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Is social capital relevant to the Physical Internet?

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Abstract: *Physical Internet is based on the physical mobility of logistic resources; therefore, we will try to move from an inefficient use of resources to a more efficient use of them. There is and will probably always be a temporal-spatial gap between providers and recipients. The logistics task is to plan and carry out the flow of goods in the supply chain in the most effective manner, which we can achieve by increasing the variables of Social Capital.*

Just as the information can be transmitted over the net, through the Internet, we should be able to do the same with the goods that could be sent through a global logistics network. This requires close cooperation of the cooperators (integration of processes, exchange of resources). Through our work we will try to relate the dimensions of Social Capital, the relational, structural and cognitive dimension with the Physical Internet.

We attempte to analyse them from the point of view of Social Capital and analysing how this cooperation is between competitors, as Physical Internet demands to share those logistical networks, so that we would be talking about the External Social Capital (Bringing Capital), focusing on external relations to the enterprise.

As defined in ALICE (European Technology Platform) we will focus on finding the benefits of social capital as a variable that deals with coordination and collaboration between the parties interested in global supply networks.

Keywords: *social capital, trust between competitors, supply chain, physical internet*

1 Introduction

Our research seeks to find connections between the Physical Internet (PI) and attributes of organisational social capital, with a specific focus on levels of trust within networks. We chose trust as the focus due to it being one of the most relevant social capital attributes for the Physical Internet.

Our current aim is to integrate logistics systems so that they can cooperate in various areas of activity; greatly increasing levels of cooperation and integration. In this context, social capital allows us to increase cooperation among individuals; improve levels of trust; and look for shared codes and systems. Whilst there is always the opportunity to share this trust and these codes, a lack of trust in the other could prevent these physical mobility networks from being shared.

2 Concept of social capital / Concept of the Physical Internet.

Social capital is an umbrella concept that is being increasingly used in multiple disciplines, including regional development, business, political science, economics, sociology and

education (Adler and Kwon, 2002). Paldman (2000) went further and even suggested that social capital is becoming a "common concept for all social sciences", while Adler and Kwon (2002) state that the concept incorporates "researchers from heterogeneous theoretical perspectives", fostering dialogue from diverse disciplines. Its use in this discipline is also appropriate.

The term 'social capital' appears in the book "*Democracy in America*" (1835), by sociologist, Alexis de Tocqueville, where he suggests that social contacts based on the rules of reciprocity and trust made it possible for democracy to function better in America. However, it was not until 1916 that Judson Hanifan used it to describe the intangible assets found in people's daily lives: goodwill, companionship, sympathy and social relations between individuals and families that form a social unit. He explained the importance of a community's commitment to satisfying the social needs of individuals. Their study was based on two premises: (1) that social networks and rules of reciprocity can facilitate mutually beneficial cooperation; (2) that the community's major social, political and economic problems can be resolved by reinforcing solidarity among citizens. In the same way, all supply chain partners could use these same rules of reciprocity when sharing logistics networks. The PI concept should be a way of improving efficiency in supply chains in the future (http://www.etp-logistics.eu/?page_id=24, 15.05.2017).
The concept of the Physical Internet was mentioned for the first time by Benoit Montreuil from Laval University in Canada. The author presented a guide on practical uses for the PI as a result of years of study. In the draft on PI theory and practices, various milestones are proposed (http://www.etp-logistics.eu/?page_id=24, 15.05.2017) to ensure that by 2020 economic, environmental, social and security objectives are completely aligned. To achieve this, we can make use of the concept of social capital since it is based on relationships and their connections, with a focus on how it helps develop trust, cooperation and collective action within well functioning logistical networks.

The Physical Internet concept is interested in physically moving logistical resources in an attempt to move away from an inefficient use of resources and toward a more efficient use of them. There is and will probably always be a temporal and spatial gap between providers and recipients. The logistics task is to plan and manage the flow of goods in the supply chain as efficiently as possible. We can achieve this by increasing relational social capital and confidence levels.
Therefore, the Physical Internet will redefine:

- The supply chain configuration
- Business models
- Value creation patterns

In logistics systems, there is currently an excessive amount of resources compared to that required, leading to a fall in profitability. This creates the need to implement a new logistics system management model.

Just as information can be transmitted over the Internet, we should be able to likewise send goods over a global logistics network, requiring close cooperation between those involved (integration of processes, exchange of resources). If global product flows were more efficient, operational costs could be reduced.

In literature on organisational social capital, there are four interconnected issues. With regard to the Physical Internet, we are interested in two of them:

• Trends and changes in the environment of organisations occur at a fast pace and it is not possible to continue in the same way with the same knowledge.
• Organisations undertake changes and redirect management.

Through our work, we will try to relate the relational, structural and cognitive dimensions of social capital to the Physical Internet. The relational dimension of social capital is characterised by high levels of trust, shared norms, perceived obligations and the feeling of mutual identification. Its conceptualisation is very similar to that used by Granovetter (1973), which assumes strong unions between individuals characterised by trust, reciprocity and emotional intensity.

These are the very same attributes we should seek to encourage in companies when developing a systematic solution. The aim is to increase efficiency in process performance and logistics development in addition to simultaneously attaining economic, social and environmental balance [Montreuil et al., 2012]. Physical Internet seeks to guarantee: stability; the mobility of a physical object across the world; and the ability to collect, store, sell and use it. [http://www.modulushca.eu, 15.05.2017] If we develop social capital attributes, all of this could be achieved in a more efficient way.

Trust is an attribute of the relational dimension of social capital and this characteristic in a relationship can lead to joint efforts. Furthermore, the fact that someone is worthy of trust means that they are more likely to receive support from others to achieve their objectives, which would not happen if that trust did not exist. In this sense, there is a direct relationship between trust and cooperation: trust paves the way for cooperation and cooperation cultivates trust (Nahapiet and Ghoshal, 1998). Accordingly, Melé (2003, a, b) indicates that generating trust and promoting cooperation are two elements that are closely related to the relational dimension. We will focus on tackling two of the five areas highlighted by the strategy (http://www.etp-logistics.eu/.15.05.2017).

Firstly, we will focus on the Information Systems for Interconnected Logistics before secondly addressing the Global Coordination and Collaboration Networks. We will analyse them from the point of view of social capital and explore what cooperation between competitors looks like in the context of the Physical Internet which requires that competitors share logistical networks. This moves us into the realm of external social capital which focuses on relationships outside of the company.

As defined in ALICE, (European Technology Platform) (http://www.etp-logistics.eu/?page_id=89) we will focus on finding the benefits of social capital for coordination and collaboration between the parties involved in global supply networks. Coordination and collaboration refer respectively to vertical and horizontal synergies throughout and along different supply chains. In this context, coordinating supply networks equates to a dynamic synchronisation and update of logistics and transport plans for all modes and actors (manufacturers, retailers, logistics service providers, operators, terminal operators, etc.). The Supply Network Collaboration is concerned with maximising the use of resources, such as vehicle capacity and infrastructure, by matching the demand of multiple shippers with the transport and logistics services available in different modes and with different service

providers. Both coordination and collaboration can yield significant gains in terms of efficiency and sustainability and represent a major step towards the Physical Internet, leading the transition from individually managed supply chains to open supply networks. Therefore, strengthening social capital will generate synergies that will help achieve the ALICE planned objectives.

Figure 1: Road Map ALICE – Global Supply Network Coordination and Collaboration

Therefore, our intention can be as defined in ALICE: (http://www.etp-logistics.eu/?page_id=89) "define research and innovation paths that need to be addressed to achieve real-time re(configurable) supply chains in (global) supply chain networks with available and affordable ICT solutions for all types of companies and participants" but using the variables of social capital as a means to generate a Physical Internet based on an open global logistics system based on physical, digital and operative interconnection, enabled through the encapsulation of products, standard interfaces and protocols. The goal of the Physical Internet vision is to move, store, produce, supply and use physical objects around the world in a way that is economically, environmentally and socially efficient and sustainable.

Figure 2: Road Map ALICE – IS for interconnected logistics

From this perspective, trust, reciprocity and cooperation will form the basis of social capital relationships and social structures, which are foundational for facilitating the sharing of logistical networks:

- Trust: attitude based on the behaviour expected from another person, taking into account the principle of reciprocity. This attitude is expressed in repeated and reinforced behaviours.
- Reciprocity: logic of exchanging objects, help and favours, which makes us see that our collaborator is willing to start or maintain a social relationship.
- Cooperation: aimed at achieving shared objectives, looking for a system that increases efficiency through logistical development.

When we discuss the relationship between social capital and the Physical Internet, we argue that companies that have greater social networks find more opportunities to establish logistical networks and better conditions to take advantage of these new opportunities. We therefore aim to highlight the importance of social capital and its attributes in the Physical Internet as a way of guaranteeing the physical mobility of objects.
The Physical Internet has two areas of interest (Roman Domanski et all, 2017):

- One is focused on the technical-technological sequence and the problems of unifying and integrating logistics units in the supply chain and the infrastructure required to facilitate the flow of these units.
- The other focuses on the organisational flow - developing the concept of managing the flow of logistics units, based on the possibility of sharing resources and skills with other participants in the supply chain as a way of guaranteeing the physical mobility of objects.

3 Dimensions of social capital.

We are going to use the classification that Adler and Kwon (2002) used and we are going to divide it into structural, relational and cognitive dimensions. We will explain each one further.

3.1 Structural dimension

This dimension attempts to encompass all the relationships that a company has and the social interactions that occur, focusing on the properties of the social system and the network of relationships as a whole (Nahapiet and Ghoshal, 1998).
Social links are the channels through which information and resources flow. A person or group can have access to others' resources through social interactions (Bolino, Turnley, Bloodgood, 2002). In this way, discovering a company's contacts and where they stand in a social structure of interactions will provide the company with a series of advantages or benefits. The organisation can use its contacts or links to obtain jobs, obtain information or access specific resources and look for information systems to interconnect logistics (Roman Domanski et al., 2018).
The structural dimension of social capital includes:

3.2 Relational dimension

The relational dimension of social capital describes the type of personal relationships that individuals have developed with others through interactions (Granovetter, 1992). According to Nahapiet and Ghoshal (1998), the relational dimension of social capital is characterised by high levels of trust, shared norms, perceived obligations and the feeling of mutual identification. Its conceptualisation is very similar to that used by Granovetter (1972, 1973) which assumes strong unions between individuals characterised by trust, reciprocity and emotional intensity.
The relational term is used to refer to the advantages generated by connections, with the following factors being key:

- Trust and honesty (Fukuyama, 1995, Putnam, 1993)
- Norms and sanctions (Coleman, 1990; Putnam, 1995)
- Obligations and expectations (Burt, 1992; Coleman, 1990; Granovetter, 1985)
- Identity and identification (Hakansson & Snehota, 1995; Merton, 1968)
- Other complex incentives that derive mainly from the company's history and reputation (Gulati et al, 2000).

Therefore, the relational dimension tries to indicate the extent to which economic actions are affected by the quality of relationships between companies (Ghoshal and Barlett, 1994). Confidence among organisations refers to how safe the company feels that a partner is not going to exploit the weaknesses of others. In other words, having the expectation that a business partner will not act opportunistically (Barney and Hansen, 1994). Confidence is the result of repeated interactions with other companies, which demonstrate in the accumulated experience that they will respond quid pro quo to an act of generosity, feeding a bond that links the acceptance of risk with a feeling of affectivity or extended identity (Tsai and Ghoshal,1998).

Trust is an attribute of a relationship, which can lead to joint efforts. There is a direct relationship between trust and cooperation: trust paves the way for cooperation and cooperation builds trust (Nahapiet and Ghoshal, 1998). So, global supply networks are facilitated by coordination and collaboration (Roman Domanski, 2018). Although expectations of trust reside within individuals, it is legitimate to think of interorganisational trust within economic organisations (Zucker, 1986, Gulati, 1995 a, 1995b).

All partners in the supply chain (manufacturers, transport service providers, retailers) will be able to carry out their independent operations through a common logistics network. This logistics network should be based on mutual trust and on the existence of shared standards. The ability to adapt to the needs of changes that may occur at any given time is a natural feature of the supply chain [Hajdul, Nowak, 2014]. In the future, the concept of the Physical Internet should be a way of improving the efficiency of activity in supply chains.

Interorganisational trust implies the presence of considerable interdependence, and a high level of task coordination among companies that have previously maintained relationships, providing them with important knowledge on the other's rules, routines and procedures (Gulati et al., 2000). In this way, we can improve efficiency in supply chains with the Physical Internet (R. Domanski, 2018). Trust has proved to be a precedent for cooperation

(Tsai and Ghoshal, 1998). When two units begin to trust one another, (manufacturers, suppliers of transport services, retailers) they may be able to function independently using shared logistical networks (R. Domanski, 2018).

Trust facilitates the exchange of resources and increases communication (Putnam, 1993, Misztal, 1996, Jones and George, 1998, Tsai and Ghoshal, 1998) in a way that facilitates stability, global mobility and the creation of distribution networks: objectives of the Physical Internet (R Domanski, 2018).

The consensus in the literature is that trust can contribute significantly to the long-term stability of an organisation (Heide and John, 1990), and Lee and Billington (1992) expand on this argument by suggesting that effective coordination of the supply chain is built on a foundation of trust and commitment.

The implementation of such a holistic view of the supply chain requires a degree of trust between all players, hence the link with partnership/relationship initiatives (Mason-Jones and Towill, 1997; Nesheim, 2001).

3.3 Cognitive dimension

The cognitive dimension of social capital refers to the resources that provide representations, interpretations, and systems of shared meanings (Cicouriel, 1973). These resources also have great importance and consideration in intellectual capital, including shared codes and languages (Arrow, 1974, Cicouriel, 1973, Monteverde, 1995). Not considering these resources as another dimension of social capital risks making the whole concept of little use, since without it, the value provided by relationships would be scarce or non-

4 Structure of the paper

Our proposal is to conduct a study of the variables of social capital and examine how these would have an influence on the PI. We will take a qualitative approach.

We propose to use the indicators of social capital used in the Integrated Questionnaire for the Measurement of Social Capital - Group of Experts in Social Capital - B.M (2002)

- Indicators of cognitive social capital:
  - Norms, beliefs and values that indicate a sense of belonging and that tend to facilitate exchanges and reduce transaction costs and commercial information without contracts.
  - Orientation towards the collective management of resources
- Indicators of relational social capital: Types and degrees of confidence:
  - Trust linked to the establishment of interpersonal relationships of friendship and social networks
  - Extended confidence in companies (based on shared expectations, norms and values).
  - Trust in government institutions (their official rules and procedures)
- Indicators of structural social capital: Types and degrees of collective action:
  - Characteristics of formal and informal organisations and networks.
  - Mode of operation of interest groups
  - Participation in decision-making
  - Heterogeneity of interest groups
  - Extension of connections with other groups
  - Results of the case

We will collect the data from companies based in Cádiz using:

- In-depth interviews with companies around Cádiz
- Structured interviews with logistics providers in the Cádiz area.

5 Conclusion

The variables of social capital that we have studied affect the Physical Internet, therefore we are going to carry out a detailed study of how they affect it and to what extent.

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