



**PROPOSTA DE APLICAÇÃO DO MÉTODO PDCA NA  
ESTRUTURAÇÃO DE UM SPL NA REGIÃO DOS CAMPOS GERAIS,  
PR, BRASIL**

**APPLICATION OF THE PDCA METHOD TO STRUCTURE A LPS IN  
THE REGION OF CAMPOS GERAIS, PR, BRAZIL: A PROPOSAL**

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**RESUMO**

O método PDCA é um instrumento utilizado para o controle e melhoria de processos, e é composto de quatro fases: o planejamento (*Plan*), a execução (*Do*), o controle (*Check*), e ação corretiva (*Act*). Embora o método tenha sido originalmente proposto para realizar o controle estatístico do processo, ele pode perfeitamente ser aplicado em processos de gestão, como



forma de garantir a efetividade do processo. O objetivo deste artigo é sugerir a aplicação do método PDCA para organizar as ações de implantação de um Sistema Produtivo Local no setor de Móveis de Metal e Sistemas de Armazenagem e Logística na região dos Campos Gerais, Paraná. Foi realizada uma pesquisa na aglomeração produtiva visando detectar qual o nível de interesse dos empresários em trabalhar de forma cooperativa e conjunta, condição essencial para a caracterização de um Arranjo Produtivo Local. Em função dos objetivos, a pesquisa é exploratória, com abordagem quantitativa. A amostra é não probabilística por acessibilidade. O procedimento técnico utilizado é o estudo de caso. A pesquisa foi realizada junto a dez de um total de dezesseis empresas que compõem o setor de Móveis de Metal e Sistemas de Armazenagem e Logística da região dos Campos Gerais, o que representa 63% das empresas. Os dados foram coletados por meio de entrevista com os proprietários e sócios majoritários, tendo como instrumento um formulário com questões fechadas e estruturadas. A análise dos resultados revela um alto nível de interesse manifesto pelos empresários da aglomeração em trabalhar de forma cooperativa, evidenciando uma das mais fortes características de um SPL segundo a literatura. Diante desta perspectiva, torna-se imperioso por parte da liderança, formalizada ou não, planejar as ações do setor a fim de que sejam estabelecidos os objetivos prioritários das empresas. Assim sendo, sugere-se a aplicação do método PDCA.

**Palavras-chave:** sistemas produtivos locais, PDCA, móveis de metal, sistemas de armazenagem e logística

### ABSTRACT

The PDCA method is a tool used to improve and control processes, and is composed of four phases: planning (Plan), implementation (Do), control (check), and corrective action (Act). Although the method was originally proposed to make the control of statistical processes, it may be successfully applied in management processes as a way of ensuring their effectiveness. The purpose of this paper is to suggest the use of the PDCA method to organize the actions of implementing a Local Production System in the sector of Steel Furniture and Storage and Logistics Systems in the region of the Campos Gerais, Parana. In order to detect the level of interest among entrepreneurs to work conjointly and in cooperation, essential condition to characterize a LPS, a research with the entrepreneurs of the agglomeration was done. To meet the objectives, the research is exploratory, descriptive and with quantitative approach. The sampling is non-probabilistic, by accessibility. The technical procedure used was the case study. The population is composed by 16 enterprises, from which 10 were researched. Data were collected through interviews with the owners and major partners of enterprises, using a form with closed and structured questions. The analysis reveals a high level of interest from the interviewed in working in cooperation, demonstrating one of the strongest features of an LPS, according to the literature. In face of this perspective, it is imperative from the leadership of the agglomeration to plan the actions of the sector in order to set the priority collective objectives. Therefore, for this matter, it is here suggested in details the application of the PDCA method.

**Key words:** local production systems, PDCA, steel furniture, storage and logistics systems.



## 1. INTRODUCTION

Territorial agglomerations have been studied in the past decades, so much in Brazil as abroad. Those so called agglomerations bring many advantages for the enterprises linked to them, such as: growth in productivity due to a better access to employees and suppliers, access to specialized information, complementarities, access to institutions and public politics, better motivation and measurement based in local rivalry, innovation, news business formation, and others (PORTER, 1998).

The theme was firstly discussed by the English economist Alfred Marshall at the end of the nineteen century. By that time, however, the dominant concept of development was related to economies of scale. Authors, like Alfred Chandler (1990), for instance, would emphasize the advantages of big corporations, vertically integrated, that could reach economies of scale and scope (MEYER-STAMER and HARMES-LIEDTKE, 2005).

Around 1980, researchers realized that the Italian industrial development did not fit the Chandlerian explanation of economy. The governmental policies concerning industrial districts had stimulated the creation of big enterprises. On the shadow of those industrial districts, and without any support from the government, a sector of small and medium enterprises was arising: the so called Third Italy. First Italy was composed by enterprises like FIAT; Second Italy by governmental supported enterprises.

In 1984, Third Italy dazzled in a study published by the American sociologists Michael Piore e Charles Sabel. On their point of view, the emergent alternative was the flexible specialization, based on intense interaction among dynamic small and medium enterprises.

Hubert Schmitz (1989) was one of the authors who researched on this theme observing particularly the situation in developed countries. Italian authors, like Becatini (1990) for instance, got international attention publishing works related to this area. The discussion on territorial agglomerations got even more importance, in the academic as well as in the economic development view, with the publication of “Competitive advantage of Nations”, by Michael Porter (1989), where the importance of clusters for industrial development was emphasized.

Once this theme aroused as a new perspective for economic development, authors and researchers in several parts of the world turned their attention to it: Paul Krugman (1998) with



the role of geography in the development; Khalid Nadvi (1999) and the cirurgical cluster in Pakistan, Jörg Meyer-Stamer (1998) on developing countries. In Brazil, Nelson Casarotto and Luis H. Pires (2001) studying the Italian model; Wilson Suzigan (2003) with Local Production and Innovation Systems; Helena M. Lastres and José E. Cassiolato (2003), and the Productive and Innovative Arrangements. A new Era in economic development studies had been launched.

In the State of Paraná, the Government, through *Instituto Paranaense de Desenvolvimento Econômico e Social* (IPARDES) and *Secretaria de Estado do Planejamento* (SEPL), developed a work which consisted, in the first phase, in identifying the agglomerations of enterprises existent in the State. The aim was to foster development by creating and implementing public policies to support the most important ones.

After the first phase was concluded, twenty five expressive agglomerations were identified. Among them, there is the sector of Steel Furniture and Storage and Logistic Systems in the region of Campos Gerais. This agglomeration is the object of study in this paper.

The main purpose of this paper is to suggest the application of the PDCA method to structure the referred agglomeration in a Local Production System (LPS).

## **2. TERRITORIAL AGGLOMERATION OF ENTERPRISES**

Several denominations and definitions have been proposed to territorial agglomerations of enterprises ever since the theme started being studied. Porter (1998) called them clusters, and defined them as geographic concentrations of interconnected enterprises and institutions in a particular field, encompassing an array of linked industries and other entities important to competition.

Casarotto and Pires (2001), name these territorial agglomerations as Local Economic Systems or Local Production Systems, characterized by nets of enterprises geographically concentrated, and by intense and active solidarity among the several actors.

Redesist (2005) name them as Local Productive and Innovation Systems (LPIS), that are groups of economic, politic and social actors, in the same territory, performing the same correlated economic activities, presenting expressive links in production, interaction, cooperation and learning. According to Redesist (2005), Local Productive Arrangements is a



category of territorial agglomerations of enterprises that do not present significant articulation among the actors, being an early stage of LPIS.

According to Termo de Referência, elaborated by Grupo de Trabalho Permanente para Arranjos Produtivos Locais (MDIC, 2006), an Local Productive Arrangement should have a significant number of enterprises and individuals in the territory, acting around the same predominant productive activity, and share perceived forms of cooperation and some governance mechanisms. It may include small, medium and big enterprises.

Suzigan et al (2003) name them as Local Production and Innovation Systems (LPS), which may have varied characterizations according to its history, evolution, industrial and institutional organization, social and cultural contexts, forms of governance, logistic, ways of learning and level of knowledge dissemination, among many other characteristics.

Suzigan et al. (2005) propose a typology of LPS, according to their importance to the region. This typology, summarized in Chart 1, presents four basic levels of development for LPS, which are:

- a) Embryonic local production systems: they have little importance to its sector and coexists, in the region, with other economic activities;
- b) Vectors of local development: they are important to a region though do not contribute decisively to the principal sector to which they are linked – exactly the opposite of the advanced vectors. They surpassed the embryonic stage, having its local importance acknowledged;
- c) Advanced vectors: they are of enormous importance to the sector – due to their participation in the production and employment – but are diluted in a much larger and more diverse economic system: the region is important to the sector, but the sector is not so representative to the region. They are usually located in big metropolitan regions;
- d) Centers of industrial and regional development: they stand out for two reasons: they are greatly important to the region as well as to the sector they belong.

To facilitate reading, the term territorial agglomeration of enterprises will be used in this paper when referring to agglomerations in general, and LPS when referring to the agglomeration object of study.



		IMPORTANCE TO THE INDUSTRY	
		LOW	HIGH
IMPORTANCE TO THE REGION	HIGH	Vector of local development	Centers of industrial and regional development
	LOW	Embryonic local production systems	Advanced vectors

Chart 1. Typology of LPS according to their importance to the region.

Source: Suzigan *et al.* (2005)

Based on the literature, it can be seen that pure territorial agglomerations of enterprises do not imply they have some synergy. To be considered a LPS, it is required from the enterprises in the agglomeration some kind of conjoint actions. The cooperation is the most important characteristic in a LPS, and the one who will determine their success as a group. Otherwise, they continue to be simply a pure territorial agglomeration.

### 3. PDCA METHOD

The concept of the improvement method, known as PDCA, was originally developed in the 1930s, in the Bell Laboratories, USA, by the American statistician Walter A. Shewhart, as being a cycle for statistical process control, which could be continually repeated in any process or problem solving. The method was given its scientific nature in 1931, with the launching of the book *Economic Control of Quality*, written by Shewhart (SOUZA, 1997).

Nevertheless, this method became popular only around 1950, when William Edwards Deming used this method to control quality in the production process, in Japan. Deming developed which he called the Shewhart PDCA Cycle, as presented in Figure 1, in honor to its former creator (ANDRADE, 2003).

The PDCA is a method to control practice, enabling an enterprise to reach the goals established, with the maximum efficiency (CAMPOS, 2001). It is an instrument of process improvement and control (SOUZA and MEKBKIAN, 1993); it is a path to reach the goals established by entrepreneurship systems (CAMPOS, 2001).

According to Hosotani (1992, p.39) “the PDCA wheel is a step-by-step method of getting things done effectively and reliably. It consists of drawing up a plan, implementing the plan, checking the results, and taking any necessary corrective action”.

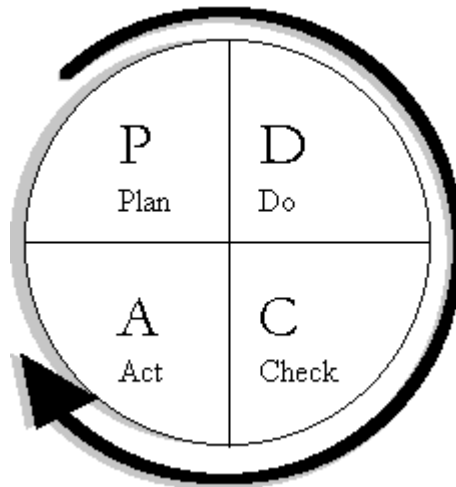


Figure 1: PDCA cycle

Source: HCI (2006)

PDCA stands for Plan, Do, Check and Act. These words correspond to four basic phases (CAMPOS, 1999), to be followed up in the process applied, as explained bellow.

**(P) Plan** consist in:

- a. Establishing goals for controlling items;
- b. Establishing the way, a path to be followed to achieve the goals proposed.

This stage is considered the most important, since it is the beginning of the cycle, and where all the process related to the cycle will start. The future effectiveness of the cycle is based in a careful, detailed and well prepared planning, which will provide data and information to all the other following stages in the cycle. Therefore, it should be discussed points such: the specific objective to be reached by the organization; who the persons to be involved in the process are; what the time limit for the effectuation of the elaborated action planning is; what resources will be expended for the conclusion of the plan; what data will be collected during the process; among other questions that may involve the detailed planning of the process to be executed (ANDRADE, 2003).

Badiru and Ayeni (1993) propose that this phase can be subdivided into five steps for a better assessment of the problem, which are:

- a. Identifying the problem;
- b. Establishing goals;
- c. Analyzing the phenomenon: this piece of work should treat the detailed analysis of those problems commonly faced by the enterprise. For this matter, data and precise



information related to those problems should be collected. According to Melo (2001) and Souza (1997), this data collecting may be done in the format of a historical occurrence survey, occurrence frequency, local and seasonality of those occurrences.

- d. Analyzing the process;
- e. Elaborating a plan of action;
- **(D) Do** consist in executing the tasks exactly as previewed in the previous phase - Plan.
- **(C) Check** will be based on the results of the preceding actions from the planning stage. Therefore, all the actions must be monitored and formalized adequately in the stage “Do”, in order to carry out the verifying as most efficiently as possible (ANDRADE, 2003).
- **(A) Act** is characterized by the standardization of the executed actions, aiming at the continuous improvement. The actions in this phase must be based on the positive results obtained in the **Check** stage, in order to apply those actions in similar occasions (BADIRU and AYENE, 1993).

The use of the PDCA method was primarily designed to solve problems related to quality control processes, mostly at the shop floor. But it can be used in several possibilities in an enterprise: it may be used to establish goals of high management level, as well as from operational level, seeking to coordinate efforts for continuous improvement (MOURA, 1997; ANDRADE, 2003). It can be applied to solve critical problems that may prejudice the performance of any project or task, denominated by Campos (2001) as Routine Management.

The methodology to be followed in the use is the same adopted in an improvement program, always having an established goal - actions to be carried out and efficiency proved - as well as continuous actions on eventual detected problems.

#### 4. METHODOLOGY

With the purpose of studying the businessmen’s interest in constituting a LPS from the agglomeration identified by IPARDES and SEPL (IPARDES, 2006), an exploratory research, in the literature, was carried out, and a descriptive research (GIL, 1999), which collected primary data from the businessmen. The research has an applied nature, once it has the





purpose of generating knowledge to practical application, involving local truths and interests (SILVA e MENEZES, 2001).

The technical procedure is the case study (GIL, 1999; YIN, 2001) that aimed to investigate in detail the businessmen's interest of the in working in cooperation with one another, which is a preliminary condition to constitute a LPS.

The research presents a quantitative approach, considering that the data can be quantified, translating opinions and information in numbers (SILVA e MENEZES, 2001). A form, with closed and structured questions, was used to collect the data, and there were eight specific questions concerning cooperation and conjoint actions. The eight questions are presented in Chart 2. The researcher interviewed the owners and major partners of the enterprises. For each questions, the interviewed should choose one of the five options of answer: agree totally, agree partially, do not know, disagree, and disagree totally. The questions are presented in Chart 2.

1. Personnel Hiring and Training: in your opinion, could this activity occur in cooperation with other enterprises of the agglomeration, concerning common tasks developed by the employees? ( ) Agree Totally ( ) Agree Partially ( ) Do not know ( ) Disagree ( ) Disagree Totally
2. Development of New Technologies: do you think it is possible to develop this activity in cooperation with other enterprises of the agglomeration? ( ) Agree Totally ( ) Agree Partially ( ) Do not know ( ) Disagree ( ) Disagree Totally
3. Manufacturing of identical parts for different final products: do you agree that this activity may occur conjointly with other enterprises of the agglomeration? ( ) Agree Totally ( ) Agree Partially ( ) Do not know ( ) Disagree ( ) Disagree Totally
4. Sharing Installations: do you consider being possible to share installations and warehouses with other enterprises of the agglomeration? ( ) Agree Totally ( ) Agree Partially ( ) Do not know ( ) Disagree ( ) Disagree Totally
5. Publicity: in your opinion, could this activity occur in cooperation with other enterprises of the agglomeration? ( ) Agree Totally ( ) Agree Partially ( ) Do not know ( ) Disagree ( ) Disagree Totally
6. New Products publicity: do you agree that this activity may occur conjointly with other enterprises of the agglomeration? ( ) Agree Totally ( ) Agree Partially ( ) Do not know ( ) Disagree ( ) Disagree Totally
7. Exports Office: in your opinion, is it interesting to maintain an exports office in cooperation with other enterprises of the agglomeration? ( ) Agree Totally ( ) Agree Partially ( ) Do not know ( ) Disagree ( ) Disagree Totally
8. Inputs and Raw Material Purchasing: do you agree that this activity may occur conjointly with other enterprises of the agglomeration? ( ) Agree Totally ( ) Agree Partially ( ) Do not know ( ) Disagree ( ) Disagree Totally

Chart 2. Questions concerning general forms of cooperation and level of interest

Source: The author (2006)



The population is composed by 16 enterprises, among which 10 were researched, constituting a non-probabilistic sampling, by accessibility (GIL, 1999). The sampling represents 63% of the enterprises.

For data tabulation, simplified mathematical formulas were used; the numbers were translated into percentages and presented in the form of a table, for better understanding.

## 5. THE SECTOR OF STEEL FURNITURE AND STORAGE AND LOGISTIC SYSTEMS

The government in the State of Paraná, through IPARDES and SEPL, started in 2005 a work directed to territorial agglomerations of enterprises, aiming at the creation of public policies to foster economic development in the State.

The research work (IPARDES, 2006) selected twenty five expressive agglomerations: five embryonic local production systems, five vectors of local development, seven advanced vectors, and eight centers of industrial and regional development. The information is detailed in Chart 3.

		IMPORTANCE TO THE INDUSTRY	
		LOW	HIGH
IMPORTANCE TO THE REGION	HIGH	5 Vectors of local development	8 Centers of industrial and regional development
	LOW	5 Embryonic local production systems	7 Advanced vectors

Chart 3. Typology and examples of LPS in the State of Paraná.

Source: IPARDES (2006)

The Steel Furniture and Storage and Logistic Systems sector in the Region of Campos Gerais was identified as a potential LPS, among the eight centers of industrial and regional development, considered by Suzigan *et al.* (2003) the most important territorial agglomerations for a region.

The agglomeration object of study is composed by sixteen enterprises, from which ten were investigated. The small enterprises, 70% of the sample, have less than 60 employees, whereas the big enterprises, 30% of the sample, have more than 100 employees. They produce



and sell mainly pallet racks, steel furniture and storage solution projects, among several other products made from steel, like safes, shelves, balconies, and also liquid and powder paint.

In Figure 2 it is possible to identify the potential territorial agglomerations of enterprises in the State of Paraná. The agglomeration studied in this paper is in the micro-region 21, highlighted in orange in the map.

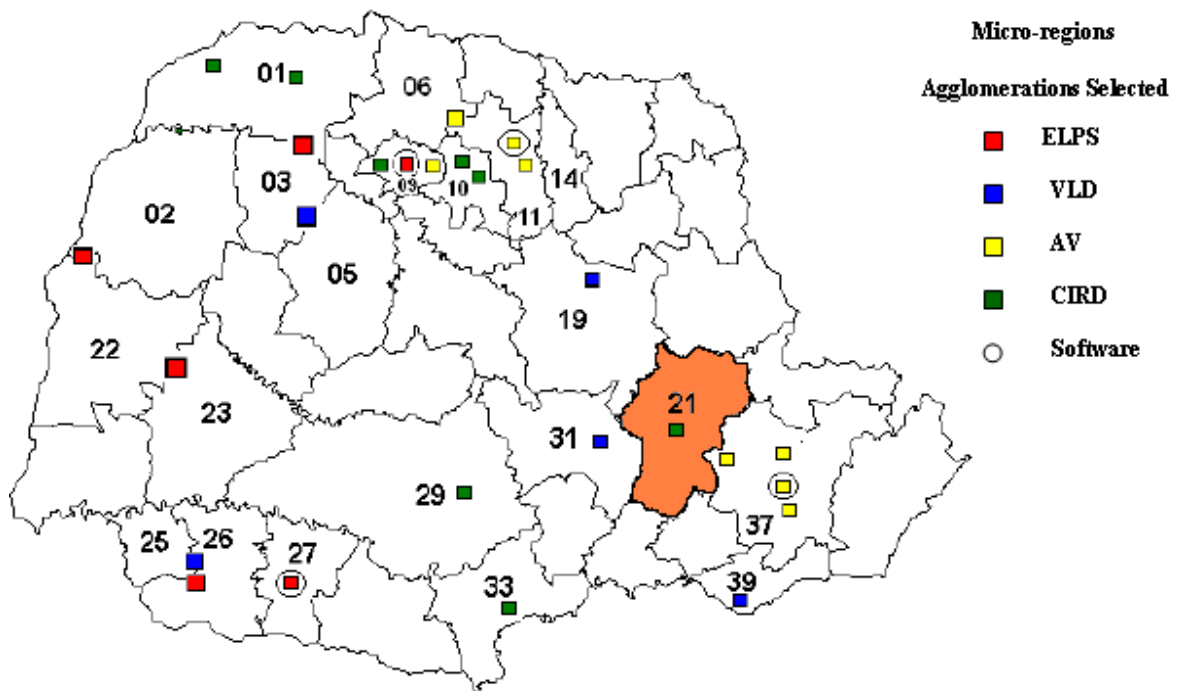


Figure 2: geographical distribution of the 25 agglomerations in the state of Paraná

Source: IPARDES (2006)

### 5.1 INTEREST IN COOPERATION AND CONJOINT ACTIONS

The main characteristic of LPS, according to the literature, is the cooperation and conjoint actions performed by the enterprises in the agglomeration. Thus, the research was conducted with the special purpose of identifying the possibilities of structuring and formalizing a LPS in the region. Then, the results of the research will be now presented.

The general forms of cooperation are shown in Table 1, ordered according to the interest level of the interviewed.



The most interesting form of cooperation is to share an Exports Office. 100% of the interviewed declared to have interest in sharing the costs of such activity. The reason is that the costs with a good exports agent are too high to be kept by a single enterprise.

Table 1: general forms of cooperation in order of interest

Order	Category	Agree Totally	Agree Partially	Do not know	Disagree	Disagree Totally	Total
1 <sup>st</sup>	Exports Office	9 (90%)	1(10%)	0 (0%)	0 (0%)	0 (0%)	10(100%)
2 <sup>nd</sup>	Personnel Hiring and Training	5 (50%)	4 (40%)	0 (0%)	1(10%)	0 (0%)	10(100%)
2 <sup>nd</sup>	Inputs and Raw Material Purchasing	5 (50%)	4 (40%)	0 (0%)	1(10%)	0 (0%)	10(100%)
3 <sup>rd</sup>	Development of New Technologies	4 (40%)	4 (40%)	0 (0%)	2 (20%)	0 (0%)	10(100%)
4 <sup>th</sup>	Manufacturing of identical parts for different final products	2 (20%)	4 (40%)	1(10%)	3 (30%)	0 (0%)	10(100%)
5 <sup>th</sup>	Publicity	5 (50%)	0 (0%)	2 (20%)	2 (20%)	1(10%)	10(100%)
6 <sup>th</sup>	New Products publicity	2 (20%)	3 (30%)	0 (0%)	5 (50%)	0 (0%)	10(100%)
7 <sup>th</sup>	Sharing Installations	3 (30%)	1(10%)	0 (0%)	0 (0%)	6 (60%)	10(100%)
Total		35	21	3	14	7	80
<b>Frequency</b>		<b>43,75%</b>	<b>26,25%</b>	<b>3,75%</b>	<b>17,50%</b>	<b>8,75%</b>	<b>100,00%</b>

Source: Data from the research

In second place of interest are the activities related to Personnel Hiring and Training and Inputs and Raw Material Purchasing. Both activities had 90% of agreement – 50% of the interviewed agree totally and 40% agree partially in working conjointly in these activities. Concerning Inputs and Raw Material Purchasing, the interviewed expect to obtain better prices and better forms of payment, which is easier to obtain when the amount to be purchased is large. Better deals with suppliers can be made when working together, in a larger group of companies, making possible economies of scale. However, all the interviewed agree that this deal must be well planned, carefully organized, and occur in a pre-established way set by a formal contract, preventing payment problems. This form of cooperation is one of the great expectations and, at the same time, a major fear among the interviewed.

When talking about Personnel Hiring and Training, those in favor believe these shared activities should be limited to those related to basic levels only, since the activities of shop floor are common to almost all the enterprises in the sector. Concerning the strategic levels, they prefer that each enterprise hire and train the employees separately, having in mind that each enterprise has its expertise and specialty that constitutes the differential of



competitiveness. This way, the core competences of every enterprise in the agglomeration would be maintained, according to the interviewed.

Development of New Technologies is the third form of cooperation elected by the interviewed. The agreement percentile is 80% - 40% agree totally, and 40% partially. This activity may be conjoint since it does not interfere in the individual differential of competitiveness, preserving the particularity of the final products of each enterprise. Examples of activities that can be researched conjointly mentioned by the interviewed: new painting that is more resistant and that could last longer; new technology in folding steel sheets; development of new personal protective equipment that is more accessible, durable etc.

As for Manufacturing of Identical Parts for Different Final Products, the businessmen said there is no problem in sharing in case one of the enterprises receives a big order and is not able to produce it alone. However, they believe that if a enterprise does not have the production capacity for a big order, such enterprise cannot be committed to take the order and take risks, having to watch its size and possibilities. Furthermore, this is not a very common situation, once they mostly sell projects, not as separated items. This case should be carefully studied.

As for cooperation in publicity, 50% of the interviewed agree totally while one of the biggest enterprises showed great interest in this kind of cooperation. The interviewed stated that it would be interesting to keep a joint stand in international fairs, and declared it already has partnerships with other enterprises outside the agglomeration, in the same business branch. But the interest of the enterprise is to promote the local business. 20% of the interviewed do not know what benefits this activity performed conjointly would bring to the enterprise alone; another 20% disagree, and 10% of the interviewed disagree totally.

Regarding the promotion of new products, the disagreement prevailed among the interviewed, for judging that this kind of action is more interesting to those enterprises that are launching new products on the market. The general opinion is that this action should be carried out separately, according to particular interest.

The last form in level of interest is sharing Installations, with 60% of disagreement among the interviewed. Though 30% agree totally and 10% agree partially, this form had the lowest level of intention among the interviewed, showing that this is not a kind of activity the LPS would be likely to share.



The results clearly evidenced that the businessmen are interested in develop conjoint actions, and perform activities in a cooperative way. It is proved by the statistics, once the frequency of agreement in conjoint actions was 43,75% for a total agreement, and 26,25% for a partial agreement, which corresponds to 70% of favorable intentions.

Therefore, after pondering on the results, further actions concerning the structuring of the LPS should be analyzed and proposed.

To help out in this sense, this paper presents, in the sequence, a proposal to apply the PDCA method in the structuring and organizing the actions of the LPS.

## **6. APPLYING THE PDCA METHOD TO STRUCTURE A LPS: A PROPOSAL**

The field research revealed that the businessmen are interested in performing actions conjointly. Some of the researched enterprises already have courses and training inbound, like welding and painting. But they would prefer that those, and other courses, could be offered and organized by some local agent and shared with other enterprise of the agglomeration, in order to reduce costs.

But by the time of the research, they had not organized themselves in the sense of constituting a formal leadership, to deal with such matters. Therefore, in order to make this interest feasible, the first is to establish a formal leadership. A survey carried out in the ENEGEPs from 2001 to 2004 (PAGANI *et al.*, 2005) reveals that one of the main concern in LPS is the governance, which facilitates the organization of conjoint actions, and other management strategic activities. But it is important, at this stage of the agglomeration, that any form of leadership arises to manage the LPS activities.

Hosotani (1992, p.38) defines management as those activities needed for continuously, rationally, and efficiently performing a job and achieving an objective. This planning may have as base the principles of the PDCA method, since, according to Hosotani (1992, p.38) if you want to be effective when managing anything, it is important to follow the four steps of the PDCA cycle. And this is what is proposed here: applying the PDCA method in the actions of the LPS.



### Phase 1 - Preparing a plan (Plan)

This is the most important phase in the whole process of management. In this step, the leadership, the governance members or the whole group will discuss questions like:

- Who will be the governance members (in case there is not governance yet)?
- Where will the business meetings take place?
- Which will be the frequency of meetings, and previously set dates?
- What are the most important goals to be reached?
- What are the enterprises that will be willing to work in a cooperative way?
- What are the actions to be developed in cooperation?
- What are the actions to be developed individually?
- What is the first conjointly action to be developed by the LPS?

In order to clarify and organize the ideas, this phase may be subdivided into five steps, according to Badiru and Ayeni (1993):

- a. Identifying the problem: what are the major difficulties faced by the enterprises in the LPS?
- b. Establishing goals: what does each enterprise expect to reach working in LPS system?

Examples of goals mentioned by the researched enterprises in the agglomeration:

- Broaden the market inside the country;
  - Reach abroad market;
  - Increase the productivity capacity;
  - Develop new technologies;
  - Create and establish a conjoint exports office;
  - Professional training and developing for basic level workers
  - Share purchasing inputs, as so to obtain better prices.
- c. Analyzing the phenomenon: this piece of work should treat the detailed analyzing of those problems commonly faced by the enterprises. Therefore, it should be collected data and precise information related to those problems. This data collecting may be done in the format of a historical occurrence survey, occurrence frequency, local and seasonality of those occurrences (MELO, 2001; SOUZA, 1997).



- d. Analyzing the process: search for those more important causes for the problems faced by the enterprises. This analyze may be done by using the Ishikawa's Cause-Effect diagram, as exemplified in Figure 3.
- e. Elaborating a plan of action: this plan of action should contain, in details, all the actions that should be performed in order to reach the goals initially proposed. The governing should build the tactic plan of action, which is to define the means to carry out the implantation, considering the resources available to the LPS enterprises.

### Phase 2 - Implementing the plan (Do)

In this module, all the goals and aims mapped out in the previous stage by the governing of the LPS should be put in action, according to the philosophy of the LPS as a whole. This stage will only be viable if there is a plan of action well structured, and if this one be put in action attentively (BADIRU and AYENI, 1993).

### Phase 3 - Checking the results (Check)

In this phase, it should be raised questions such as: what is the effectiveness of the actions concerning the initial goals? How large is the difference gaping between the initial goals and effectively reached ones? Were the planned actions effective enough so that a standard can be build?

This idea can be visualized in Figure 3.

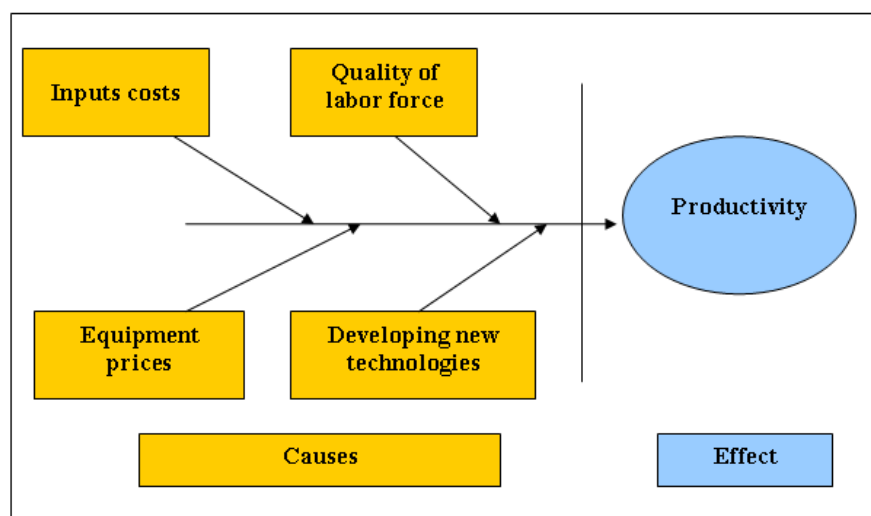


Figure 3: Ishikawa's diagram of cause-effect

Source: adapted from Walton (1990)





#### **Phase 4 - Take action (Act)**

In this step, the leadership will make the necessary corrections and take actions in order to prevent the problems to return. The actions that brought good results must be selected and put into practice by the participating enterprises. This selection must be done through correct measurement and assessment of the results. For instance:

- increasing productivity,
- increasing returns,
- product quality improvement,
- labor force improvement – due to a specific joint action in the LPS.

## **7. DISCUSSION**

The PDCA method was formerly conceived as being a cycle for statistical process control, which could be continually repeated in any process or problem solving. It became popular when started to be used in production processes to control quality. Nowadays, it can also be used to control management practices in different stages of a company, enabling an enterprise to reach the goals established, maximizing effectiveness.

The Steel Furniture and Storage and Logistic Systems sector, located in the Region of Campos Gerais, Paraná, was identified as a center of industrial and regional development, considered the most important territorial agglomeration for a region. However, according to the literature, a strong characteristic of a territorial agglomeration is the cooperation among the enterprises. Thus, the agglomeration will be considered a Local Production System if the enterprises develop actions conjointly. If the cooperation and conjoint actions are not present the agglomeration is pure, and should be viewed and treated as a system.

In order to identify whether or not there was a collective interest in performing conjoint actions in the territorial agglomeration studied, a field research was carried out. It was confirmed that there is collective interest in performing conjoint actions, with a total frequency of 70% of agreement. Once this peculiar characteristic to a LPS was identified in the sector, it can be surmised that the agglomeration presents great potential for structuring an LPS. Therefore, the next step is to systemize the conjoint actions. The PDCA method is here proposed as a guide to organize and systemize the actions to be taken by the sector of Steel Furniture and Storage and Logistics Systems.



However, putting a group of enterprises to work in a cooperative way is not an easy task. Therefore, the actions must be very carefully planned and constantly reviewed to achieve good results for the group as a whole. The first step to take is to establish the leadership or governance for the group. Then, following the PDCA principles, the leadership or governance should discuss points like: the most important goals to be reached by the group, the major difficulties faced by the enterprises in the LPS, actions to be developed in cooperation and/or individually, the first jointly action to be developed. The specific goals to be dealt and planned by the agglomerations are concerning the following topics, once they were pointed out as the most interesting ones to be developed jointly: exports office, personnel hiring and training, inputs purchasing, new technologies development. For these topics, the leadership should analyze the processes step by step, and elaborate a detailed plan of action.

In this next step, which consists in the second stage of the PDCA method, the goals have already been established. The planned actions should be put in action, according to the philosophy of the group. Then, following the sequence, the effectiveness of the actions must be measured to check whether or not the goals are being reached; which actions should be standardized and continued, and which should be changed. For instance: continue the joint actions concerning personnel hiring and training, inputs purchasing, new technologies development. Are the actions occurring as planned and previewed by the group? Should more joint actions be added to these? Should any of these be performed individually? Why is not working jointly?

In the next and last step of the PDCA wheel, the leadership will make the necessary corrections. Problems and deviations in plans were detected in the last step, as well as the good actions. In case problems, it is necessary to make corrections, either by implementing slightly changes or abandoning them completely, depending on the situation. The actions that brought good results must be adopted as part of the LPS routine. This selection must be done through correct measurement and assessment of the results. Good results can be confirmed by analyzing: increase in productivity, increasing returns, product quality improvement, and labor force improvement, among other indicators.

It is necessary to reinforce that not all the actions will be successful in a first attempt, and some may never be. But it is necessary not to give up easily. The research confirmed that the agglomeration studied in this paper statistically presents great potential for structuring an LPS. Therefore, along with this common will, and with the help of the PDCA method, good improvements can be achieved by the group. This may increase their force as a group and as



single enterprises as well, once conjoint actions enable small companies to reach economies of scale, innovation and other many advantages that a LPS bring.

This work is part of a study that is being carried out along the Steel Furniture and Storage and Logistic Systems sector in the Region of Campos Gerais. Another field research, concerning other aspects of the enterprises and the agglomeration as a whole is being prepared, which will provide important details for the LPS structuring.

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