

# APPLYING VALUE STREAM MAPPING TO A HEALTHCARE STUDY CASE. A SYSTEM APPROACH

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### Abstract

The application of value stream mapping (VSM) to improve the performance in service companies, at least in Latin America, still is developing. This includes healthcare service systems. When applying this Lean tool with a System approach for mapping these value streams, we look for a) representing both customer's actions and their interactions with the entire service system, as well as the internal interactions between contact employees (front office) and the back office employees, and b) identifying the component segments of the value stream like loops, and defining these loops like partial units of improvement. For applying this mapping tool, we identify the existing flows among the processes in the value stream in a typical Clinical Laboratory, based upon the identification of interactions (interrelations) above. Complementarily, the Lean Thinking principles and tools are applied in order to improve value flow to customers and the system's productivity. As results, the critical operational indicators were improved in values above 20%.

**KEY WORD:** System Thinking, Lean Thinking, Healthcare Service, Process Loop.

### Introduction

Lean thinking is a time-based philosophy that focuses on creating value for the customer by elimination of various forms of waste, including overproduction, waiting, unnecessary transport, over processing, excess inventory, unnecessary movement, defects and unused employee creativity, is thus at the heart of the concept [1]. In this way, Lean Thinking aims to reduce the time continually from the arrival of the order of a client until the delivery, with the smallest cost and the highest quality, Dan Jones Chairman of the Lean Enterprise Academy [2] defines Lean Healthcare as a way of streamlining the patient journey and making it safer, by helping staff to eliminate all kinds of waste and to treat more patients with existing resources. Five Lean thinking principles [3], adapted to health care case are [4]:

1. Specify value from the point of view of the patient (and the enterprise)
2. Identify the value stream flow, including both the activities that add value and those that don't add value to the patient
3. Make possible that the patient to flow smoothly and quickly through every process
4. Match capacity with demand so work is done in line with the pull of the patient

## 5. Pursue perfection through continuous improvement of the value stream flow

A value stream consists of everything including the non-value added activities and provides a pictorial view of what elements of the process the customer is willing to pay for [5]. Value Stream Mapping is a graph Lean tool that integrates the logistical flows of materials and information [6] [7] by using normalized icons in a same chart, showing the "Big Picture Mapping" of the valued stream. This tool began to be used in Toyota under the epigraph "flow of materials and information mapping" and was finally developed by Rother and Shook [8]. Rother and Shook define "value stream" to be "all the actions (both value added and non-value added) currently required to bring a product through the main flows essential to every product: (1) the production flow from raw material into the arms of the customer, and (2) the design flow from concept to launch". Jones and Womack define the VSM as the process of visually mapping the flow of information and material as they are and preparing a future state map with better methods and performance [9].

Concretely, Value Stream Mapping is used starting from the second Lean principle, that is to say, it is the value stream mapping tool. In this research the circular nature of the chains of value is stood out, beginning when the customers manifest a requirement, and finishing when these customers manifest satisfaction to have received the value required in their requirements. To apply the VSM with a circular approach, circular thinking principles [10] and tools have been applied in order to characterize the value streams. In the same way, extending the research developed by Rubiano and Micán [11] the amplified VSM structure proposed for this application in detailed is also from the combination among Lean Thinking [3], System Thinking [10] and service blueprint [12].

## 1. Identification of the attention loop in the value stream studied<sup>1</sup>

The organization under study is a non-profit entity that provides healthcare services in Colombia. It is legally approved by the Colombian National Health Superintendence and its quality management, environmental and occupational health systems are certified by ICONTEC<sup>2</sup>. It has recently achieved accreditation in health and has been recognized for its high technology both soft and hard [11]. In this paper the attention loop from the value stream in a Colombian clinical laboratory was selected to study, which starts with the arrival of a user. This user is attended to and guided by a customer service clerk who also assigns a service number according to the number of users that have previously arrived.

In this serviced system, when there was an increase in demand for the service the waiting time increased, especially during peak hours. Due to this, there was an increase in the total service time which at the end resulted in a drop in the level of satisfaction and more customer complaints, leading to a negative effect on the demand itself.

## 2. Application Road Map

Next the improvement road map used to apply Value stream Mapping in the Clinical Laboratory selected as pilot in this investigation is presented (Figure 1).

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<sup>1</sup> The formulation of this case, was taken from Rubiano and Mican (2009)

<sup>2</sup> ICONTEC is an acronym of Instituto Colombiano de Normas Técnicas

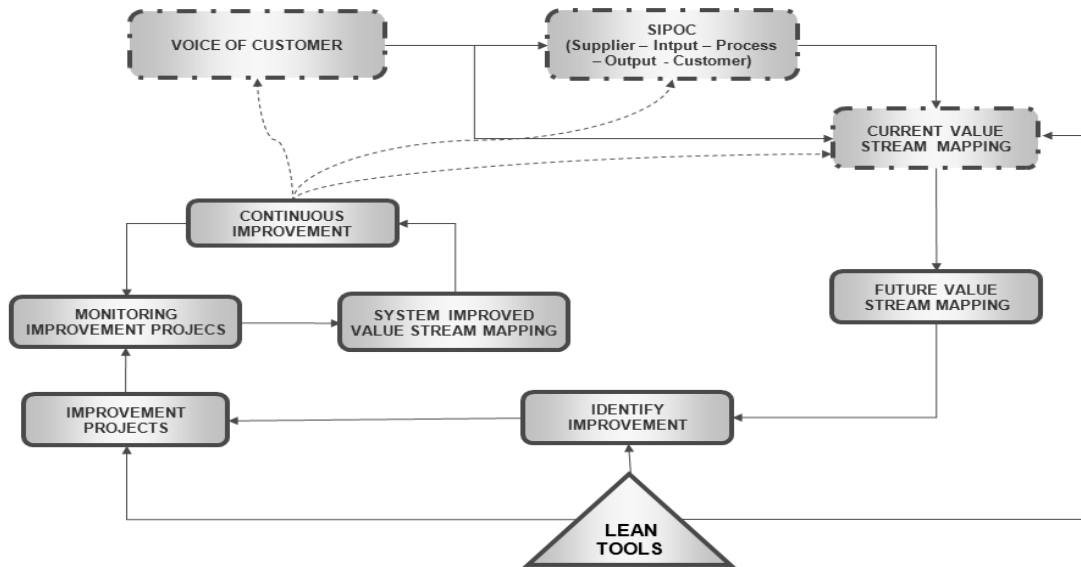


Figure 1. Road Map

## 2.1 Voice Of Customer

The tool voice of customer (VOC) was used to describe the customer requirements and perceptions about the service [13]. Figure 2 shows the VOC from the ambulatory attention value stream.

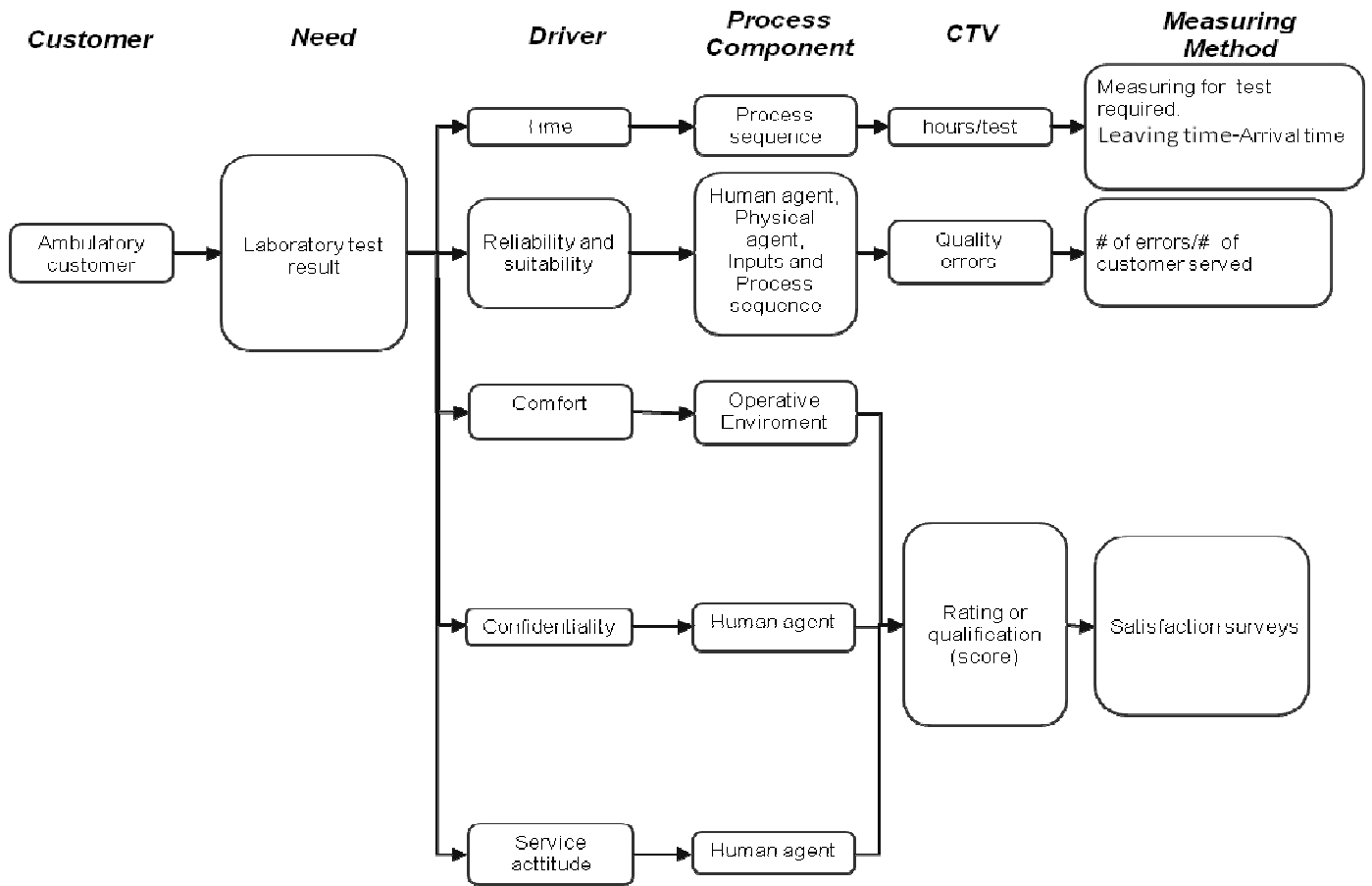
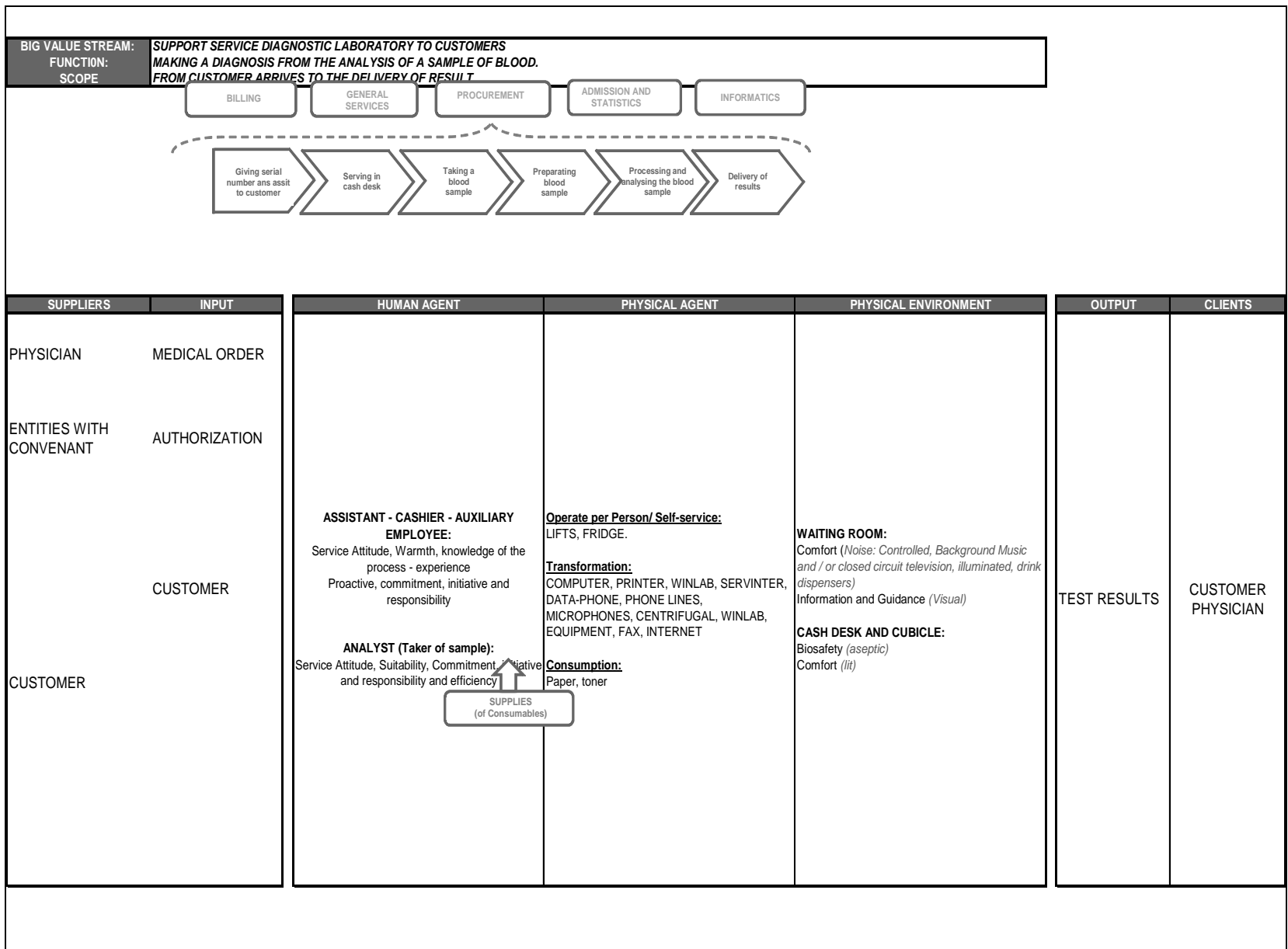


Figure 2. VOC from the ambulatory attention value stream

## **2.2 SIPOC**

To begin a Lean project, to define its scope, and identify all its relevant elements, before the VSM is built it is necessary to develop a high level characterization of value stream studied [13]. Figure 3 illustrates the SIPOC that characterizes the value stream to serve ambulatory patients in the service unit selected.



3. SIPOC from the ambulatory attention value stream

Figure

### 2.3 Mapping framework proposed for this application

In this research the generic structure proposed by Rubiano and Mican [11] (figure 4) is amplified.

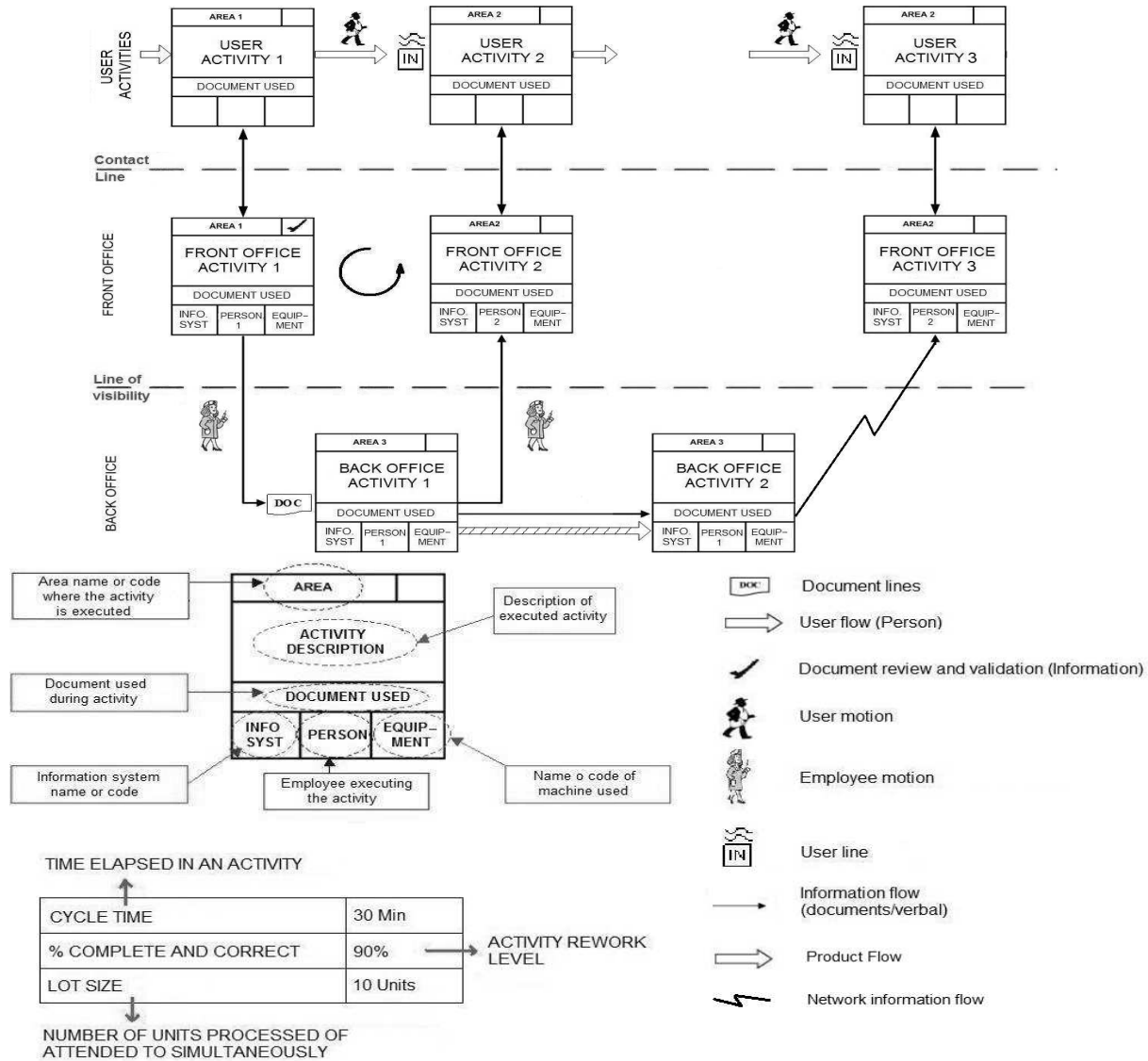


Figure 4. Structure of system mapping for an attention service value stream and Symbols

## **2.4 Current Value Stream Map**

To draw the current value stream map, the information was obtained accompanying and interviewing the customers directly from its arrival to the laboratory. The work team made a tracking to a group of customers and their respective samples of blood. The map allowed knowing the activities exactly executed by the contact employees and the customer, as well as how they interacted to each other.

From the current state analysis they all wastes were identified, characterized and measured, and the total service lead time obtained was 27 minutes, of those which, the 1% only adds value from the customer's point of view. The identified wastes were related to problems about errors, waits, unnecessary movements, customers' accumulation in the sample taking area and times lost due to disorder and dirt.

## **2.5 Future Value Stream Mapping**

From the characterization of the wastes identified, improvement actions focused in the time-based competition were formulated. By using technical for identifying causes of the problems (five whys, brainstorming, system cause-effect diagram, relationship charts and added value analysis), the improvement team outlined a desired future state that it allowed to elevate the levels of the customers' satisfaction. The figure 6 shows the map of the proposed future state.

## **2.6 Improvement actions**

During this stage the concrete improvement actions were determined in order to be implemented, which led the improvement team to eliminate or to minimize the identified wastes. They were carried out two types of actions: some of them immediate and remedial ones that looked for mainly to win flow in the short term, and other ones preventive that required bigger time to be implemented whose purpose was to win flow, avoiding that the waste was recurrent in a relative long term. These preventive actions were flow gain programs in a first improvement cycle: 5S [14], visual management [15], kanban [16], layout [17] and poka yoke [18]. Obviously all these high-priority programs implemented in this first improvement cycle were those really required according to the identified wastes.

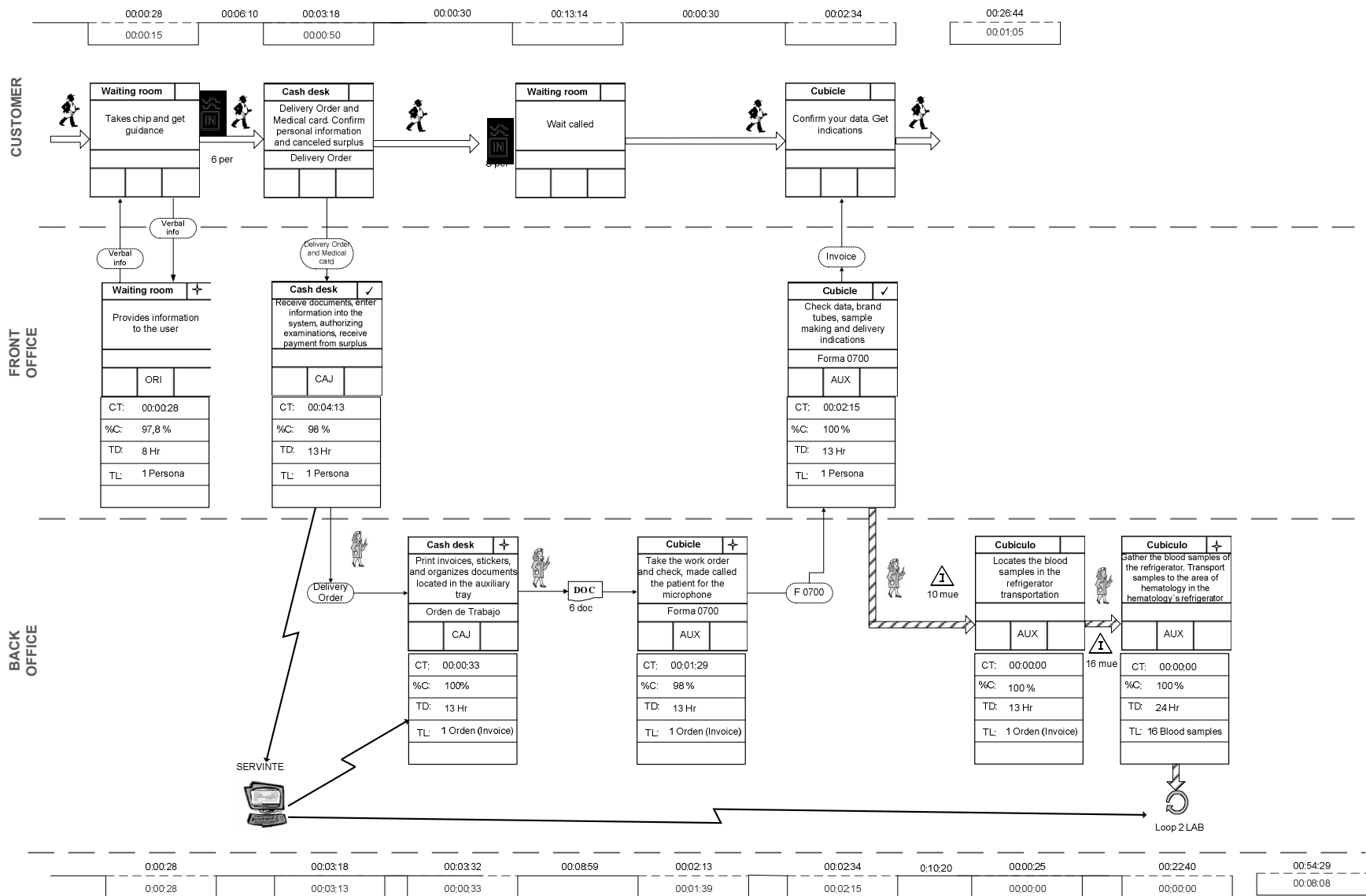


Figure 5. Current Value Stream Mapping from the ambulatory attention value stream

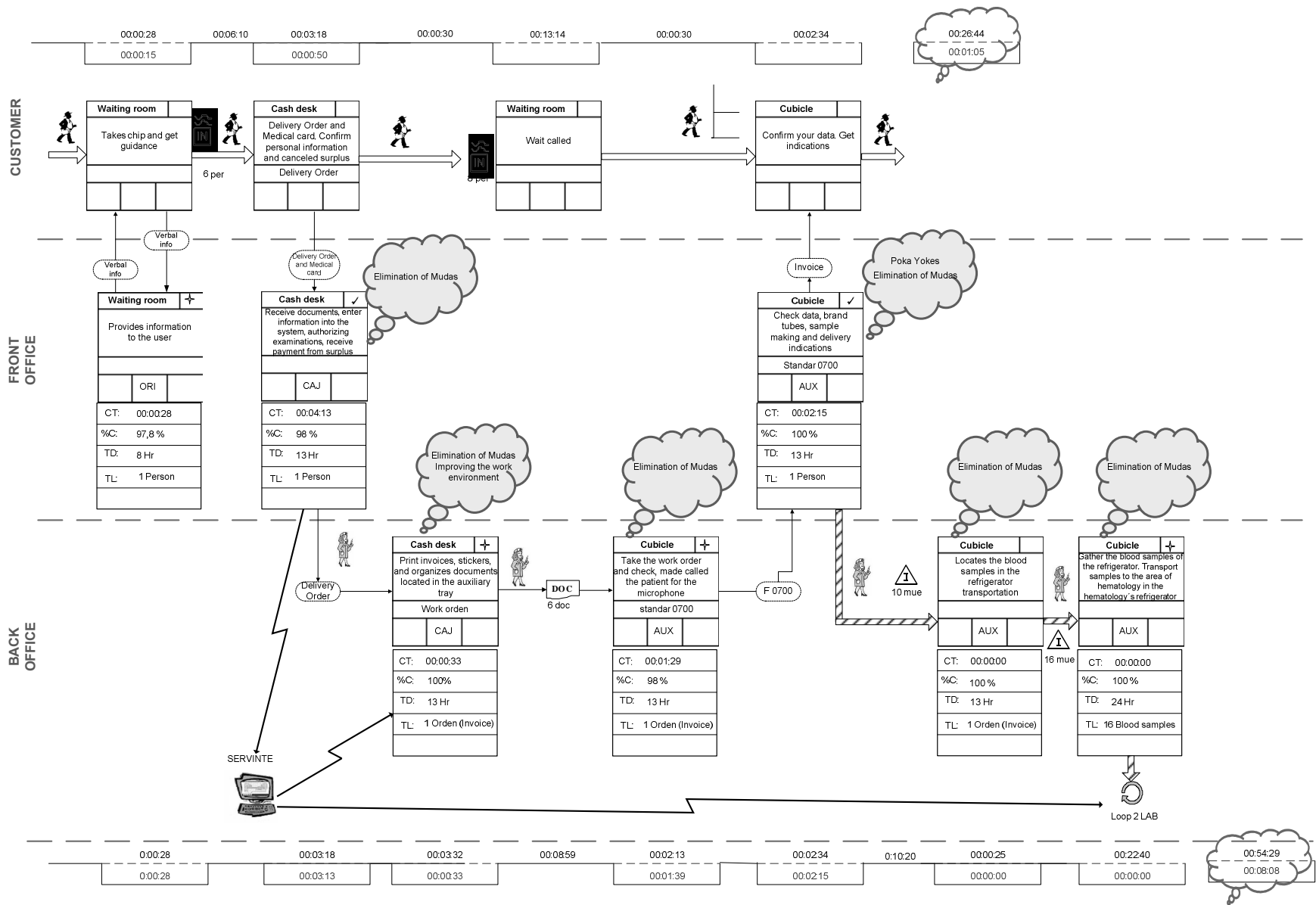


Figure 6. Future Value Stream Mapping from the ambulatory attention value stream

### 3. Results and discussion

In the following sections, generalities about the implementation of the selected flow gain actions/programs are shown, as well as the final results.

The great structural change in this research was represented in redrawing the service productive plant in the value stream of the laboratory. This change helped both personal contact and personal from back office, both to elevate the flow (and effectiveness) of service production processes and to meet their needs.

5's and Visual Management program helped the team to improve the efficiency in areas pilot when establishing a set of standards of classification, relocation, elimination, organization and cleaning that allowed: a) to eliminate totally 60% of elements that were not used and in consequence they made slow the flow of value to the customers, b) to signal the areas c) to show permanently the results of yield of the areas, d) to create in people the discipline: "cleaning to inspect", e) to create a more reliable work environment, f) to contribute from a decisive way to execute the standards of quality and service productive processes (combined with plant layout and poka yokes), and finally, g) to contribute to order, security, self-control and decisions taking process in a more flowing labor environment. The improvement achieved in the cashiers area was 31% in the implementation level; in the cubicles area it was 9%.

Area	Current state score	Future state score
Cashiers	54%	85%
Service cubicles	75%	84%

*Table 1. Results when applying the 5S check list*

After implementing this couple of tools, a more smooth work flow was observed starting from achieving new standards in the work places, as well as implementing customer kanban signals waiting to be served in the sample taking area.

A visual kanban was implemented in the process of taking of samples. It was defined like goal to have in all moment maximum three customers inside the sample taking area, of which two are waiting for the service while the third is being assisted. This way, when the sample taker employee liberates a customer, he/she leaves the cubicle, next one of the two customers in wait enters to the cubicle to be assisted, and in that instant the samples taker employee activates an external light so that the following customer in the line (formed by those that were already assisted by some cashier) enters to "replenish" the space of customers in wait liberated by the customer that entered to be served. It was guaranteed the sample taker employees didn't lose time waiting for the entrance of customers to the sample taking area, because in some cases they are dispersed and they don't assist the call on time. This allowed winning responsive capacity, when knowing the service requirement of each customer exactly once he/she enters to wait in the sample taking area, in order to pre-make the set-up of the necessary inputs and tool. The application of the all flow gain tools related above, allows reducing the service lead time from 27 minutes to 18 minutes, which represents an improvement rate equal to 33%.

Starting from the analysis of the incidents of the Clinical Laboratory, the data gathering in primary sources (those responsible for the processes) of frequent errors, the construction and analysis of a potential errors map and the application of the tool AMEF in the value stream, defects were identified for which it became necessary to implement mechanisms to eliminate or minimize the cause roots. In some processes it was enough changing operations, in other such processes as the registration of customers and the taking of samples, it was observed that the risk of human error persisted, in these cases mistake proofing devices were implemented.

### 4. Conclusions

- Lean Thinking has been developed per years in the companies manufacturers, being obtained good results, but in health care sector in Colombia its development is in learning and growth stage. In this applied research, it was possible System Thinking complements Lean Thinking in order to improve the value flow in the Clinical laboratory of a Health Care Organization.
- This research promotes and validates an appropriate tool for mapping appropriately, exactly and efficiently a) the customer as well as his document and his sample flow and e) the interaction among the customer and all the system, in order to evaluate all the activities in terms of its value added to customers.
- Finally it is validated that the symptoms of problems perceived in a value stream should be analyzed in first instance under a systemic approach in order to see the value stream as a hole of flows and interrelations, and to understand the root of the problems and the consequences of the improvement actions or programs.

## 5. References

- [1] Liker, J. (2004). *The Toyota Way: 14 Management Principles from the World's Greatest*. McGraw-Hill.
- [2] The Lean Enterprise Academy (2010). Disponible en [http:// www.leanuk.org](http://www.leanuk.org), última visita 20 febrero 2010.
- [3] Womack, J. and Jones, D. (2003). *Lean Thinking: banish waste and create wealth in your corporation*. Editorial Gestión.
- [4] Joosten T., Bongers I. and Janssen R. (2009). Application of lean thinking to health care: issues and observations. *International Journal for Quality in Health Care* 2009; Volume 21, Number 5: pp. 341–347. Advance Access Publication: 19 August 2009.
- [5] Tapping, D. and Shuker, T. (2003) *Value Stream Management for the Lean Office*, New York: Productivity Press.
- [6] Taylor, D. and Brunt, D. (2001): *Manufacturing operations and supply chain management. The lean approach*, Thomson Learning. Section 3, pp. 27-43.
- [7] Hines, P. and Rich, N. (1997). The seven value stream mapping tools. *International Journal of Operations and Production Management*, Vol. 17, No. 1, pp.46–64.
- [8] Rother, M. and Shook, J. (2003). *Learning to see: Value stream mapping to create value and eliminate muda*. The lean enterprise institute.
- [9] Jones, D. and Womack, J. (2002) *Seeing the Whole: Mapping the Extended Value Stream*. Brookline, MA: The Lean Enterprise Institute. Brookline, Massachusetts.
- [10] O'Connor J, McDermontt I. *Introducción al pensamiento sistémico*. Editorial Urano, 1998.
- [11] Rubiano, O and Mican, C (2008). Documenting and Improving Service Processes Applying Lean Thinking. A System Approach. 20th International Conference on Production Research (ICPR 20). 2 – 6 August 2009, Shanghai, China.
- [12] Shostack L, *Desing Services that delivery*. Harvard Business review (84115), 1984.
- [13] Pande, P. y Holpp, L. (2002), *¿Qué es Seis Sigma?*, McGraw-Hill. , pp 26-3.
- [14] Bekaert consulting (1998), *Metodología de Implantación Autónoma de las 5S*. Guía del Facilitador, Edita: Fundación Vasca para el Fomento de la Calidad.
- [15] Greif, M. (1993), *La fabrica visual: Métodos visuales para mejorar la productividad*, Productivity Press.
- [16] García, Á. (1998), *Conceptos de organización industrial*, Editorial Marcombo S.A Capitulo 10, pp 194-214.
- [17] Dileet, R. (2001). *Instalaciones de Manufactura, Ubicación, Planeación y Diseño*, segunda edición, Thomson Learning, pp.148-162.
- [18] Grout, J. (2007), *Mistake-proofing the design of health care processes*, Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services, 540 Gaither Road, Rockville, MD 20850, Berry College, Rome.