

A PERFORMANCE INDICATORS MODEL TO SHAPE THE GEOGRAPHICAL CLUSTERS DEVELOPMENT

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Abstract

The aim of this paper is to present a Performance Indicators Model (PIM) in order to evaluate and compare industrial districts development. Several models were compared to the proposed one, in order to show the advantages/disadvantages of the PIM. Disposing of an indicators dashboard allows the convergence and the robustness of operations districts results verification in respect of expected outputs (questa frase non l'ho capita). Thanks to this model the public entities could dispose of a unique instrument to compare the Industrial Italian Clusters (probabilmente Italian va prima di industrial) (IIC) awarding and supporting those more worthy of trust.

1. Introduction

In the last years several approaches for measuring the performance of complex systems companies were presented by many researchers and industrial managers. The aim was to offer a shot of the companys' trend and to suggest in which area they need improvements. The studies carried out on research and industrial field brought an abundance of isolated Performance Measurement (PM) information produced that maybe are duplicated and/or contradictory in nature (Folan et All, 2005). For this reason often it is difficult to generalize a PM system, taking out the specific contest in which it have been designed. Only few models have obtained success in this sense and they are so known: Balance Scorecard (Kaplan and Norton (1993), SCOR model (Supply Chain Council, 1996), Business Process Performance Prism (Neely et All, 2002) and Business

Process Reengineering. The evolution of PM can be summarized in this way. Firstly, the managers and researchers faced the importance to determine the success key of a company in our business market. Secondly, they start to think the way for integrating financial, economic and operative indicators to obtain a shot of the companies' ability. During the last years the external environment was becoming identified as the next frontier of PM: the object of the analysis, it is not the company but the company and the system in which it operates. For this reason it is increased the interest for inter-organizational systems, such as supply chain, and for extended enterprises, such as virtual enterprises. The experiences reported about measurement of industrial districts performance are limited and no adapted for being transferred in other realities. In fact, the most important works in the distributed systems' performance measurement answer to need to measure the Supply Chain Performance or the Local Government Performance. The added value brought about several actors that interact in a industrial and geographical area it is a field yet???? few explored buy researchers and managers. In order to fill this lack in this work the authors compare the different PM approaches and suggest a model to measure the performance of distributed systems as Industrial Districts, Virtual Enterprises and Clusters of firms, that is flexible and transferable. The paper is organized as follow: in Section 2 we answer the question on "how and why to measure the performance of industrial districts" and in the Section 3 we present our model to measure and shape the development of industrial cluster. Finally, the paper ends with a set consideration about the state of work' progress and with some suggestion for future works.

2. How and why to measure the performance of industrial districts

The aim of this paper is to present a Performance Indicators Model (PIM) in order to evaluate and compare the industrial districts development. For Performance Indicators Model we intend a set of guidelines to design a framework of standards or measurements against which the Community Planning Partnership can measure its performance over time.



Moreover, disposing of an indicators dashboard allows the convergence and the robustness of operations districts results verification in respect of expected outputs. In literature the question of districts performances measurement is dealt with different approaches, various for kind of industry and territory. Some examples of this variability are following reported: *(i)* economic indicators, *(ii)* demography indicators, *(iii)* relationship indicators, *(iv)* leaderships indicators for policy makers, *(v)* cluster composition indicators *(vi)* technology innovation indicators, etc ... Frequently, the synthesis of these different measures is calculated without weighting, or rather it is assumed that the phenomena measured have the same importance of the others. Our propose consists in providing a model able to integrate the different performance measures in a more structured way. The advantages of PIM application in industrial districts are several. They can be: *(i)* clusters can understand the inefficiency sources and then can decide where invest to improve own performance; *(ii)* firms can decide to fit in with district on based of specifics and published parameters; *(iii)* Public Organizations can chose to adopt this model and to allocate public funding on based of indicators levels reached by single districts.

Before of designing a new model to measure the performance and the development opportunities of an industrial cluster the authors recognized the existing approaches in literature to analyse if any of these could be adapt for this aim. In this paper introduction we nominated four model to measure the system' performance: Balance Scorecard, SCOR model, Business Process Performance Prism and Business Process Reengineering.

The Balance Scorecard adopts four points of view to measure the company success: financial, internal business, customer prospective, innovation and learning. This model can offer good possibilities to evaluate the industrial cluster in the case in which we consider a cluster as a company. The limit of this method is that it is impossible determinate in which way every actors bring about value to the cluster' success. The distributed characteristic of the system is no considered.

The SCOR model, instead, adopts a processes oriented (oriented *va prima di process credo*) approach. With this method it is possible to model the interaction between several entities but the enterprise has (or needs) to have the same objective and, in a industrial cluster, this is not always true. Moreover, in a industrial cluster, as defined by



Marshall (1925), Becattini (1989) and Porter (1998), there are several aspect linked to society and geographical aspect that often are not considered in a business model.

The Performance Prism method that consists of five "faces": stakeholders, satisfaction, strategies, processes and capabilities and the Business Process Reengineering approach that focalize the attention on activities that compose several processes presents similar characteristics of the above mentioned models. Moreover, both methods offer a guideline to select the areas that more need improvements, but don't give any quantifications of the value brought about by the entities that compose the system.

Due to all these reasons this paper' authors try to answer to this research question proposing a model based on Multi Agent System (MAS) theory.

3. The MAS model to measure the development of an industrial district

Due to distribute nature of industrial clusters, the multi agent system theory represents a good approach to analyze and represent the characteristics of a system composed by several autonomous entities acting within a network. Over the past few years, multi agent systems have been perceived as a crucial technology for building large, complex and robust distributed information-processing systems that exploited the efficiencies of organized behaviours (Zarou et all, 2005). The MAS is composed of classes of interacting agents each one having its local information and goals. Every agent communicates with others members of the network in order to reach a higher goal at level of global system. Another important advantage offered by this kind of representation is related to the possibility of introducing or removing entities from the system without re-design the functionality of the network in terms of communication protocol, exchange of information, assignment of operation. A simple re - scheduling or re - mapping of new relationship is enough to continue the network' processes. For these reason a system organized in this way presents important characteristics of flexibility and adaptability.

The PIM designed can be so described: each firm, research or public subject that act into a district can be represented as an agent. Moreover it is necessary introduce inside



the model an agent having a higher point of view and able to collect information about the whole system such as geographical boundaries, common infrastructures, etc....

The construction of the model is performed in the following steps:

- Analysis of the Cluster;
- Definition of the agents interacting in the industrial cluster;
- Definition of the information *sources* and the *atomic indicators*;
- Definition of the *agent indicators* as composition of atomic indicators;
- Definition of the integrated cluster indicator as composition of agent indicators.

Each agent at local level detains a set of information related the performance of core and no core activities. Every of these data can be related with the performance of sector' leader or with the ideal process inside the same enterprise. For instance, if the information is related to the turnover of the firm, indicator can be made by this data and the value of turnover declared by the leader of the same sector. If, instead, the information is related to quality of managing orders, the quantity of orders ends in a good way cab be related to perfect order. Once that the atomic indicators are delineated, it is possible to aggregate several indicators to obtain an indicator representative of the agent's performance.

Being the cluster composed by several agents, in a second moment, it is necessary to aggregate the agent indicators to obtain a measure of the whole network' performance.

The figure 1 shows the architecture as soon as described and offers some examples of information that the agent collects.

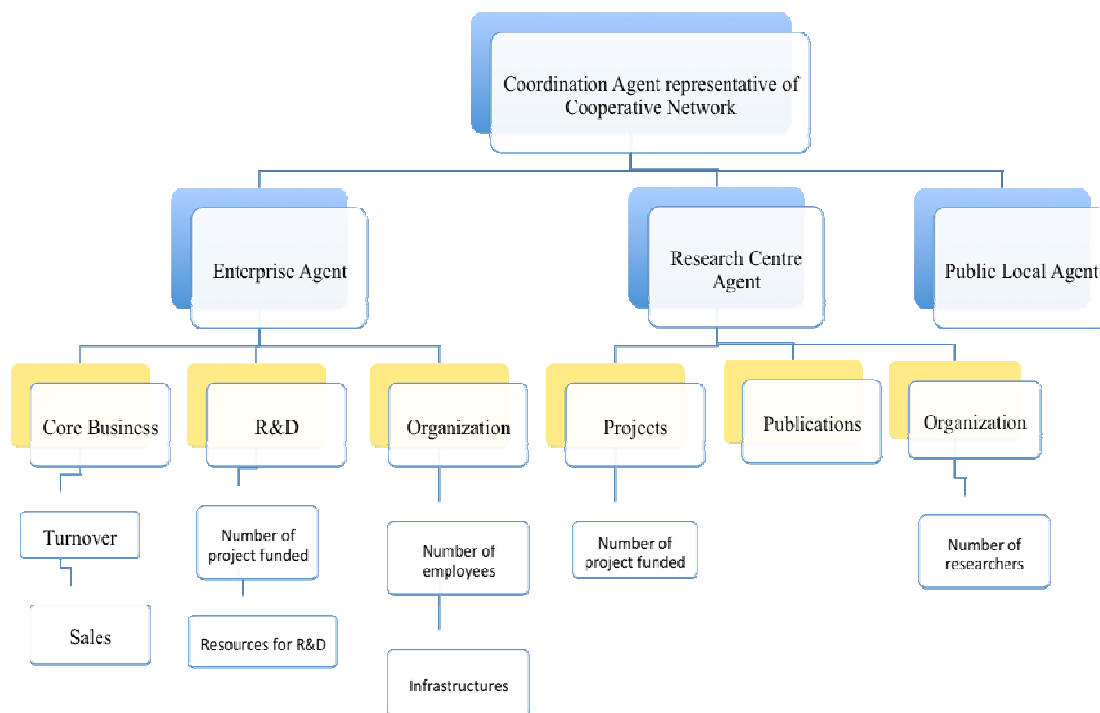


Figure 1: Performance Indicators Model architecture

In order to obtain a global indicator of the network' performance it is necessary to aggregate the indicators selected at different levels. There are several techniques able to synthesize in a unique value different measures having different characteristics. Some of these are following described: (i) Basilar approach, where the indicators are aggregated thanks to weighted average; (ii) Wroclaw method, where the aggregation is based on an Euclidean distance between a specific value and an ideal value; (iii) Benefit of Doubt Method, where the indicators are compared with a value of benchmark.

The aggregation methods have then considered also indicators more general reflecting information on the whole system, such as:

- Geographical boundaries and area availability
- Environmental impact
- Involvement of the society inside the industrial processes
- Profile of people that operate for the cluster' enterprises.
- Links with public entities external to the district



- Business or Funding opportunities arise at cluster level.

The authors are starting to test this model with a simulator tool and they are collecting the information from a real Italian industrial cluster to validate the adopted approach.

4. Conclusions

In this work the authors propose a method to measure the performance of an industrial cluster. We represent a cluster as a multi agent system where every agent is autonomous and act in collaborative manner to reach local and global goals. On basis of this model, a Performance Indicators Model is presented in order to measure the value brought about by each age to the whole network. Having a synthetic indicator of network' performance allows to do comparisons among several networks and to evaluate which model can be transferred and adopted by several enterprises operating in different countries and historical moments.

5. References

1. Becattini, G. (1989) Modelli locali di Sviluppo. Bologna: il Mulino
2. Folan P., Browne J., (2005) A review of performance measurement: Towards performance management, Computers in Industry, 56, 663-680.
3. Kaplan R., Norton D., (1993) Putting the Balance Scorecard to work, Harvard Business Review, 71(5), 134-147.
4. Marshall A. (1925) Principles of economics. London, UK: Macmillan.
5. Neely A., Adams C., Kennerley M., (2002) The Performance Prism: The Scorecard for measuring and managing business success, Financial Times Prentice Hall.
6. Supply Chain Council, (1996) Supply Chain Operation Reference (SCOR), Overview of SCOR version.



7. Porter ME. (1998) Clusters and the New Economics of competition. Harvard Business Review, vol.76.
8. Model, Zarou N., Boufaida M., Seinturier L., Estrailier P., (2005) Supporting virtual enterprise systems using agent coordination. Knowledge and Information Systems, 8: 330-349.