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Maturity levels to assess the management of industrial clusters

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Abstract

Literature has emphasized the importance of industrial clusters in the development of regions and nations. Therefore, it becomes relevant to study forms of governance to improve local managerial capabilities. This article aims at proposing a performance management model for governance agencies in industrial clusters and also a method to assess their maturity level. Hence, a literature review is made on performance management in industrial clusters and the forms of governance that may arise in such regions. Then the performance management model and the method for maturity level assessment are introduced. Two case studies in Brazilian industrial clusters were carried out to test both the management model and maturity

levels. In both cases there were local associations acting as a governance agency that was in charge of stimulating and managing joint actions. The results demonstrate the appropriateness of the maturity levels in the assessment of industrial clusters.

Keywords: industrial clusters, performance management, maturity levels, governance.

1. Introduction

Industrial clusters have been widely addressed by many researchers and are top priority in many national governments, especially due to the competitive advantage and regional development they enable (Porter, 1998; Mytelka and Farinelli, 2000; Sölvell et al., 2003). Some authors add that small and medium-sized enterprises (SMEs) may benefit greatly by settling within clusters due to external economies, collaboration and sharing of knowledge (UNIDO, 2001; Karaev, 2007; Capó-Vicedo et al., 2008). Nevertheless, such benefits need coordination to be properly enabled (Schmitz and Nadvi, 1999; Sölvell et al., 2003). A facilitator is thus required to encourage local companies and institutions to collaborate for the common good (Bititci et al., 2004). In this paper we will employ the term governance or governance agency to refer to such facilitator.

The topic we address in this paper is the management of industrial clusters, more precisely performance management. Our objective with this work is to propose a performance management model for industrial clusters and devise a set of maturity levels to classify industrial clusters according to how their governance agency plans, coordinates and assesses joint actions. We additionally formulated an assessment tool to serve as guidance in the determination of a given cluster's maturity level.

To achieve this objective, we referred to the case study technique to investigate two Brazilian industrial clusters. Both clusters have governance agencies in charge of managing joint actions. These studies were made necessary to check how effective the management model and maturity levels were in the characterization of clusters and in the identification of opportunities for improvement.

This paper is organized as follows. Section 2 reviews the literature on industrial clusters, governance, performance measurement and evolution of clusters. Section 3 describes the management model, whilst Section 4 outlines the maturity level classification and the assessment tool we used for the case studies. Section 5 reports the findings from both case studies. Finally, Section 6 summarizes the contributions we made with this paper.

2. Literature review

2.1 Industrial clusters and governance

Industrial clusters have gained much attention from national governments over the last decades in industrialized as well as in developing countries (Mytelka and Farinelli, 2000; Sölvell et al., 2003). This has stimulated many governments to formulate policies that aim at regional development (Navarro, 2008). A remarkable definition for industrial clusters is given by Porter (1998), who claims that an industrial cluster is a group of geographically proximate and interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities. After Porter (1998) made the term industrial clusters popular in the literature, many other definitions and interpretations emerged. For example, Carrie (1999) defines a cluster as a network of companies, their customers and suppliers of all the relevant factors, including materials, components, equipment, training and so on. Jones (2002) contends that clusters are networks of interdependent firms, knowledge producing

institutions, technology providing firms and customers, linked in a value creating production chain. An explanation to this great diversity may be that each country or region understands industrial clusters in a particular manner adapted to their own context (Raines, 2001). However, two aspects are noticeable in these definitions: geographic concentration and network formation, which may lead to collaboration and knowledge exchange.

To understand how companies may benefit from operating inside an industrial cluster we must shift back to the 19th century, when Marshal claimed that the concentration of firms in a geographic region might bring large scale gains and thus transform regional economies (Plummer and Taylor, 2001). He then explained such benefits by means of external economies, which are the cost-saving benefits of locating a company near external resources such as skilled labor, specialized training, raw material suppliers, research institutions, etc (Schmitz and Nadvi, 1999; Plummer and Taylor, 2001). Schmitz and Nadvi (1999) add that, besides external economies, companies may benefit from joint actions, which are enabled by the collaboration among companies. Two main ideas are often linked to collaboration in industrial clusters:

- *Social capital:* refers to the set of intangible factors that exist in a community, such as values, norms, attitudes, trust and networks, that facilitate coordination and collaboration for the common good (Cohen and Prusak, 2001);
- *Collective efficiency:* refers to the competitive advantage derived from local external economies as well as joint actions (Schmitz, 1995).

The management of joint actions raises the need of a coordinator, who should act as a facilitator in the achievement of the intended objectives (Slövell et al., 2003). This facilitator is often referred to in the literature as governance (UNIDO, 2001), cluster associations

(Aramburu and Querejeta, 2009) or cluster initiatives (Slövell et al., 2003). Regardless of the term used, the role of the facilitator is to encourage companies, educational institutes, consultants, training providers and trade associations to collaborate and create more value (Bititci et al., 2004). The participants should provide companies with specialized training, information, research and technical support, whilst companies should collaborate with each other by sharing information and integrating similar activities.

Finally we emphasize the important role that has been played by SMEs in industrial clusters. Many authors claim that such environments can boost growth and competitiveness of enterprises, especially SMEs (Humphrey and Schmitz, 1998; UNIDO, 2001; Karaev, 2007; Capó-Vicedo et al., 2008). Such enterprises have changed dramatically and shifted to a more innovative, flexible and dynamic business conception (Audretsch and Thurik, 2001). Besides external economies, SMEs in industrial clusters may gain competitive advantage through inter-firm relationships with other SMEs (Karaev, 2007) and through supply relationships with larger firms (Humphrey and Schmitz, 1998).

2.2 Performance measurement in industrial clusters

The question of whether firms in industrial clusters achieve better performance results has been addressed by many authors. Many are the evidences that such hypothesis holds true by analyzing several dimensions of a cluster's performance as new product innovation, revenue growth and survival rates (Gilbert et al., 2008). Many authors hypothesize that greater performance derives from knowledge spillovers, which makes small companies innovate more by establishing inter-firm networks (Baptista and Swann, 1998; Schiele, 2008; Gilbert et al., 2008).

However, measures as innovation, revenue growth or survival rates are just diagnosis measures, in other words they are “lagging” measures because they signalize past performance. The challenge is thus to develop performance measurement systems to assess ongoing performance and enable fact-based decision making. According to Morosini (2004), a common set of performance approaches and measures is one of the building blocks that tie companies together in industrial clusters. There is though a lack of studies that address performance measurement of inter-firm networks (Camarinha-Matos and Afsarmanesh, 2007).

Still, some contributions to the field could be found. Sölvell et al. (2003) have proposed a performance model to demonstrate how cluster initiatives should be designed and managed. Their model is based on three performance drivers: social, political and economic setting; the objectives of the cluster initiative; and the process by which the cluster initiative develops. These drivers will ultimately affect the overall cluster’s performance. Carpinetti et al. (2008) contributed by developing a four-dimensional performance measurement framework to assist the governance of industrial clusters in designing their own performance measurement systems. The dimensions of performance used by the authors were: economic and social results; company’s performance; collective efficiency; and social capital.

2.3 Evolution of industrial clusters

Clusters are very dynamic entities that undergo constant changes (Ketels, 2004). Indeed they do not emerge and disappear overnight. There is instead a variety of reasons underpinning the emergence of industrial clusters:

- The existence of a lead or anchor firm that subsequently feeds the emergence and growth of numerous smaller ones (Porter, 1998; Wolfe and Gertler, 2004);

- Public sector investments such as research laboratories and universities are usually pointed as enablers of industrial clusters (Rothaermel and Ku, 2008);
- Many companies emerge as spin-offs or imitations of pre-existing firms (Maggioni, 2004);
- The existence of local demand and market patterns (Isbasoiu, 2006).

As for the studies regarding the stages of development of industrial clusters, Ketells (2003) claim they are still in their infancy. However, Maggioni (2004) outlines three main stages of cluster development:

- *First stage:* this initial stage is often triggered by an external event and is sustained by the involuntary informational spillover provided by early entrants about the profitability of the location;
- *Second stage:* now external economies start playing a crucial role in sustaining the growth and structural transformation of the cluster through start-ups and spin-offs;
- *Third stage:* in this final stage the cluster either achieves leadership in a given sector or it declines;

3. Performance management model for industrial clusters

Based on our reading of the literature we devised a management model for industrial clusters, which is show in Figure 1. The model assumes the existence of a local governance agency formed by a set of local companies, public and private institutions and other related agents. In other words, there should be a set of people and institutions inside the cluster to run the proposed model. The model emphasizes the execution of joint actions, which in turn requires planning, coordination teams, collaboration among companies and performance measures for the assessment of results and outcomes. Each phase of the model outlines a set of activities

the governance should perform. We hypothesize that overall cluster's performance may increase if the local governance agency plans and manages its joint actions according to this model. The following subsections will discuss each of the phases of our model.

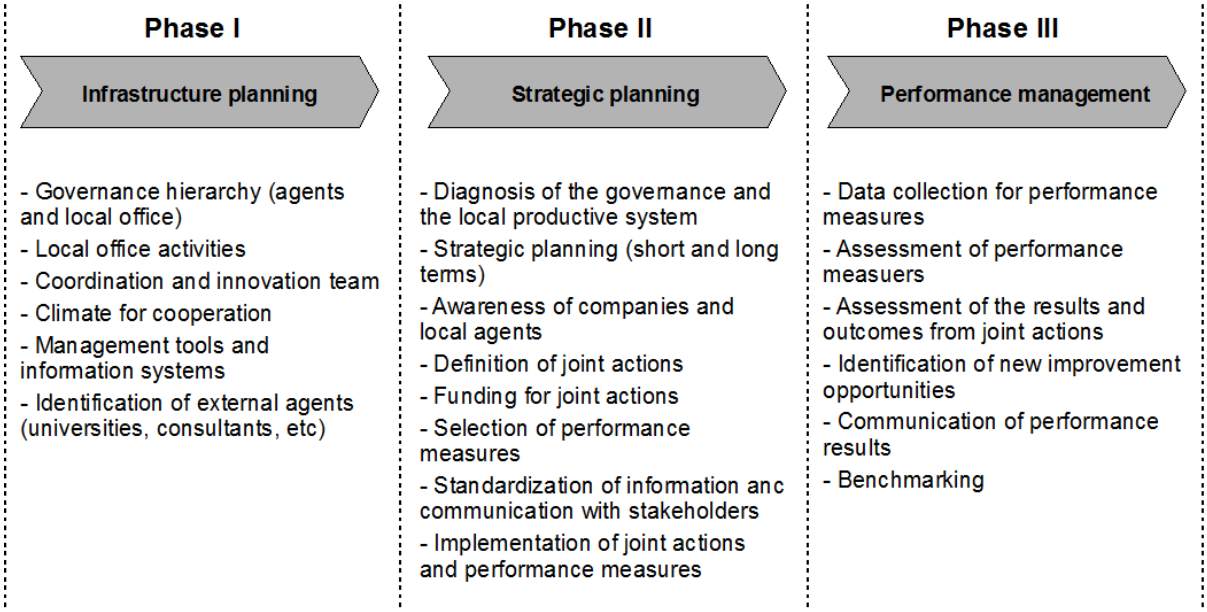

Figure 1 – Management model for industrial clusters

3.1 Infrastructure planning

Planning the infrastructure means identifying the structural elements necessary for the management and improvement of the cluster. They can be either internal or external, depending upon their role inside the governance. Both classifications are better described next:

- *Internal elements:* these are directly linked with the governance, that is, they are accountable for making decisions concerning the cluster as a whole as well as deciding on the initiatives to be carried out. They can also be involved with the execution of such initiatives, but making decisions and coordinating joint actions is their primary role. Internal elements can be referred to as the governance participants,

which include the local governance coordinator, representatives from companies and from public and private institutions;

- *External elements:* these are often involved with the governance but have no direct power for decision making. They help the governance by providing technical support and services for the execution of joint actions. Examples are educational institutions, universities, consultants, trade associations, labor unions, suppliers of raw material and the local government. The latter is especially important in establishing the physical infrastructure necessary for the companies to grow and provide funding programs and tax incentives.

Internally the governance agency has to define its hierarchical structure. This determines the people and institutions that are part of the governance and makes their role explicit. There should be a person at the top of this hierarchy (governance coordinator) to act as an intermediate among companies, institutions and the governance. To him/her is assigned the responsibility of making decisions together with the other cluster participants and managing the high-level activities concerning the cluster. Another internal element is the local office, which requires additional resources and people to support the governance activities. Besides people, the local office also needs management tools and information systems. Thus, people at the governance operational level must be trained in such tools and information systems. Their work must aim at creating a climate for collaboration among companies and incentive innovation. Both the governance hierarchy and the local office activities must be made clear to the governance members and local companies.

Identifying the internal and external elements is the first step towards the definition of opportunities for improvement. Joint actions should thus be formulated and agreed upon by

the internal elements and executed by using the capabilities of both internal and external elements. The aim of these actions may vary from simple trainings to enhance some companies' skills to investments on infrastructure to better serve local companies and enable them to reach new customers or even markets.

3.2 Strategic planning

Management schools often teach strategic planning focusing on single companies. From this perspective, Goodstein et al. (1993) define strategic planning as "the process by which the guiding members of an organization envision its future and develop the necessary procedures and operations to achieve that future". Another definition is given by Allison and Kaye (2005), who define it as the process through which the company agrees on the priorities that are essential to its mission and are responsive to the environment. They claim that strategic planning is a management tool which results in the acquisition and allocation of resources for the company to achieve its priorities. If we switch our focus to the context of an industrial cluster we will end up concluding that the outcomes of the strategic planning process are similar to those of single organizations. We thereby define strategic planning for industrial clusters as the process by which the governance agency defines its own vision of future focusing on the prosperity and growth of the cluster and chooses the actions that need to be taken to achieve this vision.

Different challenges arise when planning a cluster's strategy due to the plurality of actors it encompasses. In single organizations there is a natural bond between top management and the lower levels that facilitates the deployment of actions. Conversely, industrial clusters are made up of independent agents and climate for collaboration becomes essential for the deployment of any strategy. Literature has addressed strategic planning for supply chains

(Hilletofth, 2009), but there has not been yet any attempt to put together a strategic planning process tailored to industrial clusters. We take as a given in our model that the existing planning techniques like SWOT analysis or *hoshin* planning are suitable to assist the governance in the development of strategic plans.

In Phase II the governance is expected to carry out a diagnosis of its productive system and the current situation of ongoing improvement initiatives. This should then be combined with short and long term objectives so as to determine the priorities for the next management cycle, which is usually annual. Due to its simplicity, it is preferable that clusters employ *hoshin* planning (Akao, 2004) in the deployment of these priorities throughout the governance agency. The PDCA (Plan, Do, Check and Act) cycle would then be the default management method for all the actions foreseen in the strategic plan. Three additional aspects should be brought into account when formulating the plan:

- The sources of funding necessary for the execution of all improvement initiatives;
- The means through which the results of initiatives will be communicated to companies and other stakeholders;
- The performance measures (leading and lagging) that will be associated with the initiatives to enable their assessment.

3.3 Performance management

The third phase consists basically in executing the actions planned in Phase II and measuring their results with the performance measures selected. Results and outcomes of actions should be assessed by the governance participants and communicated to all cluster's stakeholders. Phase III is strongly influenced by the PDCA cycle. Indeed Phase II of our model can be seen

as the Plan step whilst the other three steps (Do, Check and Act) are in Phase III as depicted in Figure 2.

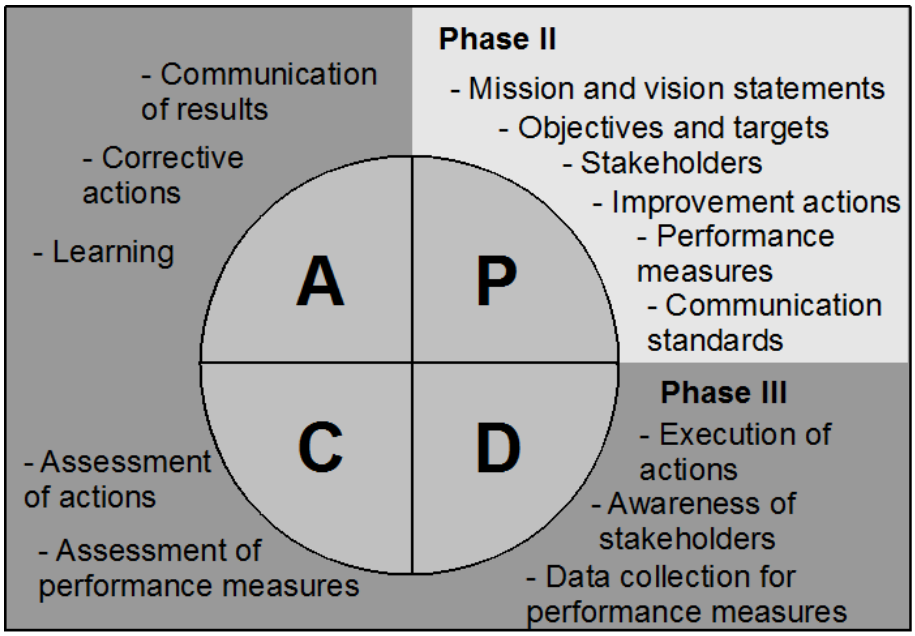

Figure 2 – Comparison between the management model and the PDCA cycle

While the most important outcomes of Phase II are the initiatives to be taken and the set of performance measures, Phase III is simply the execution of such initiatives and the use of performance measures to assess whether the actions achieved their goals or not. By the end of the cycle it is expected that the governance will have learned and improved its own operations and the cluster's performance as a whole, thus identifying opportunities for further improvement in the next management cycle.

4. Maturity levels for the management of industrial clusters

It is very unlikely that any governance agency would be able to implement the activities from the management model at once. It is rather advisable that the model be implemented incrementally, so that learning takes place and activities improve naturally. It is thereby

presented in this section the maturity levels a governance agency may achieve in the management of an industrial cluster by following the model from Section 3. Figure 3 shows how the maturity levels relate to the phases from the management model.

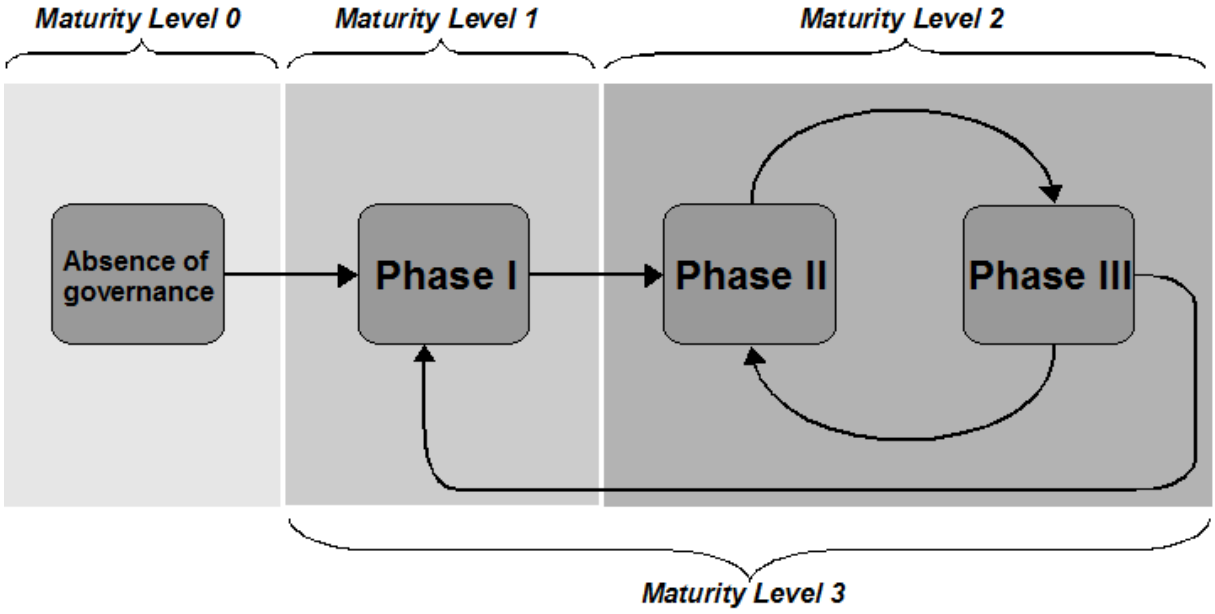

Figure 3 – Maturity levels for the management of industrial clusters

In fact, the maturity levels from Figure 3 demonstrate how the governance agency should implement the model. The identification and planning of the internal and external infrastructural elements characterizes maturity level one (ML-1). It is followed by ML-2, which consists of an iterative cycle between Phases II and III. Finally, ML-3 is reached when the governance closes the loop encompassing the three phases. Note that ML-2 is an iterative cycle shorter than ML-3. We assumed this because planning, execution and assessment of actions tend to occur more often than changes in the local infrastructure. A more detailed description of each maturity level is given next:

- *Maturity Level 0 (ML-0):* the null maturity level is used to classify clusters where no governance has been established;

- *Maturity Level 1 (ML-1):* at this level, the governance agency has managed to create a local office and identified, not necessarily formally, the internal and external infrastructural elements;
- *Maturity Level 2 (ML*-2): this maturity level is assigned to a cluster that has formally planned the use of the local infrastructure by devising joint actions to improve the overall cluster's performance. As depicted in Figure 3, this maturity level includes not only the planning of such actions, but also their execution and assessment through performance measures. It is thereby essential that, at his level, the cluster develop a PMS with leading and lagging measures to indicate whether joint actions are succeeding. Also, performance results should be communicated to stakeholders.
- *Maturity Level 3 (ML*-3): a governance agency that has reached this maturity level has already had much experience in conducting and assessing join actions. It allows the agency to promote long term initiatives that may have impact over the local infrastructure, both internally and externally.

Ideally, the governance should formulate plans and measurement system before taking actions over a cluster. It is however unlikely the case in most clusters, especially in the younger ones, where joint actions are set out without a proper planning and assessment mechanisms. Therefore, we cannot oversee the fact that our management model and maturity levels will not be strictly followed by cluster managers. Conversely, it is expected that activities from each phase will run and evolve in parallel, but that does not mean that the maturity levels will evolve in synchrony. We thus found appropriate to build an assessment mechanism based on criteria derived from the management method and organized according to the maturity levels discussed in this section. Tables 1, 2 and 3 show the assessment tool we propose to assess the

management of industrial clusters. A score-based approach was used to determine the level of attainment of the cluster to a set of requirements.

Requirements for ML-1		
Requirement	*Question*	*Score (1 to 7)*
R1 – Establishment of a local office	Has the governance agency established a local office to allow it to operate?	
R2 – Management tools and information systems	Are there appropriate management tools and information systems for the governance agency to conduct its operations?	
R3 – Coordination	Has the governance named a coordinator to manage joint actions and innovation programs?	
R4 – Identification of the external elements	Have the infrastructural elements external to the governance agency been formally identified and documented?	
R5 – Identification of the internal elements	Have the infrastructural elements internal to the governance agency been formally identified and documented?	
R6 – Climate for cooperation	To what extent are companies willing to cooperate with the governance agency?	
Maximum Score: 42		

Table 1 – Requirements for Maturity Level 1

Requirements for ML-2		
Requirement	*Question*	*Score (1 to 7)*
R7 – Diagnosis of the local productive system	Has the governance diagnosed the local productive system?	
R8 – Awareness of companies and local agents	How effective has the work of the governance been towards the awareness of companies and other agents with respect to collaboration and innovation?	
R9 – Strategic planning	Is there a formal strategic plan covering short and long-term objectives?	
R10 – Definition of joint actions	Have the resources for conducting joint actions been properly defined? (coordination and execution team, stakeholder's needs, funding, performance measures)	
R11 – Existence of a PMS	Is there a formal PMS in place to assess the effectiveness of joint actions?	
R12 – Assessment of joint actions	Do the assessment of joint actions result in corrective actions or in new actions for further improvement?	
R13 – Communication of	Are the results of joint actions and	

performance results	performance measures reported to the cluster's stakeholders?	
R14 – Benchmarking database	Is there a benchmarking mechanism so that companies can compare their performance against companies from inside and outside the cluster?	
Maximum Score: 56		

Table 2 – Requirements for Maturity Level 2

Requirements for ML-3		
Requirement	*Question*	*Score (1 to 7)*
R15 – Existence of a long-lasting PMS	Has there been a steady use of the PMS over the years?	
R16 – Planning and conduction of joint actions	Has the governance learned from the experience with joint actions so that new ones are easier to coordinate and more likely to be successful?	
R17 – Long term initiatives	Is the governance capable of formulating initiatives with long term objectives, which may affect local infrastructure (either internal or external to the governance)?	
R18 – Involvement of small and large companies	Have the joint actions formulated been able to attract interest from both small and large companies?	
R19 – Impact of joint actions on collaboration	How dos the governance perceive the impact of the joint actions it formulates over the climate for collaboration?	
Maximum Score: 35		

Table 3 – Requirements for Maturity Level 3

The criteria shown in Tables 1, 2 and 3 should be applied as a questionnaire to the governance. The assessment can be done either by an external evaluator or through self assessment. The total score achieved in each maturity level need to be divided by the maximum score achievable to calculate the rate that demonstrates to what extent the management of the industrial cluster has met the requirements at each level.

5. Case studies

In this section we present two case studies to demonstrate how the criteria from Section 4 can be used to assess the management of industrial clusters. Both cases are from Brazilian industrial clusters. The first of them is a metal-mechanic cluster and the second is a wooden furniture cluster.

5.1 Metal-mechanic cluster

This first case study was carried out in the cluster of Sertaozinho, which is a city characterized by having many metal-mechanic companies that produce equipment and parts for sugar and ethanol plants. The city has just over 110,000 inhabitants and more than 150 companies specialized in producing such equipment. There is also a number of companies providing maintenance and other support services for the sugar cane industry. The cluster emerged in the 1970's after a few large companies went bankrupt. This caused many of the employees to start off their own businesses, since the sugar cane industry kept on needing the equipment and services that were before provided by those large companies.

Despite the concentration of companies began a few decades ago, joint actions are quite recent. The governance agency was formed in 2008 as an initiative of the local association of entrepreneurs. Since then, the governance has established partnerships with local institutions and educated companies on the benefits enabled by collaboration in industrial clusters. Some joint actions are in progress, although there is neither a formal planning nor assessment mechanisms for them. The cluster coordinator was interviewed based on the criteria from Section 4. The findings are shown in Table 4. Scores were determined by the coordinator with assistance of the interviewer, who was one of the authors.

Req.	Findings	Score
R1	The governance has an office established inside the building of the local	5

	association of entrepreneurs.	
R2	There are no specialized information systems in place. Traditional management tools are used for ad-hoc purposes.	3
R3	There is a coordinator in charge of managing joint actions and innovation programs.	7
R4	External elements have been identified, but not formally.	3
R5	The elements internal to the governance have been identified. A statute has been set down to clarify their roles and how decisions should be made. Improvements on the statute are still necessary though.	6
R6	Small companies are more inclined to cooperate than the large ones, although most of them have not realized benefits from cooperation.	4
	Total score for ML-1	28
R7	The governance has sponsored some studies to diagnose the local productive system and the supply chain. The great complexity of products and raw materials prevented these studies from finishing.	4
R8	The awareness efforts have been more effective with small companies. There is much work yet to be done in this regard.	4
R9	There are no formal strategic plans, objectives or targets. There is however planning for ongoing initiatives.	2
R10	The ongoing joint actions are built upon local companies needs and are coordinated as projects. Funding sources have been identified. There are no performance measures to assess the impact of actions.	4
R11	There is no formal PMS.	1
R12	Joint actions are assessed in a qualitative manner, which results just in minor adjustments.	2
R13	There are no formal mechanisms for performance communication. Meetings are held to discuss the results from joint actions. The governance also uses the local newspaper and television to divulge its activities and results.	3
R14	There are no benchmarking mechanisms in use.	1
	Total score for ML-2	21
R15	There is no formal PMS in use.	1
R16	After conducting actions without proper planning, the governance realized the need to go through a strategic planning process. There is not a deadline for that to happen though.	2
R17	The ongoing initiatives are mainly focused on the improvement of the capabilities of small companies. Although none of the initiatives have impacted the local infrastructure, the governance has many plans of establishing common laboratories and educational centers.	2
R18	Only a fraction of the small companies are involved with joint actions.	2
R19	Joint actions have impacted positively the will of some small companies to collaborate. However, such impact is still viewed by the governance as limited.	2
	Total score for ML-3	9

Table 4 – Findings from the interview in Sertaozinho

5.2 Wooden furniture cluster

The second case study was carried out in the wooden furniture cluster located in the Brazilian city of Arapongas. The cluster covers also four surrounding cities: Apucarana, Cambe, Rolandia and Sabaudia. Araponga's population is estimated to be of 100,000 inhabitants, which accounts for almost one third of the whole cluster's population (330,000 inhabitants). The five cities together have about 270 wooden furniture factories, from which 150 are in Arapongas (55%). Most of the companies are SMEs, since about 90% of the companies have less than 100 employees. Both SMEs and large enterprises are specialized in producing low cost wooden furniture and sell most of their production to retailers.

Local governance was established in 2004 to manage several joint actions that had been previously started off by the local association of furniture producers. Such initiatives include common laboratories for product design and a technological center to educate companies on best environmental practices. Since its establishment, the governance has sponsored many joint actions, such as sending companies to national and international furniture fairs, promoting the annual local trade fair and providing training and education for employees. Although the cluster encompasses 270 companies, only about 40 of them participate actively in the governance, most of them SMEs. Table 5 describes our findings after the application of the assessment tool from Section 4. Again the scores were determined by the cluster coordinator with assistance of the interviewer.

Req.	Findings	Score
R1	The local office has been built in an area inside the local association of furniture producers.	7
R2	There are no specific information systems for the cluster management. Traditional management tools are used to deal with daily tasks or to solve problems as they arise.	3
R3	The governance named a coordinator and a vice-coordinator. They are not fully dedicated to the governance because they also own businesses in the city. They also do not get paid for this work.	5
R4	The external elements that support the local governance have been formally	7

	identified with assistance of the state government.	
R5	There is no formal statute to determine how decisions should be made. However, there is a certain degree of trust among the governance members and no decisions are made before all of them are inquired.	4
R6	Many SMEs participate actively in the governance, whilst large companies have a limited participation.	5
	Total score for ML-1	31
R7	The governance has not formally diagnosed the local productive system, specially due to its great complexity. Nevertheless, there is much tacit knowledge inside companies on how the productive system works.	3
R8	Monthly meetings are held to discuss matters that concern the cluster as a whole. All the companies are invited and the participation levels are high. It thus appears that the majority of companies are aware of the benefits derived from collaboration and innovation.	6
R9	The governance has attempted to formulate strategic plans, but not on a regular basis.	4
R10	Joint actions are defined and conducted as projects to satisfy the needs of companies. No performance measures are associated to indicate their impact over the cluster's performance. Funding is often provided by the local association of entrepreneurs.	5
R11	There is no formal PMS. A few social and economic indicators are calculated in a non-periodic basis to demonstrate how much the region has developed.	2
R12	Joint actions are assessed in a qualitative manner, which may lead to adjustments in the ongoing projects.	3
R13	Periodic meetings are held with the governance members to discuss ongoing projects and decide on what should be done next. Means of communication as newspapers, television and internet are also used to divulge results.	4
R14	There are no benchmarking mechanisms in use.	1
	Total score for ML-2	28
R15	There is no formal PMS in use.	1
R16	The governance has gained some experience in dealing with joint actions and companies seem to respect its projects, which makes new joint actions more likely to be successful.	4
R17	As previously discussed, even before the governance had been established there were joint actions that affected the local infrastructure. However, today there are no long-term joint actions in progress.	4
R18	A great number of SMEs take part in joint actions and other events promoted by the governance. Large companies seem to act just as viewers.	4
R19	The governance has gained trust from companies due to positive results obtained over the years. It is thus quite likely that companies collaborate with the governance. This does not hold as much true among companies in joint initiatives not supported by the governance.	4
	Total score for ML-3	17

Table 5 – Findings from the interview in Arapongas

5.3 Discussion

After compiling the data from both case studies and summing up their scores, it was possible to calculate the level of attainment of each cluster to the maturity levels from Section 4. Table 6 summarizes the results.

	Case 1 – Metal-mechanic cluster		**Case 2 – Wooden furniture cluster**	
Maturity level	*Score*	*Ratio*	*Score*	*Ratio*
ML-1	28	0,667	31	0,738
ML-2	21	0,375	28	0,500
ML-3	9	0,257	17	0,485
Overall	58	0,436	76	0,571

Table 6 – Scores obtained in each case study

We can learn from the analysis of the data that the wooden furniture cluster (Case 2) is more mature that the metal mechanic cluster (Case 1) in many aspects (see also Figure 4). Both cases achieved a high level of attainment to the ML-1, which means that they had reached a certain degree in the identification and formalization of its infrastructure. Still, there are some barrier to be overcome regarding ML-1 in each cluster.

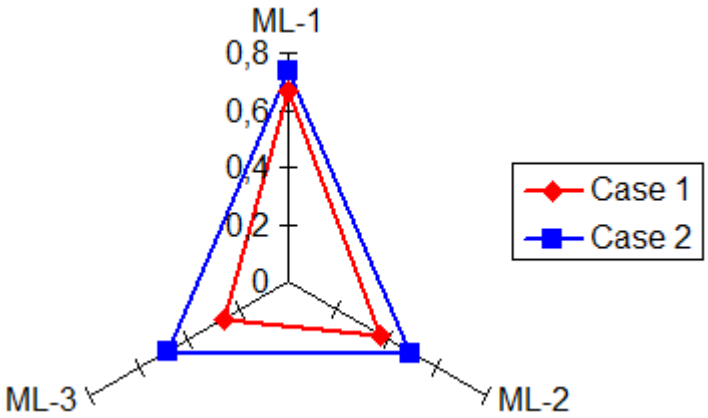

Figure 4 – Radar chart with results from Table 6

It is, however, in the second maturity level that both clusters start facing bigger challenges. This is mainly due to the inexistence of strategic planning and performance measurement

systems in both cases. Even with Case 2 scoring 50%, the inexistence of formal plans and performance measures will prevent them from reaching excellence in ML-3. The use of planning techniques may enable the governance to devise better solutions to the cluster problems, whilst performance measures are better mechanisms to demonstrate that joint actions are being effective. If the benefits of collaboration are translated into numbers, it will be more likely that companies cooperate in future initiatives. This, in turn, will improve the climate for collaboration and allow the governance to learn with well succeeded experiences.

If we were to classify both industrial clusters into maturity levels, we would place them both into ML-1. None of them has developed the fundamental practices that would allow them to be classified into ML-2. After they reach ML-2, it will be just a matter of time until they reach ML-3, since it requires that the governance master its planning, coordination and assessment capabilities.

6. Conclusion

In this article we proposed a management model and a set of maturity levels to assess the management of industrial clusters. We assumed that matters concerning the whole cluster are managed by local agencies, which we referred to as governance agencies. We also put forth a tool based on requirements and scores to help determine at what level the industrial cluster is. After describing the tool, two case studies were carried out to evaluate whether the tool was capable of determining the maturity level of each cluster. The scores resulted from the assessment tool itself are not sufficient to determine exactly the maturity level of a given cluster, but it is usable in identifying areas of improvement in the governance. An important finding of our investigation in both clusters is that none had formal strategic plans or

performance measurement systems. This may prevent them from reaching higher levels of collaboration and performance.

More empirical research is required to validate our management model and maturity levels. It is very likely that we will need to update them as new case studies are carried out. However, due to the lack of research addressing such topics, we believe that our contribution opens an important debate on how clusters should be managed and assessed.

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