Lean Office and Material and Information Flow (MIF): a case study applied in a small Brazilian sports consulting company

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ABSTRACT

Administrative processes are firmly focused on information flows. Understanding how and which informational means are used in these processes is vital to supporting improvements in the management of operations in these environments. In this context, the research aimed to apply the combination of the value stream mapping techniques of Shingo Lean Office and Material Information Flow (MIF) to identify the informational means and possible

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opportunities for digital transformation in the administrative environment of a small sports consulting company in Brazil. The combination of these mapping techniques enabled a detailed analysis of the business process, in which we identified that only 0.94% of the activities of the analyzed process add value and that the other activities do not. Through the application of MIF, it was possible to observe that the business process does not have any information linked to systems, which occurs due to the lack of an integrated system that unites the information relevant to the processes. The results obtained suggest the need to implement systems and a digital transformation program that can contribute to facilitating the flow of information in the company analyzed, aiming at better service and relationships with its clients, increasing productivity, and making it more competitive in its market.

KEYWORDS: Material Information Flow (MIF), Shingo Lean Office, Digital Transformation, Small Businesses.

1 Introduction

The number of street runners has been increasing every year, and the COVID-19 pandemic was one of the effects of this increase. According to a study carried out by Asics® in 2022, three out of four people who started running during this period continued to practice the activity. The study also revealed that, for two-thirds of those interviewed, the primary motivation for this increase in the sport is to improve not only their physical health but also their mental health. Between 2022 and 2023, street races in Brazil increased by 20%. The data from this survey was collected by the largest platform for selling race registrations in the country, Tickets Sports, which observed this significant increase. Within this context, the demand for sports consultancy has also been increasing in the country. These processes involve everything from client prospecting to monitoring the execution of activities by athletes (Cavalcante, 2022; Luz, 2014).

This consultancy may be compromised by the increase in the number of clients if there is no orderly workflow and management of activities. In addition, the lack of processes and management results in failures in activities, rework, loss of information, low agility in the execution of activities, and loss of productivity. To do so, we need to understand how racing consultancy works based on the mapping of activities and processes. It is essential to identify the main failures of the processes, plan improvements, and create processes for the execution and management of workflows. Furthermore, we need to control these processes and implement improvements over time. For this, it is necessary to implement systems for the management of these business processes (Zanutello, 2014). Thus, Value Stream Mapping (VSM) can be a strategic tool for companies, including those focused on sports consultancies, because it allows a detailed analysis of the processes involved in the provision of services, from client collection to the final delivery of services (Chiasera *et al.*, 2018; Setiawan, Tumanggor, and Purba, 2021).

By using VSM, companies can optimize the flow of information and improve the efficiency of the services provided, identifying and eliminating activities that do not add value, such as bureaucracy and unnecessary steps. Personalized and fast service can increase client satisfaction and retention (Chiká and Nunes, 2024; Hussain and Figueiredo, 2023). VSM allows sports consulting companies to identify opportunities to implement continuous improvements, aligning their processes with the best market practices. By understanding the complete value stream, companies can adapt their services to respond more quickly to client needs and adjust to changes in market demands (Womack and Jones, 2003, 2015).

In this context, the research question of this work is: how can the combination of Material and Information Flow (MIF) and Shingo Lean Office contribute to identifying opportunities for the digital transformation of a small sports consultancy? As a general objective, the work seeks to apply a combination to propose a mapping tool through the union of MIF and Shingo Lean Office to identify opportunities for digital transformation in a small sports consultancy company.

The lean vision plays a vital role in the implementation of continuous improvement practices, as it allows companies to create a constant cycle of continuous improvements. This results in a more agile organization that can quickly adjust to market changes, maintaining long-term competitiveness. The lean vision not only helps companies optimize their current processes but also prepares them for future challenges by promoting a culture of operational excellence (Chiká & Nunes, 2024; de Aragão Guimarães et al., 2023; Müller Nunes et al., 2022; Strassburguer et al., 2023)

This article is divided into six sections: (i) this introduction; (ii) the theoretical review encompassing the themes of Toyota Production System, Value Stream Mapping for Digital Transformation, Material and Information Flow (MIF), Lean Office for the Digital Transformation of Small Businesses; (iii) the methodology applied in conducting this research; (iv) the presentation of the company in which the case study was carried out, as well as the analysis of the data regarding the current state of the information flow and presentation of the value stream and the discussion of the results; and (v) the final remarks and suggestions for future research.

2 Theoretical review

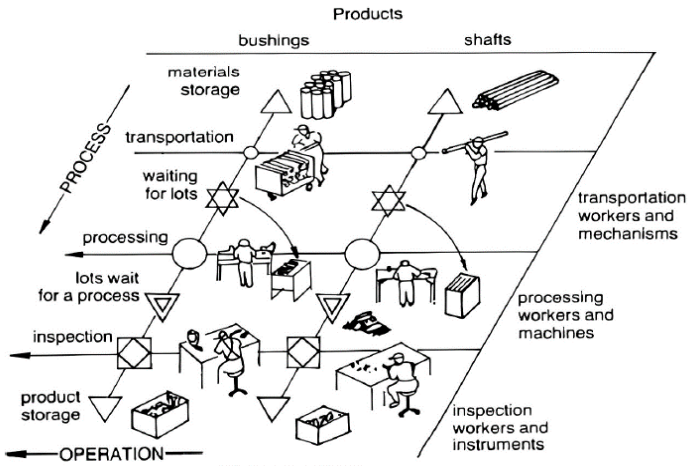
2.1 Toyota Production System and Shingo Production Mechanism

After the Second World War, with the need to make production more efficient, the Toyota Production System (TPS) emerged in Japan, which aims to expose and solve problems in the most diverse environments and situations (Nunes, Vaccaro, and Antunes Júnior, 2017). The TPS seeks to improve the organization's competitiveness by increasing productivity generated by the total elimination of waste (Shingo, 1989, 1988; Hirano, 2013). This system has some essential characteristics: cost reduction through the total elimination of waste as a fundamental principle for the company's health, production against order through the elimination of intermediate stocks, and reduction of batch sizes as the best way to meet demand (Ohno, 1988; Khan, 2022; Jylhä, 2021). In the TPS, the seven losses resulting from a production process are identified, namely overproduction, transportation, processing, defective products, waiting, movement, and inventory (Monden, 2012; Khan, 2022; Silva, Nunes, and Müller Nunes, 2022). TPS is a production management system that aims to increase profits by reducing waste. To this end, the primary tool for identifying waste is the SPM (Shingo Production Mechanism), presented by Shingo (Shingo, 1988, 1989; Strassburguer et al., 2023) The SPM is a tool for analyzing production that establishes a broad and systemic view of the elements that make up a production system. By observing production as a network of processes and operations through axes that intersect orthogonally, the SPM allows the focus of improvements to be directed to the activities belonging to the axis that effectively adds value to what is being produced, that is, the process axis (Chiká & Nunes, 2024; Nunes et al., 2024; Strassburguer et al., 2023)

The SPM is the distinction between the Process and Operation functions. It emphasizes that there are basically two perspectives that allow the observation and analysis of the facts that occur in production, verifying the flow of the work object (material) and the flow of the work subject in time and space. The SPM consists of a method for analyzing production systems, taking into account the simultaneous processes of the flows of materials (production objects) and workers and machines (production subjects) (I. B. da Silva & Godinho Filho, 2019; Isatto & Zuchetti, 2014) According to Shingo (1988), the SPM breaks with the traditional view of production, which considers processes as a set of operations, when it distinguishes the flow of production objects (Process Function) and the flow of production agents (Operation Function). The Process Function refers to the flow of products from one worker to another, that is, the stages through which the raw material moves until building the finished product. The Operation

Function refers to the distinct stage in which a worker can work on different products, that is, a unique temporal human flow that is firmly centered on the worker. The SPM is a distinction between the process and operation functions. It emphasizes that there are basically two views that allow observing and analyzing the facts that occur in production, which allows for the verification of the flow of the work object (material) and the worker in terms of time and space. The SPM is a method of analyzing productive systems that take into account the flows of materials (production objects) and workers and machines (production subjects) simultaneously (Alles et al., 2018; Nunes et al., 2024; Shingo, 1988, 1989; Strassburguer et al., 2023) Shingo's (1988) representation of the SPM is presented in Figure 1.

Figure 1 – Shingo Production Mechanism in Shingo's view (1988)



Source: Nunes, Chiká, and Santos (in press); Shingo (1988) and Strassburguer *et al.* (2023).

The following is a Lean vision for administrative and office processes, called Lean Office.

2.2 Lean Office

The Lean Office concept (Danielsson, 2013; Strassburguer et al., 2023; Takeda Yokoyama et al., 2023) highlights the application of Lean Thinking principles in the office and administrative services environment, aiming at the elimination of waste and the optimization of processes. Strassburguer *et al.* (2023) emphasize that, although Lean has its roots in manufacturing, its principles can be effectively adapted to improve the efficiency and quality of administrative processes. By applying techniques such as value stream mapping and standardization of procedures, it is possible to reduce activities that do not add value, such as redundancies and unnecessary bureaucracy, resulting in a more agile and productive workflow. The practical implementation of the Lean Office highlights the importance of a systematic

approach to identify and eliminate waste in administrative processes. For Lean Office to be effective, companies must first profoundly understand their internal processes, identifying where the main bottlenecks and waste are. From there, Lean tools such as 5S, kaizen, and value stream mapping can be applied to reorganize and simplify these processes (Chiarini and Gabberi, 2020). Thus, we observed that the lean office (LO) is recognized for focusing on reducing waste (which does not add value to the product or service) applied to administrative environments. One of its primary tools is value stream mapping (VSM), which assists in the Lean transformation, aiming at the visualization and elimination of waste (Chiarini & Gabberi, 2020; Danielsson, 2013; Strassburguer et al., 2023; Takeda Yokoyama et al., 2023).

The adoption of the Lean Office approach, very traditional by VSM (Value Stream Mapping) (Rother and Shook, 2009; Chiarini and Gabberi, 2020; Carneiro *et al.*, 2017), had as an alternative presented as Shingo Lean Office, by Strassburguer *et al.* (2023) because it is a direct mapping technique in which it is possible to visualize the value journey along the administrative flows and offers a detailed analysis of the activities that add or do not add value within the analyzed flow. Figure 2 presents the mapping symbology of the Shingo Lean Office (Strassburguer *et al.*, 2023).

Figure 2: Shingo Mapping Symbology for Lean Office

Symbol	Description	Application
	Process starts	It represents either reviewing or checking a file performed by a person manually without the help of software or software bots.
	(Manual) Human Review/Check	It represents either reviewing or checking a file carried out with the help of software.
	Digital Review/Check	It represents either reviewing or checking a file carried out with the help of software bots.
	Automated Review/Check	It represents the movement of a person, e.g., going to a printer to get a printed document, taking a physical document to another colleague's desk, or getting someone's signature.
	Human movement	It represents digital movements, i.e., moving a file from one folder to another, downloading or uploading, or deleting a file.
	Digital movement	It represents either reviewing or checking a file performed by a person manually without the help of software or software bots.
	(Manual) Exchange of human information	It represents the exchange of human information, the exchange of ideas carried out over the telephone, in a meeting, or even in an informal face-to-face conversation.

	Exchange of digital information	It represents the exchange of digital information, that is, any exchange through e-mail, company portal, or chat message.
	Exchange of automated information	It represents automated information exchanges, e.g., sending automatic responses to collect information before reaching someone, reducing steps, and reducing waiting time.
	Manual process delays	It represents a wait for manual processing, characterizing a waiting job, waiting for the end of another job to start, e.g., a document waiting to be signed by someone in charge before proceeding with the process, a call waiting for another to be finalized.
	Digital process delays	It represents a wait for digital processing, characterizing a stand-by job waiting for the end of another job to be started, e.g., waiting for a file to download or for a file to open.
	Automated process delays	It represents a wait for automated processing, characterizing a stand-by job waiting for the end of another job to start, e.g., waiting for software to scan for typos.
	Manual processing	It represents manual work, e.g., a signature.
	Digital processing	It represents digital work, e.g., filling in a spreadsheet.
	Automated processing	It represents automated work, e.g., creating a chart for decision-making.
	Lot delay	It represents the wait that can be elucidated by a file waiting for something, e.g., a broken computer, an internet crash, a blocked user, or an employee leaving the workplace to resolve personal issues.
	End of process	It represents the end of the process.

Source: Strassburguer *et al.* (2023).

The following are the techniques used to identify information flows and means and to identify possibilities for improvements in digital transformation.

2.3 VSM 4.0

The study by Meudt *et al.* (2017) on VSM 4.0 highlights the importance of adapting traditional Value Stream Mapping to the new realities of Industry 4.0. The research emphasizes how VSM 4.0 incorporates emerging technologies, such as the Internet of Things (IoT), cyber-physical systems, and Big Data analytics, to create a value stream mapping that not only captures the current state of processes but also predicts and adapts to variations in real time. According to these authors, this more dynamic approach is essential to improve the efficiency and flexibility of operations in complex and interconnected operating environments. VSM 4.0

facilitates the integration and visualization of data from different sources, including sensors, Enterprise Resource Planning (ERP) systems, and client feedback, creating a more comprehensive and interconnected representation of the value chain, which allows for a more accurate analysis of the interdependencies between processes and the identification of opportunities for improvement that would be difficult to detect using traditional methods. The authors also point out that the ability to simulate different scenarios and proactively adjust the value stream is a crucial feature of VSM 4.0, providing companies with a significant competitive advantage in volatile markets (Meudt, Metternich, and Abele, 2017; Hartmann *et al.*, 2016; Chiká and Nunes, 2024), which makes VSM 4.0 an essential tool for any organization seeking to adapt to the Industry 4.0 era.

2.4 MIF (Material and Information Flow)

MIF is a mapping approach that combines the principles of the Shingo Production Mapping and VSM 4.0 to analyze and optimize operational flows in diverse environments, such as manufacturing, administrative, and service operations. The main objective of MIF is to provide an understanding and complete picture of how materials and information flow through a system or process (Nunes et al., 2024).

The MIF technique helps identify value-adding activities, inefficiencies, bottlenecks, and waste in the system. This detailed analysis allows organizations to make decisions about process improvements, resource allocation, and digitalization strategies to increase efficiency, productivity, and overall performance. Material and information flow serves as a tool for managers and researchers to analyze, evaluate, and improve operational flows, focusing on both the physical movement of materials and the information flow within a system (Roh, Kunz, and Wegener, 2019; Chiká and Nunes, 2024). According to Nunes, Chiká, and Santos (2024), three criteria are used to evaluate information flow:

i. Informational means;
ii. Resources used (except human resources);
iii. Human resources.

To detail the measurement of the digitization/automation rate, the authors divided the information flow data collection into three categories: activities in the ERP, digitized activities outside the ERP, and other activities. The activities in the ERP group are all activities in which information is exchanged using the ERP and its integrated modules (Equation 1) (Nunes et al., 2024).

$$Activity\ rate\ in\ ERP = \frac{\sum Information\ generated\ via\ ERP\ and\ integrated}{Total\ flow\ information}\ x\ 100 \qquad (1)$$

Digitized activities, except ERP, are all those activities that are in digital format but are not handled through ERP and its integrated software. These are means such as spreadsheets and text editors, among others (Equation 2).

$$Activity\ rate\ except\ ERP = \frac{\sum Information\ in\ which\ software\ not\ integrated\ with\ the\ ERP\ is\ used}{Total\ flow\ information}\ x\ 100 \qquad (2)$$

The other activities consist of those actions carried out in the flow that are not exchanged by digital means and can be through memory, voice, and movement, among others (Equation 3).

$$Rate\ of\ other\ activities = \frac{\sum Information\ that\ does\ not\ use\ digital\ means}{Total\ flow\ information}\ x\ 100 \qquad (3)$$

The informational mean criterion identifies whether this medium is linked to a system/software or integrated module owned by the organization, which makes data and information available to all corporate users with access authority to them (Equation 4).

$$Information\ access\ rate = \frac{\sum System-Related\ Information}{Total\ flow\ information} \qquad (4)$$

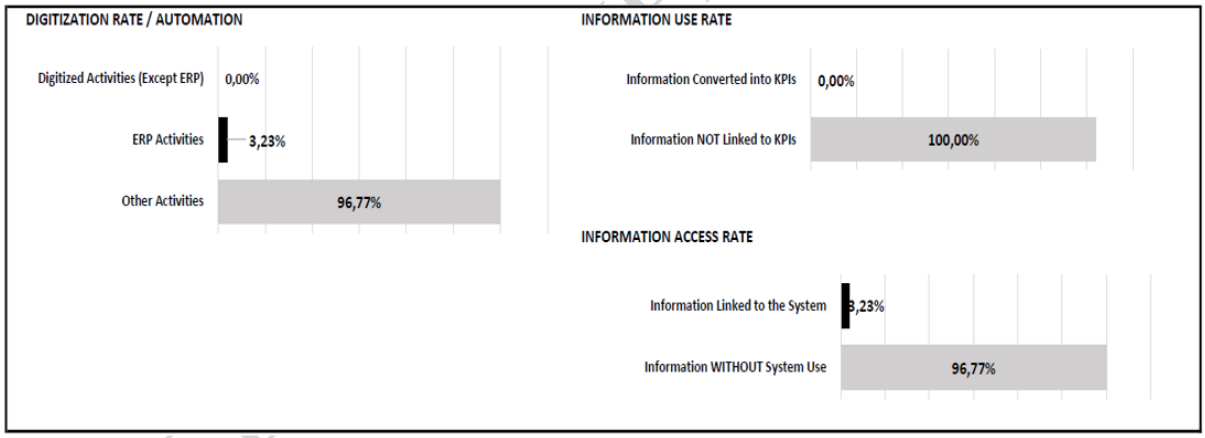
Information tools should identify the people who provide the Key Performance Indicator (KPI), and this allows us to calculate the amount of information that is used in decision-making. During the data mapping process, the name of the indicator (KPI) will be displayed in the "KPI Name" column. This metric is known as the information utilization rate by researchers and is calculated by Equation 5.

$$Information\ use\ rate = \frac{\sum of\ the\ information\ collected\ that\ generate\ KPIs}{Total\ flow\ information}\text{x}\ 100 \qquad (5)$$

These rates aim to identify the association of the information medium with some system/software or integrated module, with the aim of verifying whether the data and information are centralized and available to the company. In general, MIF mapping seeks to

combine the flow of information with the flow of operations so that companies can make better decisions. Figure 3 shows an example of these measured indicators.

Figure 3 – Example of KPIs generated by the MIF technique



Source: Nunes, Chiká and Santos (2024).

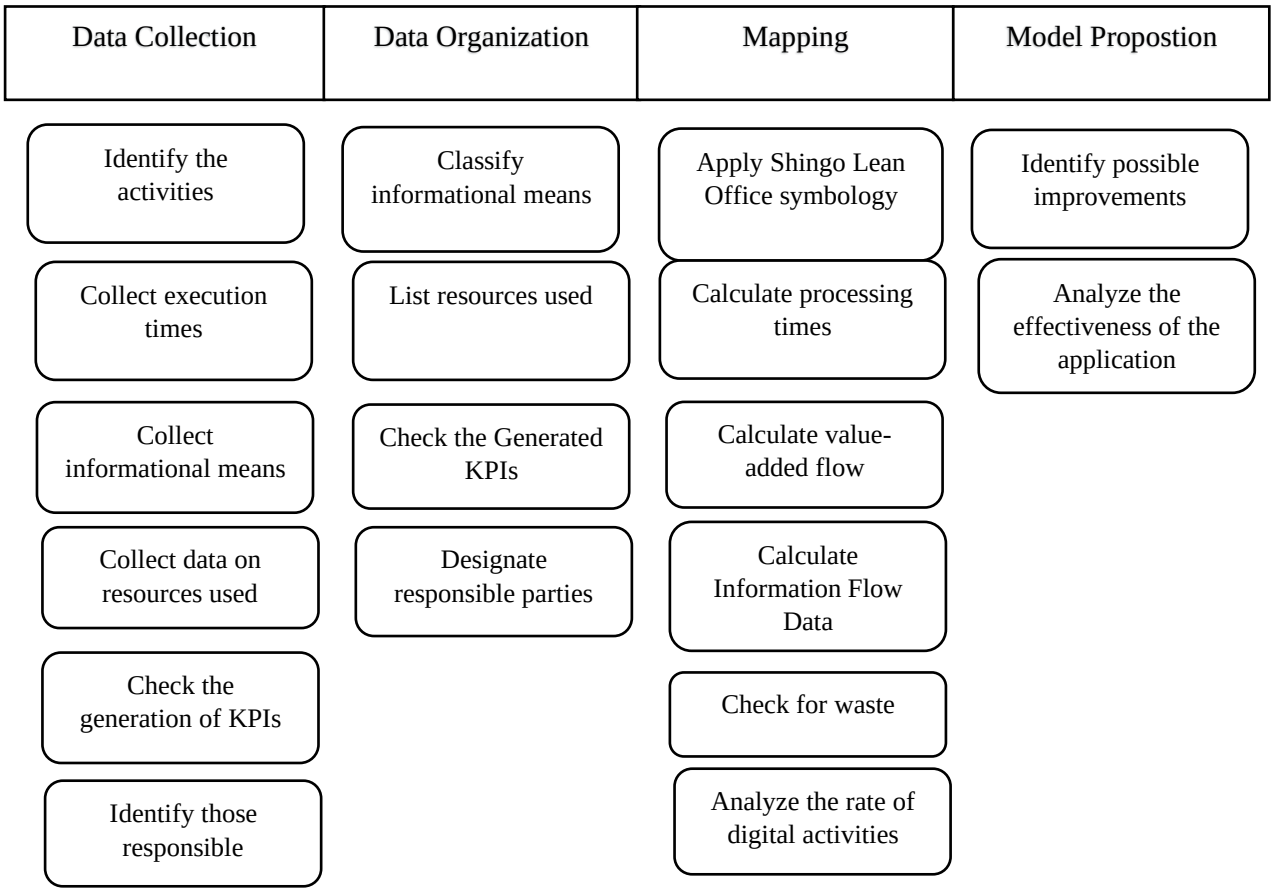
The methodology applied in conducting the research is presented below.

3 Methodology

From the point of view of its objectives, the research is classified as descriptive. It is a case study (Yin, 2002; Eisenhardt, 1991, 1989; Ravenswood, 2011) in which the selected company was a small sports consultancy, and the process chosen for mapping was the commercial process. This choice was made with the aim of verifying the use of techniques in Small and Medium Enterprise (SME) environments. The commercial process was chosen because it is an operational deficiency in the company under study regarding digital transformation and clear and defined processes. Data collection was carried out in ten services provided by the company. The data collected were the time of each of the activities, the informational means by which these activities were being carried out, which resource was being used to carry out that action, whether the information generated any KPI, and who was responsible for carrying out each of the activities (Nunes et al., 2024; Strassburguer et al., 2023)

The collected data were then organized in an MS Excel® spreadsheet, and the mapping of the chosen process began. This action was carried out using the MIF methodology (Nunes, Chiká, and Santos, 2024) and the Shingo Lean Office mapping symbology (Strassburguer et al., 2023). Then, calculations were made to determine the value added to the process and calculations related to the information flow of the system. Finally, an analysis of the proposed model and the results obtained in the mapping of sports consultancy were carried out. Figure 4 shows the diagram of the steps that were carried out until the model was proposed.

Figure 4: Diagram of the steps



Source: The authors (2024).

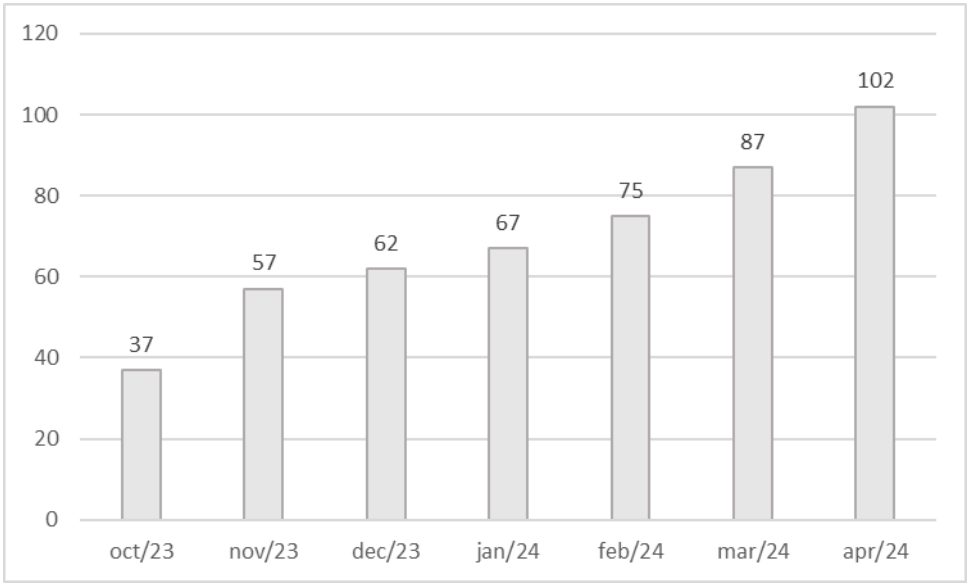
The following is a case study in which the Shingo Lean Office and MIF techniques were applied to identify the information flow and its opportunities for improvement.

4 Results and Discussion

The application of this combination of process mapping techniques arose from the need to visualize the flow as a whole and, together with it, visualize the flow of information within the stages of the processes that comprise it. The company studied is a sports consultancy located in the South of Brazil that has been operating in the personalized running training market for two years. The company provides online services and has athletes spread across more than ten Brazilian states. Furthermore, its headquarters are in Gramado/RS. The focus of the consultancy is to create personalized running training spreadsheets for each athlete according to their goals, their sports history, and their availability to train. In addition, the service provided by the consultancy also includes the support of the coach to the students and the monitoring of the training sessions. For confidentiality reasons, the name of the company will not be disclosed. The company under study was chosen to conduct this study because it is constantly growing,

and this increase in demand is compromising the quality of service and student monitoring. In Figure 5, it is possible to observe the rise in the number of clients in the period from October 2023 to April 2024. With this increase, the current way of working is generating failures and a lack of agility in the processes, and this needs to be improved so that the company continues to grow and can deliver the best service to its clients.

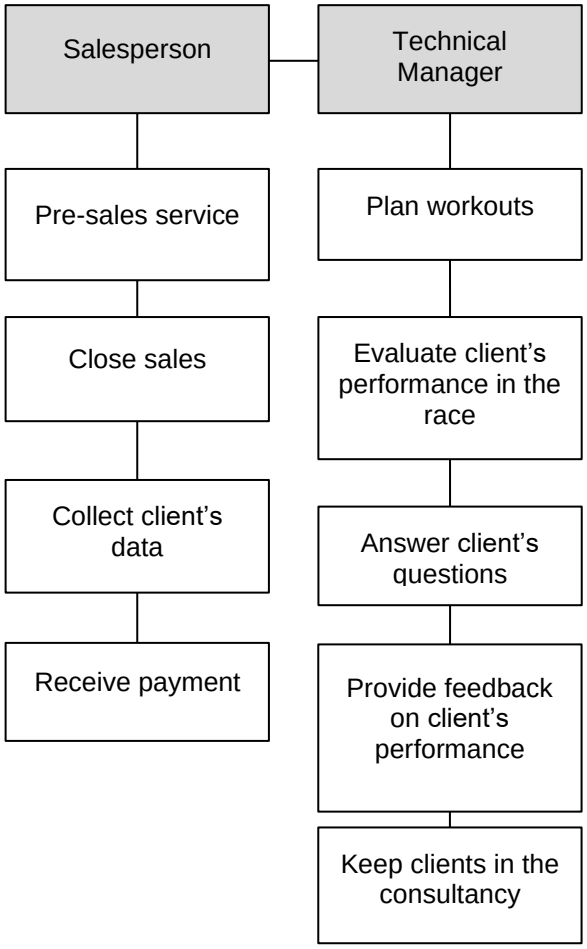
Figure 5: Number of clients per month in sports consulting (October/23 to April/24)



Source: The authors (2024).

The people involved in this study are the two partners of the company and the ten clients from whom the service data was collected. One of the partners is responsible for sales, and the other is the technical manager (trainer). Figure 6 represents the activities carried out by the partners. The salesperson is the one who will have the first contact with the client. After making the sale, the technical manager continues to serve the client within the consultancy.

Figure 6: Activities carried out by the partners of the company under study



Source: The authors (2024).

The company's sales process was mapped to apply the model proposed in this study. This process was chosen because there is a flow of information between the sales department and the trainer via WhatsApp, and as the number of clients increases, this information can end up getting lost along the way. Furthermore, it is through the sales process that the company begins its relationship with the client. If this process is not well executed, the service loses its quality. Another point is that the consultancy's sales model is based on recurrence, so if clients are not well served, they stop being clients of the company the following month.

Each of the steps performed in the Alpha company's business process was first described to perform this mapping. In addition, data was collected to identify the execution times (hh:mm:ss) of each of these steps (results of the average of ten services), the information flow, the resources needed to perform the activity, and the person responsible for the execution. Furthermore, we determined whether these tasks were linked to a system and whether they generated any KPI. The result of this data collection can be seen in Table 1.

Table 1: Activities performed from initial customer service to first service delivery

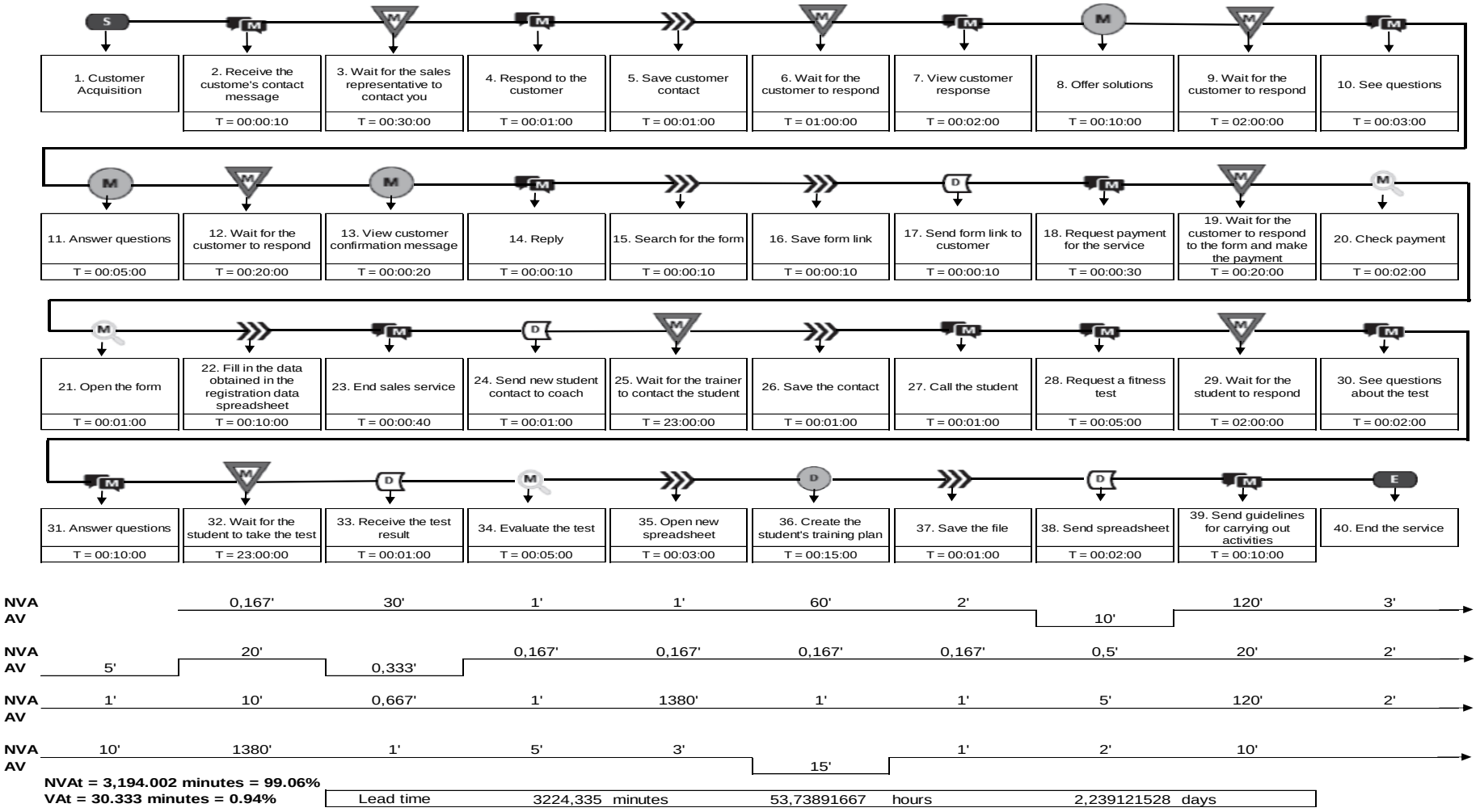
TYPOLOGY	ACTIVITY DESCRIPTION	Time (hh:mm:ss)	Information Flow	Resources (except HR)	System Linked Information	Generates KPIs	Personnel Flow
Start of flow	Client acquisition - WhatsApp redirect link	-	Instagram	Cell phone	No	No	Commercial
Message	Receiving client contact message	00:00:10	WhatsApp	Cell phone	No	No	Commercial
Manual hold	Wait for the sales representative's contact	00:30:00	Memory	Cell phone	No	No	Commercial
Message	Respond to the client - Why are they looking for the company?	00:01:00	WhatsApp	Cell phone	No	No	Commercial
Digital movement	Save client contact	00:01:00	WhatsApp	Cell phone	No	No	Commercial
Manual hold	Wait for the client to respond	01:00:00	Memory	Cell phone	No	No	Commercial
Message	View client response	00:02:00	WhatsApp	Cell phone	No	No	Commercial
Manual processing	Offer solutions - Record audio explaining the service offered	00:10:00	WhatsApp	Cell phone	No	No	Commercial
Manual hold	Wait for the client to respond	02:00:00	Memory	Cell phone	No	No	Commercial
Message	See questions	00:03:00	WhatsApp	Cell phone	No	No	Commercial
Manual processing	Answer questions	00:05:00	WhatsApp	Cell phone	No	No	Commercial
Manual hold	Wait for the client to respond	00:20:00	Memory	Cell phone	No	No	Commercial
Manual processing	View client confirmation message	00:00:20	WhatsApp	Cell phone	No	Yes	Commercial
Message	Respond	00:00:10	WhatsApp	Cell phone	No	No	Commercial
Digital movement	Search for the form	00:00:10	Cell phone desktop	Cell phone	No	No	Commercial
Digital movement	Save form link	00:00:10	Google Forms	Cell phone	No	No	Commercial
Digital exchange of information	Send form link to client	00:00:10	WhatsApp	Cell phone	No	No	Commercial
Message	Request payment for the service	00:00:30	WhatsApp	Cell phone	No	No	Commercial
Manual hold	Wait for the client to complete the form and make the payment	00:20:00	Memory	Cell phone	No	No	Commercial
Inspection	Check payment	00:02:00	Bank App	Cell phone	No	No	Commercial
Inspection	Open the form	00:01:00	Google Forms	Computer	No	No	Commercial
Digital movement	Fill in the data obtained from the form in the registration data spreadsheet	00:10:00	Excel	Computer	No	No	Commercial

Message	End commercial service	00:00:40	WhatsApp	Cell phone	No	No	Commercial
Digital exchange of information	Send new student contact to the coach	00:01:00	WhatsApp	Cell phone	No	No	Trainer
Manual hold	Wait for the trainer to contact the student	23:00:00	Memory	Cell phone	No	No	Trainer
Digital movement	Save contact	00:01:00	WhatsApp	Cell phone	No	No	Trainer
Message	Call the student	00:01:00	WhatsApp	Cell phone	No	No	Trainer
Message	Request a fitness test	00:05:00	WhatsApp	Cell phone	No	No	Trainer
Manual hold	Wait for the student to respond	02:00:00	Memory	Cell phone	No	No	Trainer
Message	See questions about the test	00:02:00	WhatsApp	Cell phone	No	No	Trainer
Message	Answer questions	00:10:00	WhatsApp	Cell phone	No	No	Trainer
Manual hold	Wait for the student to take the test	23:00:00	Memory	Cell phone	No	No	Trainer
Digital exchange of information	Receive the test result	00:01:00	WhatsApp	Cell phone	No	No	Trainer
Inspection	Evaluate the test	00:05:00	Training App	Cell phone	No	Yes	Trainer
Digital movement	Open new spreadsheet	00:03:00	Computer	Computer	No	No	Trainer
Digital processing	Put together the student's training plan	00:15:00	Excel	Computer	No	No	Trainer
Digital movement	Save the file	00:01:00	Desktop Computer	Computer	No	No	Trainer
Digital exchange of information	Send spreadsheet	00:02:00	WhatsApp	Computer	No	No	Trainer
Message	Send guidelines for carrying out activities	00:10:00	WhatsApp	Computer	No	No	Trainer
End of flow	End the service	-	WhatsApp	Computer	No	No	Trainer

Source: The authors (2024).

Then, each of the activities was classified according to a typology, as shown in Figure 2. From this, it was possible to assemble the Lean Office mapping with these activities and their respective operating times, as observed in Figure 7.

Figure 7: Shingo Office mapping of the current process state



Source: The authors (2024).

When checking the mapped flow (Figure 7) from the first contact to the delivery of the service, a total of 4 value-adding activities (8, 11, 13, and 36) were obtained, and these activities together added up to a total of 30.33 minutes (0.94%). Regarding the non-value-adding activities, a total of 36 activities were obtained, totaling 3,194.002 minutes (99.06%). The total lead time of the commercial process from the first contact with the client until the first training spreadsheet was delivered was 3,224.332 minutes, approximately 2.24 days.

Regarding the information flow, Table 1 shows that none of the information means is related to ERP, so the rate of information linked to ERP and the rate of information linked to the system is zero. The rate of digital activities that do not include ERP is 80%, and the rate of information not linked to digital media is 20%. In total, the process has ten information flow paths to manage its activities. Since information circulates in many paths, it can easily be lost. In addition, two activities generate KPI, resulting in a KPI use rate of 5%. These results can be seen in the calculations below:

- Activity rate in ERP:

$$\frac{\Sigma\ information\ generated\ via\ ERP\ and\ integrated}{Total\ flow\ information} = \frac{0}{40} = 0\%$$

- Activity rate, except in ERP:

$$\frac{\Sigma\ information\ that\ use\ software\ not\ integrated\ with\ ERP}{Total\ flow\ information} = \frac{32}{40} = 80\%$$

- Rate for other activities:

$$\frac{\Sigma\ information\ that\ does\ not\ use\ digital\ media}{Total\ flow\ information} = \frac{8}{40} = 20\%$$

- Information access rate:

$$\frac{\Sigma\ information\ linked\ to\ systems}{Total\ flow\ information} = \frac{0}{40} = 0\%$$

- Information use rate:

$$\frac{\Sigma\ information\ that\ generates\ KPIs}{Total\ flow\ information} = \frac{2}{40} = 5\%$$

This work presented the union of two process mapping models, the Shingo Lean Office (Strassburguer et al., 2023) and MIF (Nunes, Chiká and Santos 2024). In the work by Strassburguer *et al.* (2023), one of the proposals for future work was the application of the Shingo Lean Office in practice. The present work accomplished this, and the analysis of the information flow of the commercial process was carried out using the application of MIF. This

new model allowed the analysis of both the information flow and the flow of activities of the same process. According to Strassburguer *et al.* (2023), the objective of the Shingo Lean Office is to map processes of administrative environments and identify the activities that add and those that do not add value, and this can be done as shown in Figure 4. In relation to MIF (Nunes et al., 2024), the objective of this model is to provide a complete understanding of how information flows in the system, and this was possible to identify, as Table 1 presented.

Through the information flow, the combination of the two methods made it possible to identify that much of the information is not concentrated in an integrated system. The Shingo Lean Office mapping (Strassburguer et al., 2023) showed that only 0.94% of the activities add value. This low result is linked to the information circulation stages that can be observed in the information flow survey. Another vital point observed is that only 5% of the activities generate KPIs, and the lack of indicators can hinder the decision-making process. Regarding the process lead time, the activity that has the longest execution time is the wait for the student to take the physical fitness test (an average of 23 hours). According to Strassburguer *et al.* (2023), this is a human wait, in which one must wait until the person performs the activity. This process represents around 43% of the total lead time. Still, because it depends on a third party, it is more difficult to attack this wait. However, the other steps in the process that do not add value still need to be eliminated or optimized to reduce the lead time of the sales process.

Therefore, the consultancy's commercial process needs improvements that involve the implementation of systems and digital transformation to facilitate the flow of information so that both the technical trainer and the salesperson can dedicate themselves to value-adding activities. According to Nunes, Chiká and Santos (2024), the implementation of improvements that involve digitalizing processes becomes necessary due to the difficulty of circulating information. Therefore, these improvements need to allow the company to continue growing and receiving new clients.

5 Final remarks

This research aimed to apply a combination of MIF and Shingo Lean Office to propose a mapping tool and apply it to map the activities of the commercial sector of a sports consultancy. When applying this tool, we noticed that only 0.94% of the activities in the analyzed process add value and that the other activities do not. This low result is linked to the information circulation stages, as this information circulates between different channels, which

increases the probability of information being lost throughout the process. Based on this, this process can be used to implement improvements through digital transformation.

The combination of methods made it possible to understand this business process better, analyzing not only the operational flow but also the information flow. In addition, the combination of methods helped identify areas for improvement, such as the need to optimize some activities or even eliminate them to reduce lead time. Finally, the research developed by combining the Shingo Lean Office and MIF mapping methods was considered appropriate for the study, as it highlighted the need to implement systems and digital transformation in the company under study. These factors will contribute to facilitating the flow of information, in addition to presenting opportunities for application in other processes and sectors.

Digital transformation offers many opportunities for small and medium-sized companies in terms of improving their processes, increasing their operational efficiency, and increasing their market reach. Through this transformation, companies can automate repetitive tasks, improve communication with clients and suppliers, and have access to intelligent real-time data that understand behaviors and trends. From this, small and medium-sized companies can quickly adapt to changes in the market and new consumer demands, thus generating competitive advantages for their businesses. However, flows and processes (especially informational ones) are essential assets for the productivity, competitiveness, and development of Small and Medium-sized Enterprises (SMEs). The effectiveness of these flows allows for more efficient management of information and resources, resulting in more agile and coordinated operations. Through structured processes, it is possible to ensure that information flows in an organized manner between the different sectors of the company, minimizing possible rework and improving decision-making.

Although the advent of digital transformation can provide automated tools and resources, well-defined flows and processes ensure the practical application of these technologies. Since the efficiency of these assets structures the workflow, they ensure the consistency and quality of operations and facilitate internal and client communication. Robust flows and processes allow SMEs to optimize their operations, reduce errors, and increase their productivity, regardless of the technologies applied. These assets help companies adapt and integrate new technologies more effectively, ensuring that investments in new assets (machinery, equipment, and software) bring the expected benefit to the business. Finally, although technologies and tools are essential, the actual basis for the sustainable growth of SMEs lies in the implementation and management of their flows and processes.

Suggestions for future research include generating a future state map along with the business process of the company under study and carrying out a new mapping of activities so that the results obtained after the improvements are applied can be evaluated. It is also recommended that a study be developed that formalizes the combination of the Shingo Lean Office (Strassburguer et al., 2023) and MIF (Nunes et al., 2024) techniques and that a method for applying these techniques be proposed with the aim of directing the actions of administrative operations managers so that they can be guided in improving material and information flows.

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