Economics*, 36, 650-671.

- Rupasingha A., Goetz S. J., Freshwater D. (2002), *Social and institutional factors as determinants of economic growth: evidence from the United States Counties*. Papers in Regional Science, 81, 139-155.
- Rupasingha A., Goetz S. J., Freshwater D. (2000), *Social capital and economic growth: a county-level analysis*, Journal of Agricultural and Applied Economics, 32, 565-572.
- Salamon L. M., Anheier H. K., List R., Toepler S. S. (1999), *Global Civil Society: Dimensions of the Nonprofit Sector*, The Johns Hopkins Center for Civil Society Studies, Baltimore.
- Serageldin I., Grootaert C. (1997), *Defining social capital: an integrating view*, The World Bank, Working Paper, Washington, DC.
- Schmid A. A. (2003), *Discussion: social capital as an important lever in economic development policy and private strategy*, American Journal of Agricultural Economics, 85, 716-719.
- Schmid A. A., Robison L. J. (1995), *Applications of social capital theory*, Journal of Agricultural and Applied Economics, 28, 59-66.
- Schuller T., Baron S., Field J. (2000), *Social Capital: A Review and Critique*, in Baron S., Field J., Schuller T. (eds.), *Social Capital: Critical Perspectives*, Oxford, Oxford University Press, 1-38.
- Skocpol T. (1996), *Unravelling from above*, The American Prospect, 25, 20-25.
- Skupin, A., Agarwal P. (2008), *Introduction: What is a Self-Organizing Map?*, in Agarwal P., Skupin A. (Eds.), *Self-Organising Maps: Applications in Geographic Information Science*, Chichester, England: John Wiley & Sons, Ltd. 1-20.
- Tabellini G. (2006), *Culture and institutions: economic development in the regions of Europe*, Bocconi University, Mimeo.
- Temple J., Johnson P. A. (1998), *Social capability and economic growth*, Quarterly Journal of Economics, 113, 965-990.
- Wallis J., Killerby P., Dollery B. (2004), *Social economics and social capital*, International Journal of Social Economics, 31, 239-258.
- Wilson P. N. (2000), *Social capital, trust, and the agribusiness of economics*, Journal of Agricultural and Applied Economics, 25, 1-13.
- Woolcock M. (2001), *The place of social capital in understanding social and economic outcomes. The contribution of Human and Social Capital to Sustained Economic Growth and Well-Being*, International Symposium Report, Human Resources Development Canada (HRDC) and OECD, 65-88.
- Zak P. J., Knack S. (2001), *Trust and growth*, The Economic Journal, 111, 295-321.