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LEAN AND AGILE MANUFACTURING CONCEPTS IN THE
TELECOMMUNICATIONS INDUSTRY

ABSTRACT

This paper analyses Lean and Agile Manufacturing concepts in the Brazilian Telecommunications Industry. The specific industry segment analysed is the corporate communication data services. Case studies with three Brazilian Telecommunication service providers enrich this study.

Keywords: Supply Chain, Lean, Agile, Services and Telecommunications.
LEAN AND AGILE MANUFACTURING CONCEPTS IN THE
TELECOMMUNICATIONS INDUSTRY

1 – INTRODUCTION

During the past hundred years manufacturing carried out a series of technical and organizational development, which strongly increased its efficiency. Insofar as lean and agile manufacturing is the more contemporary organizational structure in terms of manufacturing management, as well as the implementation of such structure is improving enterprise’s competitiveness, this paper focuses on its applicability to services supply chain. Therefore, this work is aimed at analyzing the applicability of the lean and agile manufacturing concepts to the supply of services, attention is paid specifically to the Brazilian telecommunications market. Emphasis is given to corporate data communication services focusing on enterprises that supply such services in Brazil. In order to assess the applicability of those concepts, the following questions are to be answered here:

- Is the concept of lean manufacturing suitable to the services industry?
- In the case that the concept of lean manufacturing should be applicable, how could it formally and structurally be used to the services industry?
- Is the concept of agile manufacturing suitable to the services industry?
- In the case that the concept of agile manufacturing should be applicable, how could it formally and structurally be used to the services industry?

Three case studies are to be examined in this paper. Analysis focuses on the point of view of customers of such services through examining case studies associated to the Functional Analysis Systems Technique (FAST).
In almost all countries the services industry has significantly improved its economic influence, but it has not had so far, even partially, the opportunity for usufruct the huge development that the manufacturing industry, as well as its processes, witnessed since the early beginning to now. Bearing in mind such facts, providing the services industry with new tools aimed at improving efficiency and effectiveness in order to increase competitiveness is crucial.

2 – INTRODUCTION TO TELECOMMUNICATIONS ENVIRONMENT

Unfortunately the telecommunications industry was not able to usufruct the huge development of operations strategies. There are not many material published regard this subject. British Telecom was an pioneer in the use of lean concepts in telecommunications industry and almost all material published was based directly or indirectly in BT experience. (ROBERTSON and JONES 1999), (LOWE 2003), (WILLETIONS and LOWE 2003), (ADAMS and WILLETIONS 1996) and (HOOPER and JONES 1998) analysed telecommunications industry with different points of view and provide us good basements to analyse the applicability of Lean and Agile Thinking in telecommunication services. First of all the reader will find benefits reviewing basics of telecommunications industry. Special attention will be paid to corporate data services.

The complete order-to-collect cycle business cycle in corporate services in telecommunications industry includes these stages:

- Business Analysis & Network Design
- Customer negotiation
- Order processing
- Circuit Design
- Service provision
- Network test & Turn-up
• Service Monitoring
• CRM & Billing

There are three basic types of customers for telecommunications services: Retail, Wholesale and corporate. This study focuses on Corporate Services. The main products are: fixed telephony, mobile telephony, IP Access, Links, network services such as Frame Relay and IP VPN networks, Contents access, networking Consulting and network outsourcing. There are many other services but the main products are listed above. One example of the backbone of one services provider as well as network of two corporate customers are shown in Figure 1. Basic components in this typical topology, in a very basic way, are:

• Customers’ sites. Some examples are: Sales offices, plants, headquarters. Corporate corporate data services mean services that connect all these sites providing communication to customer fulfill its business targets.
• POP – Point of Presence, means sites where the service provider has infrastructure that allow it to receive all data from customers and route this information to other POPs on order to reach the final destination.
• Backbone means all basic network infrastructure that allow the connection among POPs.
• Link – Basic communication service that connects two points.
• Last Mile – The link used to connect the customer site to the backbone of the service provider.
• Backbone link – This kind of link connects two POPs.
• CPE – Basic equipment installed at customer site to support the telecommunications solution.

For example: routers, modems, etc…
In figure 1 there are two customers. ABC Inc. and XTC S/A, both with sites in different regions of USA. ABC Inc sites are shown in green boxes and XTC S/A in yellow ones. The blue lines represents the main backbone links, the red lines represents the redundancy backbone links. Green lines represent the last miles.

Figure 1 – Carrier’s Backbone and networks of two corporations: ABC Inc and XTC S/A.

Source: Author.

The communication service is usually specified by the following characteristics: transmission capacity (measured by bits per second), availability (percentage of the time the service is
operational), MTTR (Medium Time to Repair), and some specific technical specifications such as latency, BER, etc…

Other relevant environment conditions in this market are: legislation, technology, capital and competition. One example of the elements of one service provider is shown in figure 2. The main elements are:

1 – Facilities owned by the provider, called carrier’s facilities, such as: links, sites, POPs, etc...

2 – Third parties facilities used to build the backbone

3 – Backbone hardware and software.

4 – Backbone installation and configuration services

5 – Backbone maintenance services

6 – Backbone services such as: transport backbone and IP peering.

7 – Third parties facilities such as last miles.

8 – Customer Premisse Equipments, CPE, such as routers.

9 – CPE installation and configuration services.

10 – CPE maintenance services

11 – Backbone Third Party Facilities such as: high capacity links connecting POPs, civil infrastructure (ducts, dark fibers, …)

12 – Backbone transmission and network hardware and software such as modems, radios, switches, etc..

13– Facilities installation and configuration services

14 – Facilities maintenance services
Figure 2 – Supply Chain for one telecommunications services provider

Fonte: Author
3 – THEORETICAL REVISION OF THE BASIS FOR A LEAN AND AGILE PRODUCTION AND SERVICES

3.1 – LEAN MANUFACTURING

Lean manufacturing or lean thinking are characterized by four key principles: specify value precisely, identify the value stream for each product, make the value flow and let the customer pull the value. All these four principles pursue the perfection (WOMACK et al 1990). These principles are connected with these strategies and techniques: doing more with less, zero inventory, elimination of the waste, JIT, quality, co-operation with suppliers, empowerment of the workforce and team working. Lean manufacturing or lean thinking is the most powerful paradigm when cost is the winning criterion.

3.2 – AGILE MANUFACTURING

To be agile one company must be able to be capable of operating profitably in a competitive environment of continually, and unpredictably changing customer opportunities (GOLDMAN et al 1995). This agile thinking was consolidated in some agile concepts:

- Products are solutions to customer’s individual problems. The idea is sell solutions instead products.
- Co-operation to enhance competitiveness. It can be reached through virtual organizations.
- Mastering change and uncertainty. Entrepreneurial approaches are adopted to reach this goal.
- Leveraging people and information. The company must be knowledge based.

Agile manufacturing is a business strategy aimed at providing a enterprise with the capabilities for success in the current changing environment that demands flexible solutions (Gunasekaran 2001). When service and customer value enhancement are prime requirements for market
winning then agility become the critical dimension (CHRISTOPHER and TOWILL 2000).

Figure 3 shows the differences in focus between the agile and lean paradigm versus market qualifiers and winners, based upon work of Mason-Jones (Mason-Jones et al 1999).

Figure 3 – Market winners – market qualifiers matrix for agile versus lean supply.

<table>
<thead>
<tr>
<th>Agile Supply</th>
<th>Market Qualifiers</th>
<th>Market Winners</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Quality</td>
<td>Service Level</td>
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<tr>
<td></td>
<td>Cost</td>
<td></td>
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<tr>
<td></td>
<td>Lead Time</td>
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</table>

<table>
<thead>
<tr>
<th>Lean Supply</th>
<th>Market Qualifiers</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Quality</td>
<td>Cost</td>
</tr>
<tr>
<td></td>
<td>Lead Time</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Service Level</td>
<td></td>
</tr>
</tbody>
</table>


3.5 – SERVICES

The conventional approach to services’ production, as FITZSIMMONS (1987) puts it, involves three basic characteristics that make it different from other goods production:

a) simultaneousness of service’s production and consumption, which means eliminating inventory, a “just in time” approach;

b) customer has to ask for the service so that it can be produced and/or delivered;

c) services are not corporeal.

CORRÊA e CAON (2002) examine the characteristics and elements of services through a broader perspective and their findings are more closely attached to the “value package” acquired by customers. However, when the characteristics of the conventional approach of FITZSIMMONS is more deeply examined with the support of the work of CORRÊA e CAON, the value package acquired by customers is quite often composed by goods and services. The complexity of services ordered by customers varies extremely, thus an enormous flexibility of the attendant is often required. Figure 4 is helpful for understanding services according to the
The interrelation of capital and labour regarding the customer. The categories in this classification are: service factory, professional services, mass Services and Service Shop.

The above classifications do not constitute a definitive categorization. It is possible to have specific services in a grey area between 2 categories listed above.

Figure 4 – Service Process Matrix

<table>
<thead>
<tr>
<th>Degree of Interaction &amp; Customization</th>
<th>Degree of Labor Intensity</th>
<th>Service Factory:</th>
<th>Service Shop:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Low (Capital &gt; Labor)</td>
<td>Airlines, Trucking, Hotels, Resorts &amp; Recreation, Fixed residential phone services, Residential Internet Access, ADSL Internet Access.</td>
<td>Hospitals, Auto repair, Other repair services, Basic WEB Sites creation</td>
</tr>
</tbody>
</table>

Source: SCHMENNER (1986) adapted by author.

3.6 – THE LEAN AND AGILE MANUFACTURING CONCEPTS APPLIED TO SERVICES

Getting along the relationship between the lean and agile manufacturing concepts applied to services some works should be highlighted here, as for instance, the Uday Apte and Chon-Huat Goh, which focus on the application of the lean manufacturing concept to the insurance services market. (APTE e GOH 2003). Ray Hooper and Carole Jones, which examines the application of the lean manufacturing concept in telecommunications; the Michael Robertson and Carole Jones
putting forward the concepts of lean and agile manufacturing in telecommunications; and, finally, Elizabeth Adams and Keith Willets, also discussing the concept of lean manufacturing applied to telecommunications.

Ray Hooper and Carole Jones (HOOPER & JONES, 1998) put forward the application of the lean manufacturing concept to telecommunication enterprises highlighting its adoption as a crucial element for the survival of such enterprises. In spite of focusing on the lean thinking concept, the authors consider that the lean enterprise together with principles of product as a solution for customers’ specific needs; virtual organizations; and entrepreneurial approaches to deal with changes and uncertainty in addition to an organization based on knowledge with authority, and supported by tools of information systems, are the basis of the so called “agile manufacturing”. Elisabeth Adams and Keith Willets, in their work (ADAMS & WILLET, 1996) discuss the significance of excellence in services provision, which, as put by them, can only be reached through three principles: providing excellent value (keeping prices competitive), providing excellent quality (meeting or exceeding customers expectations) and continually offering new ways in which services can make life better for the customer. These challenges can be boiled down to three basic objectives that must be continually met: reduce cost, improve quality of the service and reduce time-to-market of new services. As a result the lean thinking is a basis to be worked (WILLETS & LOWE 2003). Carole Jones and Michael Robertson, also based upon the results of British Telecom marched forward such considerations and put the agile and the lean manufacturing concepts applied to telecommunication services (ROBERTSON & JONES, 1999). In that work, the authors pointed out that generally speaking the physic network of enterprises should adapt and follow the lean manufacturing concept. The logic network instead, which can be configured by software, should adapt and follow the agile manufacturing concept. In that work the authors strongly emphasize specific sectors of the telecommunication
services, such as services factories and mass services, mainly on voice services, which in spite of representing the major parcel of the income associated to telecommunications services do not represent its totality.

The principles and strategies of the lean thinking should then be linked to the activities that are inherent to the value making cycle in telecommunications services, more specifically to the communication services of corporative data. Regarding to value as well to value flow specification, activities that don’t aggregate value should either be thrown aside or optimized. Avoiding unnecessary contact or interruptions to activate and/or testing a value service add to the customer is an example of what should be done. Considering the task of activating a Frame Relay port for example, the same technician should activate the link, and the Frame Relay port, as well as test it and collect the necessary information to update the technical inventory of information. Another example is not using technology and/or products that the customer couldn’t perceive as value. Another significant aspect is the JIT that in services allows us adding to the physical element the necessity of obtaining the right information in the right time, and in the right place. The information flow is as significant as the flow of goods.

Regarding quality the search for perfection in the process, and not only through filtering the failures is fundamental. The significance of quality can be demonstrated through the direct interaction with the customer in the main activities insofar as any fail in their will result on a negative impression of the service. As many enterprises usually operate through sharing a series of activities such as implementation, maintenance, and operation with a network of services’ providers, there is a strong need for cooperation to the providers insofar they are closely in touch with costumers, and thus need to carry out properly such activities as well as to aggregate value to the service through feedbacks and upgrading suggestion. Therefore, as manufacturing
enterprises can improve efficiency, and competitiveness through implementing the concept of lean enterprise. The same can happen to the telecommunications services enterprises.

On the other hand the agile thinking is based on providing customers with solutions not only products, cooperation is the key word for increasing competitiveness. Enterprises should face change and uncertainty through adopting the virtual organizations concept along with reinforcing the employment of people and information.

Providing solutions instead of products is a need of the corporative data insofar as the share of information among all the units of an enterprise is an essential tool for meeting its goals. Understanding such need in order to find the proper solution to technical and commercial aspects of the provision of services is a basic requirement of this market. What increases the complexity of this approach is that each project has a demand for a specific analysis of the technical and commercial aspects involved on it, which in several cases should lead to a need for changes in the provider’s structure so that it can supply the customer. One usual example of this is when a customer demands for the adoption of a specific technology that is not dominated by the service provider. A cooperation partnership with another enterprise that dominates the required technology should then be established to meet such demand. Another example of the significance of cooperation between enterprises is when there’s a need for providing an international client with solutions that the services provider does not usually carries out in order to capture an opportunity for business even if out of the providers expertise. The concept of virtual organizations is useful for attending the need for restructuring in order to articulate the supply of the customers’ needs. As seen when discussing de benefits of cooperation and partnership between different providers in the lean manufacturing as well as in telecommunications, the same can be said here, but bearing in mind that in this case partnership and cooperation should only be established to meet businesses opportunities not as definitive partnerships. Finally, the human
aspects of information are strongly significant in a dynamic and highly dependent of information and knowledge environment. One example of this is that in services supply there is always some contact with the customer, which is usually made through human contact, personally or by phone. Another example is the management of a complex telecommunications network that demands for a sophisticated and also complex system of information as well as the work of capacitated personnel to operate such a system.

Regarding services, the supply chain of a corporative data communication service involves a series of activities, which in turn demands for different degrees of labor participation, capital and adaptation to the customer needs. In the eight stages of the business supply cycle of the referred service, those of business analysis, network designs, and interaction to the client aimed at delivering the service, are the closest to what is known as professional service. The project of the service network should be better categorized as Service Shop. Considering the activities related to registering the application for the service in the enterprise; provisioning the network; testing and activating the network; and monitoring the network, are the closest to what is known as Service Factory. Finally, relationship can be categorized as professional service and billing as Mass Services.

The claim’s winner parameter will guide the supply chain structure insofar as the qualifying parameters have been met. Therefore, in the case that the claims winner criterion is the level of the service the chain should follow the agile thinking. On the other hand, in the case that the claims winner criterion is cost the supply chain should follow the lean thinking as shown in figure 3 (CHRISTOPHER and TOWILL 2000 and HARRISON and HOEK 2002).

Nowadays competition takes place between supply chains not between enterprises. (CHRISTOPHER 1998). Thus, as in manufacturing enterprises is hard - or quite impossible for better saying – that the enterprise of communication corporative data services should have all the
resources and core competencies to the full supply of the referred services. The enterprise then tends to focus in maintaining only the core competencies (PRAHALAD and HAMMEL 1990). The complementary competencies should and ought to be searched in other enterprises that may supply them. Thus, structuring a competitive supply chain is fundamental to the survival of any enterprise.

4 - METHODOLOGY

For the purpose of this work option was made for examining multiple Case Studies due to the better consistency of results that can be achieved (YIN 1994). In order to collect data in a way that a structured analysis could address the aims of this work the Functional Analysis Systems Technique (FAST) was adopted. The FAST methodology enlarges the vision of the related functions and together with the questions “how” and “why” question how the goal of satisfying the client can be reached. (CSILLAG 1995).

5 – CASE STUDIES

5.1 – INTRODUCTION TO CASE STUDIES

The purpose is collecting information of the enterprise in order to identify the applicability of the agile and lean manufacturing concepts to the services enterprises. The case studies focused on primary data collected through interviewing in the three enterprises that were chosen, as well as secondary data collected on institutional printed matters or on electronic media as well as through enterprises’ WEB sites or institutions such as the Brazilian SEC, so called CVM. As for identifying data to be collected in the studied enterprises that could serve to an analysis closely attached to the goals of this work the Functional Analysis Systems Technique, FAST was
adopted. This methodology, which is the basis of the Value Analysis and the Value Engineering (CSILLAG, 1995) allowed broadening the vision of the involved functions. This analysis through the FAST methodology reinforced the developed model that is the basis for understanding the fundamental components for the provision of communication services of corporative data. In sum, data that are significant to the customer’s satisfaction was searched.

On the basis of such principles the three enterprises which were studied here are: VICOM, INTELIG, and COMSAT. The case studies were based on a structure involving: enterprise qualifying, infrastructure, products, structure, operation and input. Due to the large quantity of data collected for the scope of this work will be not considered here: the interviewing script, the complete mapping provided by the FAST methodology, and the detailed findings of each case study. In the case that the reader wants to know more about such materials should contact the authors. This text presents only a small resume of each case together with the enterprise identification and a table of its supply chain data is presented.

5.2 – CASE 1 – VICOM LTDA.

VICOM is a unit of the NET Serviços de Comunicação S/A, that have been acting for 18 years in the Brazilian telecommunications market, and has an annual income of US$ 35 million. Figure 5 shows a general view of the inputs searched by the enterprise.

5.3 – CASE 2 – INTELIG TELECOMUNICAÇÕES LTDA.

INTELIG have been acting for 5 years in the Brazilian telecommunications market. It has total year revenue of US$ 350 Million in 2003 and income of US$ 50 million regard corporate data services. Figure 6 shows a general view of the inputs searched by the enterprise.
Figure 5 – Main inputs of VICOM’s supply chain.

<table>
<thead>
<tr>
<th>Input</th>
<th>Outsourced? (Y/N)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation Services</td>
<td>N</td>
<td>Exception to civil infrastructure</td>
</tr>
<tr>
<td>Operation Services</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Design Services</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Maintenance Services</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Facilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infra and Backbone</td>
<td>S</td>
<td>Space segment in commercial satellites</td>
</tr>
<tr>
<td>Facilities - Last Mile</td>
<td>S</td>
<td>Biggest part of last miles is provided using own infrastructure: fiber optics cables, satellite and radio links. Other part is provided by other carriers.</td>
</tr>
<tr>
<td>Hardware - Transmission</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Hardware - Backbone</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Hardware – CPE</td>
<td>S</td>
<td>CISCO and HUWAEI</td>
</tr>
</tbody>
</table>

Source: Author

Figure 6 – Main inputs of INTELIG’s supply chain.

<table>
<thead>
<tr>
<th>Input</th>
<th>Outsourced? (Y/N)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation Services</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Operation Services</td>
<td>S</td>
<td>Level I – Call Center – Outsourced Level II – Internal people</td>
</tr>
<tr>
<td>Design Services</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Maintenance Services</td>
<td>S</td>
<td>Basic services – Outsourced Advanced Services – Internal People</td>
</tr>
<tr>
<td>Facilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infra and Backbone</td>
<td>S</td>
<td>Space segment in commercial satellites is representative.</td>
</tr>
<tr>
<td>Facilities - Last Mile</td>
<td>S</td>
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</tr>
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<td></td>
</tr>
<tr>
<td>Hardware - Backbone</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Hardware – CPE</td>
<td>S</td>
<td>HUWAEI, CISCO and CYCLADES</td>
</tr>
</tbody>
</table>

Source: Author

5.4 – CASE 3 – COMSAT BRASIL LTDA.

COMSAT have been acting for 10 years in the Brazilian telecommunications market, and has an annual income of US$ 35 million. Figure 7 shows a general view of the inputs searched by the enterprise.
Figure 7 – Main inputs of COMSAT’s supply chain.

<table>
<thead>
<tr>
<th>Input</th>
<th>Outsourced? (Y/N)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation Services</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Operation Services</td>
<td>N</td>
<td></td>
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<tr>
<td>Design Services</td>
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<td></td>
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<tr>
<td>Maintenance Services</td>
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<tr>
<td>Hardware - Backbone</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Hardware – CPE</td>
<td>S</td>
<td>HUWAEI, CISCO e CYCLADES</td>
</tr>
</tbody>
</table>

Source: Author

5.5 – CROSS ANALYSIS OF CASE STUDIES DATA.

Cost as pointed by all the interviewed is the decisive factor to the customer once the specified technical requirements have been attended. As usually clients have specific demands, there’s a need for individually examining such requirements. Thus, attending the customer’s requirements is the qualifier criterion. However, such requirements usually demand specialized technical analysis that, in some cases involves creating a new product and/or establishing cooperation agreements to other companies for complementing capacity and providing the client the right solution. Such agility and flexibility on understanding the customer’s demand, as well as in the previous approach through firstly designing a commercial propose, and next through the implementation of the sold solution, was highlighted by the three companies as a fundamental factor.
As the companies design each client a personalized project their operation sector works by demand in the implementation and sale stages. This conduct is also adopted by the supply chain to the suppliers. The relationships with suppliers are focused on establishing a commercial relationship of by and sell with suppliers. Any structured partnership is established reflecting only the downstream chain with the client. In other words, once the technical criteria are satisfied decision making will be guided by price.

Designing the client a solution is in many times a matter of simply aggregating already made and standardized modules. Many components of a corporative communication data solution are modulated, as for instance, routers, backbone ports, configuration activities, implementation, and many times the last mile links. Many of the routers used in the client’ sites follow the international operation pattern thus there are some option such as CISCO, CYCLADES and HUWAEI. In terms of services suppliers for activating and implementing, some pattern procedures can also be found, as well as company-made scripts and certification processes for workers of those activities in the adopted technologies, as a form of uniformization of the labour force, as well as of the activities developed by them. One should note here that the need (or not) for a module to be like the pattern (or not), as well as if a project should (or shouldn’t) be special will demand a specialized technical analysis. The project and the implementation of customer’s chains are generally complexities activities. Whereas involving many personal interactions between client and professional, company and/or suppliers, the activity is performed in several localities by different persons and in also different conditions. As a result, companies usually allocate project managers to coordinate the different phases which come from firming the contract to the first invoice. Implementing activities could be more simple if the modules were properly provided and information flew easily.
Findings pointed also that some enterprises see some activities as modules that can be developed by cooperation with another services supplier, and other opt by developing the same activities on their own. Decision making on what to be delegated to other supplier through cooperation agreements and what to be maintained as an activity to be developed by the enterprise itself, was basically guided by economic reasons - such as reducing cost, number of employees, and business opportunity - than due to the results of an analysis of strategic core competence.

All enterprises agree about the significance of analyzing customers’ demand, designing projects, confirming technologies and their suppliers. The development of such activities is not linked to any specific department whereas there are many sectors involved on it. However, the engineering sector has always a relevant participation in the process.

The eight stages of the order-to-collect process have been executed by all the interviewed companies, however not articulated to an information system that include the workflow, and where the information are accessible to all components of the chain in a whole. They all have shown their work of processes’ integration and systems in different implementation phases and adopting different technologies. This demonstrates that the companies have in some different degree a common sense about the urgency of integrating information and processes that goes beyond departmental barriers to assure a bigger fluidness to processes. In that sense the fluidness of information is fundamental to the process.

After being implemented activities tend to be more standardized and predictable than before its implementation.
6 – FINDINGS AND CONCLUSIONS

6.1 – ARE THE CONCEPTS OF LEAN AND AGILE MANUFACTURING APPLICABLE TO THE SERVICES INDUSTRY?

The examined enterprises already adopt some concepts related to the lean thinking, but not in a formal or structured way. Among the detected cases enterprises demonstrated that they are more concerned to the value flow, and in the three referred companies a strong concern to the information flow could be identified. Another strong concern that could be detected was that about the services quality insofar as customers’ patterns of exigency are usually very high and constitute a qualifier criterion.

In conclusion, is possible to say that the examined enterprises have similar concerns to those of a manufactured that compete in a market guided by cost, and that some concepts related to the lean thinking are being already applied by these services suppliers.

6.2 - IN THE CASE THAT THE CONCEPT OF LEAN MANUFACTURING SHOULD BE APPLICABLE, HOW COULD IT FORMALLY AND STRUCTURALLY BE USED TO THE SERVICES INDUSTRY?

As seen before the concepts of lean thinking are already being applied to the corporative data communication services industry, as for instance the following:

**Specify value by specific product.** None companies presented a clear work on value analysis that could be noticed by customers. In many cases what is evident is that companies followed the market solution pattern adapted to each client specific needs.
**Identify the value stream** – This issue was analyzed in detail by only one enterprise. In that way processes are tools for optimizing the value flow, but not to synchronize different activities of different departments. As the information factor is very significant to that kind of industry systems that bring efficiency to value flow are fundamental.

**Quality** – The implementation of quality programs such as quality circles, six sigma among other already in use by the manufacturing enterprises for long are of great support in that kind of services enterprise. Emphasis should be done to the quality measurer according to the clients’ point of view, but not to what is better according to the supplier company point of view.

6.3 – **IS THE CONCEPT OF AGILE MANUFACTURING SUITABLE TO THE SERVICES INDUSTRY?**

According to the studied enterprises the winner criterion once the technical requirements were satisfied is cost. Firstly, regarding costs the lean thinking is more suitable in spite of some considerations that should be posed here. Secondly, enterprise must attend the customers’ needs as a specific solution and not as a product itself. Costs composition should be changed whenever the enterprise changes its supply chain to improve competitiveness. Finally, an enterprise is not able to attend itself the majority of the business opportunities of the communication corporative data. Thus, the concept of agile manufacturing can help enterprises on increasing competitiveness.

As could be noticed in this work the concept of agile manufacturing can help the suppliers on assuring competitiveness as well as on qualifying themselves into a strongly price-guided market.
6.4 - IN THE CASE THAT THE CONCEPT OF AGILE MANUFACTURING SHOULD BE APPLICABLE, HOW COULD IT FORMALLY AND STRUCTURALLY BE USED TO THE SERVICES INDUSTRY?

Among various examples that can be referred to here, the virtual organization will be highlighted for the purpose of this work.

**Virtual Organization** – Is of extreme relevance that telecommunication enterprises pay attention to the way of offering solution to clients that really addresses their needs, as well as that can be better than other offered by the competitor. What can be noticed here is that, in spite of all companies seems to know what is significant only one out of the three already has a process to deal with this issue. That is to say, the composition of special structures to attend customers is not an exception but part of the operation. There is here a really interesting suggestion regarding the model of Architect, Lead Operator and Caretaker (SNOW et al 1992). This model is interesting because focuses not only on the fast designing of a structure but also on its implementation and maintenance.

In the case of the examined enterprises an interesting possibility that should be highlighted here is the use of the de-coupling point approach (CHRISTOPHER and TOWILL 2001) in which in one part an enterprise is partially lean and in another is agile. In the stage of business opportunities’ analysis, and of elaboration and implementation of a solution the enterprise structure itself easily. In the operation the enterprise structures itself in a lean way.
6.6 – CONCLUSION

In spite of the application of the lean thinking and the agile manufacturing being not similar in a manufacturing enterprise and in a services enterprise, the main goals are, as well as the various tools and techniques should be applied. Is possible to speculate in many ways about reasons for not formally and structurally using analised principles such as for instance: lack of knowledge, rejection due the association to companies of goods, market dynamism, financial capacity for allocating resources, short-sighted vision of the companies managers, and many other. What happens, however is that in spite of any reason there is a huge range of knowledge already accumulated in the field of the lean thinking and the agile manufacturing that can help the enterprises of telecommunications services.

REFERENCES:


