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Modeling tools of service value networks to support social innovation in a Smart City

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Abstract. The scarcity of public funding collides, today, with a growing demand for social services by the citizens. In this context, the main challenges that governments face in the welfare service sector are the need to improve economic and social sustainability of the service and the creation of public value. This paper presents a new model of sustainability based on the concept of generative welfare. Through the cooperation of different public and private actors, citizens (Public-Private-People Partnership - 4P) and the use of ICTs such as the Idea Management Systems and Gamification techniques, our methodological approach aims to analyze a service value network, model the key processes, identify structural holes and turn them into new public-private business opportunities. This approach, carried out within the Living Lab Puglia Smart Lab, was adopted for the service of collection and redistribution of excess food in the city of Lecce, called "Solidarietà in rete". The results achieved have allowed to identify significant solutions for the optimization of the value network and to support the development of an IT platform, able to manage this service. This platform enables gaming mechanisms that encourage citizens' participation.

Keywords. Welfare, Service Sustainability, Value network.

Introduction

Public administrations, due to the lack of public funds, are obliged to find new solutions for the development of the city, to allow the rationalization of resources and to make delivery services more efficient, according to the needs of citizens. Against this background, the concept of the 'smart city'[1] has recently been introduced as a competitive model of a city, able to ensure a better quality of life, thanks to really useful, efficient and sustainable services, through the cooperation of different public and private actors, citizens (Public-Private-People Partnership - 4P) [2] and the use of Information and Communication Technologies (ICTs).

It's important to specify that the word "smart" does not imply exclusively the use of digital technologies, but considers the central role of citizens, the use of ICTs and new methodological approach, as tools able to support social innovation. In the "smart city" context, this paper proposes a methodology to analyze a service value network, identify structural holes and turn them into new public-private business opportunities for co-creating new innovative and sustainable services.

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The research and methodological challenges are related to a real life context and to real citizen's needs. The practical problem related to the research questions is: How can public-private welfare services be sustainable? To answer this question we have developed a case study in a living lab context (Puglia Smart Lab[2]). The implementation and analysis of this case study allowed us to create the methodology proposed in this paper. This methodology has, as its main aim, the identification of the public-private business opportunity, able to optimized service value network analyzed with the case study. The case study is related to the service of collection and redistribution of excess food in the city of Lecce, called "Solidarietà in rete".

1. Background

As already indicated in the introduction, our research domain aims to provide a new approach to analyze and evaluate a public-private service value network.

For this purpose, some important methodologies were used for the identification and visualization of actors and goods of the exchange network and for the acquisition and modeling of the workflow processes.

1.1. Value Network Analysis

A value network is any network of relationships that generates tangible and intangible value through complex dynamic exchanges between two or more individuals, groups or organizations. Any organization or clusters of organizations, in private and public or governmental sector, committed in the business of tangible and intangible nature, can be seen as a value network.

To better manage value creation in the knowledge economy it is necessary to have a clear vision of the role that intangible assets play in the corporate business model, as well as a depth understanding of the dynamics of the network of which the company belongs to [3].

The Value Network Analysis provides a methodology useful to model, analyze, evaluate, and improve the ability of a business to transform, both tangible and intangible assets, in other forms of negotiable value. Verna Alee [4] maps the value exchange as a flow diagram where arrows represent the tangible and intangible exchanges.

This methodology has been successfully deployed in the European Commission to better understand the impact of research networks on Intellectual Capital formation and competitiveness in regions [5].

1.2. Stakeholders Management

To have a complete view and understanding of the relation characterizing the parties involved in the tangible and intangible exchanges, it is essential to define importance, strengths and weaknesses of each actor.

[2] The Living Lab is the first tangible result of Puglia@Service a project supervised by the technological district Dhitech scarl and co-funded by the Italian Ministry of Education, Universities and Research as a part of the Research & Development piano Operativo Nazionale 2007/2013. http://www.pugliasmartlab.it/

A very pragmatic and comprehensive approach of the Stakeholders Analysis, developed by Zimmerman and Maennling [6], is able to answer this question because it is a very flexible analysis and can be adapted to any context and characteristic of the stakeholders involved.

The purpose of this analysis is to identify, in relation to the objective of the network analyzed, those stakeholders influencing the decision-making process through their ability, skills and relations with other actors.

The previous empirical studies, focused on the acquisition of the potential of relevant stakeholder and the changing in perspective regarding the cooperation landscape, make important this analysis.

1.3. Process modeling and management

The technical literature is very rich in recommendations for the companies about the need to take actions to innovate their own business activities and operations [7]. All these indications have something in common: a strong emphasis on the need to understand the business processes with the aim of improving them.

The processes are considered strategic assets that need to be analyzed, managed, and improved, to provide better products and value-added services for customers.

The BPM uses a systematic approach that aims to design processes, deploy run-time processes, monitor and manage those processes, and report and analyze the performance of those processes, in order to improve and modify them according to the business objectives [8].

In recent years, also, the government organizations have recognized the benefits of BPM, redefining, restructuring their processes and service delivery [9]. For government agencies, if properly implemented, BPM facilitates the processes of oversight, and makes easier the management of finances, finding bottlenecks in processes, and responding to new legislative and executive directives. It may mean saving money and improving services to citizens, by making easier the interaction within and among departments and agencies [10].

This work intends to highlight the usefulness of the BPM for the co-creation and sharing of goods and services in the public-private network for the development of a smart city.

1.4. Structural holes

Starting from information derived by the process modeled, in the value network there may be some "holes" where something is provided without receiving anything back.

Ronald Burt [11] introduced the term "structural holes" referring to positional advantage/disadvantage of individuals resulting from the way in which they are positioned within a network and neighbors. A structural hole is a relation of non-redundancy between two actors in a network. Redundant ties are those relations connecting the same people, providing the same benefits within the network.

On the basis of this definition, one stream of literature, captained by Burt [11], tends to underline the importance of sparse networks for diversity of knowledge, information, resources, and perspectives. Conversely, another stream, captained by Coleman [12], stresses the importance of the creation of dense networks because these connections create a social structure that favors communication, coordination and trust among the people involved.

According to Coleman, we believe that closed networks facilitate the exchange of goods and services, in order to increase the public-private cooperation [13].

2. Research Methodology and case study

The tools and methods underlined previously are the basis of methodology presented in this paper and they support the implementation of the case study analyzed.

The innovation of our methodology consists in the integration of these methods widely known and applied in the literature, in order to provide a significant solutions for the optimization of the value network and to support the development of an IT platform, able to manage the public service.

The methodology is characterized by a sequence of steps with continuous feedback. Each step has some input, output, activity and deliverables [14]. To facilitate the understanding and demonstrate the applicability of the methodology, for each step was presented the corresponding part of the case study.

The choice of the steps presented below derives mainly from the analysis of the value network of the case study analyzed: this network involves different actors, with different positions and roles establishing relationships of a different nature.

It is also important to consider that, this methodology applied in the service value network analyzed, can be continuously improved, thanks to interaction with all stakeholders and thanks to new context and needs analysis.

The methodology considers five steps (fig. 1).

Figure 1: The Research Methodology

2.1. Step 1: Needs identification

The first step consists of analysis of the real needs of citizens using the innovative approach of the Living Lab, a space where citizens, public administrations and enterprises can work together, on an equal basis, in order to identify and cover the urgent needs of the territory.

The implementation of this methodology started within the Living Lab 'Puglia Smart Lab'. In order to support the participation of citizen in the Living Lab it is realized an Idea management system[3] (IMS). The IMS enables knowledge sharing and

[3] http://www.ideeperlecce.it/

the opportunity to develop and design ideas in order to promote the emergence of new economic initiatives.

In a perspective of co-experience that has seen the involvement of the City of Lecce[4] and the Caritas of Lecce[5], the Living Lab 'Puglia Smart Lab', thanks to Idea Management System, aims to optimize the process of collection and redistribution of excess and unsold food to citizens in distress.

In this step have been identified the citizens needs and the public utility areas.

2.2. Step 2: Network, Stakeholders and Processes Analysis.

From the data extracted in the first step, we define the network of collection and redistribution of excess and unsold food to citizens in distress as an AS-IS context, in which implement the process of innovation.

To analyze this network will be used *Value Network Analysis* proposed by Verna Allee, *Stakeholders Analysis* proposed by Zimmerman & Maennling and the *Business Process Management Notation (BPMN)*. Because the final focus of the proposed methodology is the optimization of the public-private service value network, in which the value is co-created with citizen, it's important to analyze the network with different levels of detail, considering the relations among people, technology, knowledge and processes. The optimization of a public-private service value network requires the changing of the whole socio-technical service system.

Were taken into account three levels of analysis.

First Level. The representation of the value network with the formalism proposed by Verna Allee is provided in this level. The *Exchange Analysis* [3] of the service value network is also applied. A description of the value network, of actors involved, of the nature of the exchanges (tangible and intangible assets) among them and of the operational properties of each actor, is given as follows.

To curb a situation of poverty that, in recent years, has become a real social emergency, the Caritas distributes hot meals at various soup kitchens located in different districts of the city. In addition to this, there is a project "Emporio della Solidarietà", a supermarket with automated teller machines, trolleys, shelves and signs, where to find free basic necessities. To deliver these services, both the Caritas and the Emporio della Solidarietà, can count on a series of contacts with various outlets, that offer their food to then be allocated to the soup kitchens.

Other aids and food come from different Emporio's partner companies, from various government agencies, such as the Civil Protection Department, from some charitable institutions such as the "Banco delle Opere di Carità" and from schools. The Italian Red Cross is also involved in the network, distributing food and hot drinks to homeless and families in difficulty.

The institution CAF[6] verifies and manages prerequisites of citizens requesting the service. Confindustria Puglia [7] supports the Emporio through management and communication of fundraising initiatives.

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[4] Department of Social Affairs and Equal Opportunities.

[5] Organization of the Diocese of Lecce for the promotion and coordination of charitable initiatives.

[6] Italia Fiscal Assistance Center

[7] Industry associations in the provinces of Puglia

Important contributions come from the public community, i.e. citizens, parishioners and volunteers through various offers, initiatives and volunteering activities.

In addition, there are a lot of intangible flows among Caritas, Emporio, Public Administration and food providers. These flows are mainly information about assistance activities or services and gratification or social consensus for providers, volunteers and shops, who donate food or money.

Through weekly meetings and interviews and using Value Network Analysis it was possible to map the network related to the flow of tangible and intangible value. As explanatory example of such work, the trade flows from intangible assets among the various actors of the network were provided in figure 2.

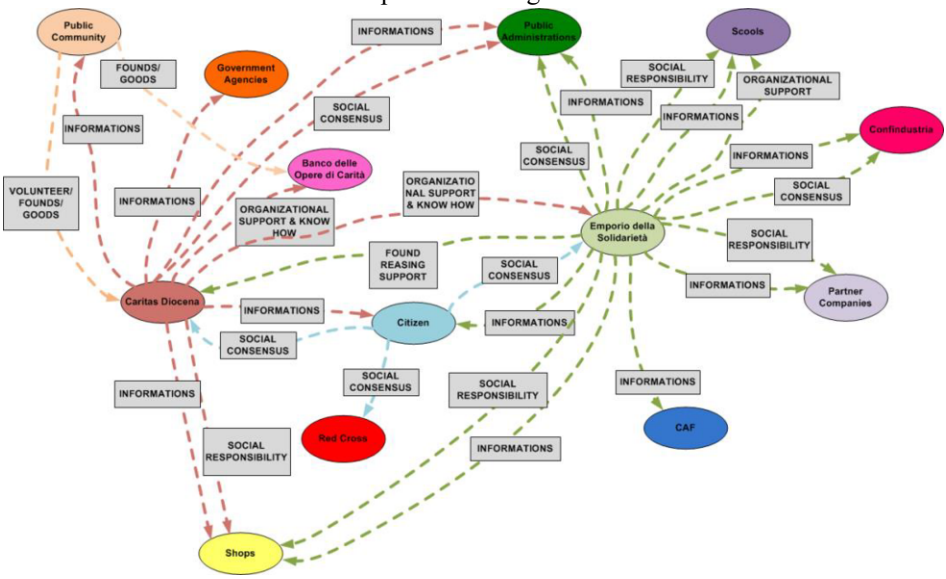

Figure 2:Intangible assets in the AS-IS Service Value Network

Second Level. In the second level of analysis was made the classification and actor's network mapping to identify the primary, secondary and key actors.

Through the Stakeholder Analysis, the actors involved were categorized in three classes: stakeholders with strong legitimacy (Confindustria Puglia, Caritas, the City of Lecce and the citizens), stakeholders with control over essential resources (citizens, Caritas and Emporio Solidale) and strongly networked stakeholders (partner companies and shops that donate food to Caritas and Emporio, Schools, Government Agencies and the Red Cross).

The result is that actors as the City of Lecce, Caritas, 'Emporio della Solidarietà' and citizens are the key actors of the network; the various food providers, the Government Agencies and the Red Cross are primary actors, while the others are secondary actors (fig. 3).

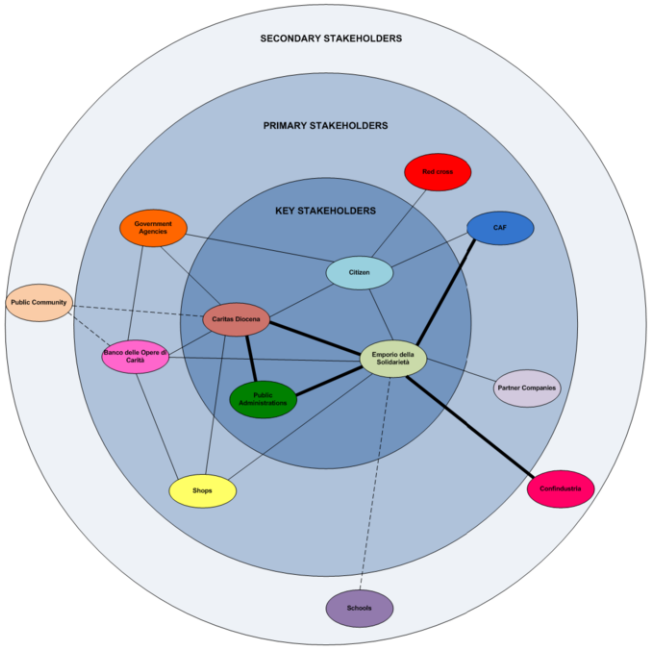

Figure 3: AS-IS Stakeholder mapping

Third Level. To identify the integration level of activities carried out by key actors of service value network, the key actors' processes have been modeled using the BPM tools.

The modeling of the processes related to the service of access request of the Caritas and "Emporio della Solidarietà" has allowed to understand that, these processes, not integrated and structured, causing waste of resources.

2.3. Step 3: Structural Holes and new actors introduction.

The analysis of the service value network allows identifying the main criticalities of the network, previously defined as *structural holes*. In this step it will be possible to identify:

- The lack of co-operative relations among different actors that leads to the generation of the asymmetric information, no positive redundancy and absence of bridges among the various actors;
- Actors and initiatives not horizontally integrated with absence of central coordination;
- Ego-centered actors;
- The lack of shared vision between the actors' network and the lack of cooperation between the network nodes.

By using this information, new solutions (new actors, new processes, new deliverables, new technologies, etc.) can be proposed, able to optimize the service value network and generate new business opportunity.

In the case study analyzed, the main structural holes found through the use of the previous three levels of analysis and through the interview to Key actors are:

- The absence of cooperative relations among the core activities, causing useless flows and replication of initiatives,
- The prevalence of intangible flows than tangible flows and low efficiency and effectiveness, due to a misalignment between times and objectives, and
- The inadequacy of network's size, i.e. long times to supply the food and main services and a higher demand for services.

The TO-BE network, an ideal network, was created to bridge structural holes identified. In this network were introduced new players and links.

In the opinion of the Public Administration and the other key stakeholders of the network of the Living Lab, the TO-BE network represents a solution economically sustainable.

A new actor, the logistic provider, has been included because it allows a faster and efficient movement of food from suppliers to the Caritas and the Emporio. Furthermore, more food vendors, as restaurants and pubs of the city, can be introduced in this mechanism because they can offer the exceeding food, not sold or near to expire. The Public Administration of Lecce would give some tax incentives for these donations.

It would be desirable also introducing Italian local health authority (ASL) to regulate specific rules concerning the transport conditions of food products, in order to preserve the nutritional properties. Another actor, a computer services provider, will carry out a series of activities aiming at structuring the processes of the Caritas.

This actor, also, will produce an intelligent platform that manages all activities of food distribution and all administrative, fiscal, sanitary/health and logistical aspects.

2.4. Step 4: Testing and evaluation.

The inclusion of new actors within a complex system requires more than a simple qualitative analysis. It's necessary to implement a quantitative analysis to assess and validate the innovation policies adopted. The quantitative analysis used in this work is the structural holes analysis proposed by Burt. But, unlike Burt that hopes the existence of structural holes in a social network in order to broker flow of information between people, we believe that in the service value network considered in the case study, it is desirable to reduce the structural holes. More redundant ties, in fact, facilitate the exchange of goods and services and increase the public-private cooperation.

In quantitative terms, if the Efficiency, defined by Burt, allows calculating the percentage of ego's neighborhood ties, which are non-redundant, we define with the Resilience (eq.1) that the extent a ties of ego with alter, is redundant. This parameter can therefore give useful information on the impact of ego on the entire network. The increase of Resilience involves an increase of redundant contacts number in the network, in order to minimize the number of structural holes.

$$Resilience = 1 - Efficiency \qquad (1)$$

To calculate this parameter, the adjacency matrix of the two networks previously described, the network as-is and the network TO-BE, has been obtained. Starting from the calculus of the Efficiency, proposed by the theory of structural holes [11], the Resilience equation (eq. 1) was applied for each actor of the two networks.

Comparing the value of resilience obtained (the new nodes have been clearly ignored, because they are present only in one of the network), it is observed an increase of the resilience for the most part of the nodes of the network. The other nodes present a constant resilience because they were not affected by the introduction of new actors and ties. This trend demonstrates a decrease of the structural holes identified and, consequently, an improvement of goods and services distribution among the actors of the network.

	As-Is Resilence	To-Be Resilence
Government agencies	0,22	0,44
Banco delle opere di carità	0,39	0,39
Caritas	0,17	0,27
Citizen	0,20	0,35
Emporio della solidarietà	0,09	0,18
Public Administration	0,29	0,49
Shops	0,28	0,52
Red Cross	0,00	0,36
CAF	0,47	0,49
Partner companies	0,00	0,00
Confindustria	0,00	0,30
Schools	0,00	0,31
Public community	0,44	0,44

Table 1. Comparison of the resilience value

2.5. Step 5: Design, Implementation and Monitoring.

The TO-BE service value network, identified and validated in the previous phase, has been redesigned using the BPMN graphical formalisms and the formalism of the Value Network proposed by Verna Alee. Also in the face of these first outcomes, the Municipality of Lecce, the Italian Red Cross, Civil Protection and various food shops of the city, are currently evaluating the enforcement of a first experimental network, in order to verify the optimization of the distribution of not consumed or not sold food to Caritas and others charities entities.

A mobile application has been developed to facilitate the matching between demand and supply of not sold food, but still suitable for consumption. Also, have been used the gamification principles and the application of the concepts of game theory and techniques to non-game contexts [16] [17] to involve citizens and foster the co-design service. After all we proceed with the implementation of the identified solution and the consequent monitoring. The Living lab will be the direct channel for the interaction between citizens and service providers thus determining the restart of the methodology.

3. Conclusions, limitations and future research

The Public Administration does not act alone in the implementation of any type of service, but cooperates and interacts with a high number of actors, thus creating a network structure, that is, a complex service value network.

The methodology proposed in this paper allows identifying new public-private business opportunity able to optimized the service value network analyzed. In our society despite of the significance of sustainability models for social welfare services, it has received limited attention in scientific literature. This paper intends to bridge this

gap by focusing on a particular welfare services, called "Solidarietà in rete" provided by the Public Administration, related to the food assistance of Lecce's people and families. This case study allowed to explore a new sustainability model of welfare service able to transform costs into investment and able to generate, not only social value, but also economic opportunities. Subsequently, due to the combination of different tools, such as Value Network Analysis, Multi stakeholders Management and Business Process Management, different structural holes have been identified and analyzed. In the face of these results has been considered the possibility of introducing new ties and involve new actors, in order to allow an innovation and an overall improvement of the network. It is desirable, in the future, to analyze the results of the new network "Solidarietà in rete" to quantify (i.e. number of people helped, number of meals provided, number of volunteers, etc.) the effective network optimization. An additional Testing and Evaluation analysis about this case was performed using the System Dynamics approach [18]. This methodology could be applied to other types of social services, thus offering more opportunities to study and implementation.

References

[1] Rudolf Giffinger, Christian Fertner, Hans Kramar, Robert Kalasek, Nataša Pichler-Milanovic, Evert Meijers, *Smart cities – Ranking of European medium-sized cities,* Vienna, Centre of Regional Science, 2007.

[2] Wisa Majamaa, *The 4thP - People- In Urban development based on pubblic private part-nership*, Helsinki Unversity of Technology, 2008.

[3] Verna Alee, *A Value Network Approach for Modelling and Measuring Intangibles*, Presented at Transparent Enterprise, Madrid, November 2002.

[4] Verna Alee, Value Network Analysis and value conversion of tangible and intangible assets, *Journal of Intellectual Capital* **9** (2008), 5–24.

[5] Verna Alee and Oliver Schwabe, *Measuring the Impact of Research Networks in the EU: Value Networks and Intellectual Capital Formation*, European Conference on Intellectual Capital, Haarlem, The Netherlands, 2009.

[6] Arthur Zimmermann and Claudia Maennling, Mainstreaming participation, *Multi-stakeholder management: tools for stakeholder analysis, 10 building blocks for designing participatory systems of cooperation*, from the series: Promoting participatory development in German development cooperation. Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH, 2007.

[7] M. Hammer, J. Champy, *Re-engineering the Corporation; A Manifesto for Business Revolution*, Harper Business, New York, 1993.

[8] Harmon, Evaluating an Organization's Business Process Maturity, *Business Process Trends* **2**, 2004.

[9] Gartner, *Hype Cycle for Smart Government*, 2013.

[10] Layna Fischer, 2009 *BPM and Workflow Handbook: Spotlight on Government*, Future Strategies, 2009.

[11] Burt, R. S., *Structural holes: Social structure of competition*, Harvard Business Press, London, 1992.

[12] Coleman, J. S., Social capital in the creation of human capital, *American Journal of Sociology*, **94**, (1988), 95–120.

[13] Matteo Caroli and Caterina Tantalo, *Le Reti d'Imprese come strumento privilegiato per la diffusione di una Sostenibilità di Sistema,* Luiss business school, 2009.

[14] Karl Johan Aström and Richard M. Murray, *Feedback Systems - An Introduction for Scientists and Engineers*, Princeton University Press, 2008.

[15] Lanfranco Marasso et al., Idea Management System for Smart City Planning, *Interdisciplinary Studies Journal, Special Issue on Smart Cities,* **3**, (2014), 227-236.

[16] B. Stokes, Videogames have changed: time to consider Serious Games?, *The Development Journal*, **11** (2005).

[17] G. Zichermann and C. Cunningham, *Gamification by Design: Implementing Game Mechan-ics in Web and Mobile Apps*, O'Reilly, Sebastopol, 2011.

[18] Enzo Bivona, Enza Giangreco, Valentina Chetta, Mona Soufivand, *Towards a sustainable social delivery system through Public-Private Partnership: a conceptual System Dynamics Approach*. IFORS Barcelona, 2014