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In order to meet their growing needs to remain competitive by constantly introducing innovative products and/or services, companies today face challenges in their administrative process that originally were not designed to handle the significant increase in the flow of information. In the innovation cycle only a structured process is not enough. However, the organization must have agility and efficiency. This paper reports an analysis of the Patent Application Filing Process (PAFP) of the Brazilian subsidiary of a multinational company, which is the world leader in the manufacturing of home appliances that for strategic reasons needs to expand its patent portfolio. This study, supported by the value stream mapping (VSM) tool, aimed to identify opportunities to improve the flow and the quality of information, as well as optimization of human and technological resources to reduce their cycle time. As a result of implementing the proposed actions for eliminating waste identified, approximately 45% reduction in the cycle-time of the patent application filing process has been achieved and thereby increases in the number of patent applications filed without the need for additional human and technological resources.

Keywords: Patents, patent portfolio, competitiveness, innovation, value stream mapping, lean thinking

This study addresses the challenges faced by business that need a responsive, effective and systematic approach to being constantly innovative with regard to their products and/or services, in the search for the competitiveness necessary for their survival in various aspects. Achieving and maintaining this competitiveness through innovation involves the evaluation and optimization of the process involving the generation and protection of intellectual capital in the form of industrial property.† This process should be structured and determined by technical and strategic activities.

In an economy increasingly based on knowledge the relevance of managing intellectual property in accompany is growing. This management also performs an important role in market monitoring and technology watch.

Patents, a form of industrial property, represent one of the key elements for achieving market competitiveness and a key factor for innovation and the survival of any company in the twenty-first century. Several studies have used patents as a variable to measure innovation. In general, for a country to become competitive, it must strengthen its research agenda, becoming innovative and "strengthening" its patent bases.

Patents support organizations by giving them rights and legal guarantees that are granted once recognized by the State in an organized civil society. In return for the public disclosure of an invention through the publication of a patent, the inventor is granted the right to deny, for a limited period, third parties the right to produce, use, sell or import the invention in question in that country without the permission of the patent holder.

In Brazil, as in other countries, the legislation (Law No 9.279, 14 May 1996) ensures that the holder of a patent has the right to ask for compensation for the unauthorized exploitation of the object, including exploitation occurring between the dates of publication of the application and granting of the patent.

Based on the role and the importance of the generation and protection of industrial property in relation to the innovation and competitiveness of companies, this paper reports an analysis of the Patent Application Filing Process (PAFP) of a Brazilian subsidiary of a multinational company, which is a world leader in the manufacturing of home appliances and looks for alternatives to increase its capacity of generation and applications of patents to expand its patent portfolio. There are several studies that demonstrate that excellent results are achieved using a
value stream mapping (VSM) tool to reduce the lead time of the product development process. This study, supported by this tool, aimed to identify opportunities to improve the flow and the quality of information, as well as optimize the use of human and technological resources to reduce their cycle time.

As a result of thorough analysis of this PAFP, several waste issues were identified. For each example of waste, actions were formulated and implemented in order to eliminate or reduce them. In general, the cycle time of the PAFP was considerably reduced (by 45%), which allowed a significant increase in the capacity of the company investigated in terms of generating and filing patent applications, avoiding the need for further investments. In addition, improvements that reflect a significant increase in the completeness and accuracy of information, as well as a more effective use of human and technological resources, were achieved.

Intellectual Capital

The intellectual capital can be described as intellectual material that has been formalized, captured and leveraged to produce a higher asset value. The basic difference between intellectual capital and traditional assets, such as land and buildings, which are tangible, is that intellectual capital is an intangible asset. Intellectual capital has two main components: human capital (knowledge held in the minds of people) and intellectual assets (knowledge which is encoded in some way). Within the classification of intellectual assets there is a subgroup of ideas, which can be protected legally, called intellectual property.

In the business world, knowledge, inventions, innovations and other expressions of human creativity are likely to be converted into private property and protected by law through a system of intellectual property. This type of property can be treated for accounting purposes and marketed as intangible assets. Proper protection of intellectual property is crucial to the successful commercial exploitation of a potentially innovative product, process or service.

In Brazil, for example, the protection of intellectual property is characterized by its distribution into different types of modalities. Patents, an intellectual type of asset owned by a type of industrial property, represent, for companies, an effective and robust option for: a) market protection; b) revenue generation; c) providing a work incentive for employees; d) monitoring competitors; e) measuring the value of the company; and f) creating value.

Patent Portfolio

In addition to configure as a key element for competitiveness, innovation and survival of organizations, patents can be used strategically to stop the threats and advances of its competitors. In this sense, the increase and incentives for the generation of patents in order to create a portfolio of patents, becomes a strategic guideline for organizations. In this process, the patent portfolio acts as a kind of fence that prevents or blocks competitors from registering patents related to its core technology.

In order to create a defensive technology fence, the company must also develop non-core patent technologies. The fence makes it difficult for competitors to incorporate similar technology without infringement. On the other hand, a patent cluster brings together many patents of alternative technologies, and strategically makes defining the underlying technology trends more difficult. The illustrations of patent fence and patent cluster are shown in Figure 1.

Process of Developing and Obtaining a Patent

In general, the process of developing and obtaining a patent comprises five steps, as shown in Figure 2. However, each country has its own legislation regarding intellectual property protection, which determines, in greater detail, the specific variations in the process. However, these differences do not prevent the transaction of applications and patent grants between most countries. This process is supported by international agreements that guarantee the reciprocity of the same or equivalent rights.

• Step 1: Those interested in protecting their ideas through patents, supported by a structured process or not, make decisions based on strategies and/or beliefs about the preparation and forwarding of the application for a patent.

Fig. 1 – Purpose of patent portfolios
Step 2: The analysis, research on previous registrations and preparation of the application for a patent can be carried out by the inventors themselves or, for example, in the case of companies or universities, by a section in charge of this task. However, due to the complexity of the text of a patent, which consists of technical and legal terms, stakeholders most often seek patent offices, which are specialized in the development and routing of patent applications.

Step 3: The patent office interacts with the inventors and the company in order to draft the patent application according to the details and their expectations in terms of what is actually possible and of interest to the claiming company, in accordance with the requirements of patentability established by law.

Step 4: Having aligned all of the information and the set of claims, the patent office finalizes the document, obtains the approval of the applicant and deposits the application for the patent with the government agency responsible in the destination country.

Step 5: In a structured process, which includes the period of publication of the patent application, publication of the application, the period of secrecy and later the technical examination, with no demands and or objections from third parties, the state registers the patent and grants it to the applicant.

Lean Thinking

Being lean in the context of a process means eliminating waste in order to create value.

In the particular case of the development of products or services where innovative processes are sought, the lean model is based on three key points, that is, processes, people and tools or technology: a) in relation to the processes, the value set by the client should be identified to separate the aggregated amount of waste and rigorous standardization needs to be applied in order to reduce variation and create flexibility and predictable results; b) in relation to the people, suppliers should be fully integrated into the system of developing products and services and consolidating the learning and the practice of continuous improvement, and; c) in relation to the tools or technology, these must be adapted to the people and process, aligning the organization through simple visual communication and the use of powerful tools for standardization and organizational learning. These three key points should be considered as a reference in the analysis of the waste in the current value stream and the preparation of the future value stream.
Concept of Value
The starting point for the lean approach is the concept of value, which is understood as the set of activities that the customer values. In administrative proceedings, there are activities that add value and others which do not.\(^\text{28}\) The critical area for obtaining any improvement is to clarify the definition of the value of a product or service from the perspective of the consumer, otherwise one runs the risk of improving the flow of value but effectively providing the end consumers with something they do not actually want. Thus, the mapping should start with customer demands.\(^\text{29}\)

Value Stream
The value stream is related to the progressive carrying out of tasks along a value chain.\(^\text{28}\) It is the set of all of the specific actions required to allow a specific product (whether goods, a service, or, increasingly, a combination of the two) to pass through the three critical management tasks in any business: a) troubleshooting; b) managing information, ranging from receipt of order to delivery, following a detailed schedule, and; c) physical processing, from the raw material to delivering the finished product or service to the customer.\(^\text{30}\)

Value Stream Mapping (VSM)
In the lean approach, the processes have to be visualized through charts and the flow needs to be mapped in order to search for waste.\(^\text{28}\) VSM is much more useful than quantitative tools and layout diagrams which produce a set of steps that do not add value. VSM is a qualitative tool which describes in detail how the production unit should operate. Numbers are good for creating a sense of urgency or as measures of comparison (before and after). Value stream mapping is useful for describing what really should be done to reach the numbers obtained. VSM is a tool used to manage the change process and to map the value stream in order to highlight the sources of waste and eliminate them through the implementation of a future state value stream.\(^\text{29}\)

Identification of Value
The activities of a value stream must be analyzed and their remaining in the flow decided on by complying with the following value analysis criteria:\(^\text{31}\)

- Value added (VA) activity: an activity that transforms or shapes the material or information.
- Necessary no value added (NNVA) activity: activities that do not create value but cannot be eliminated based on current technology, legal regulations and/or necessity due to the lack of robustness of the process.
- No value added (NVA) activity: activities that consume resources, create no value in the eyes of the customer and are considered as a loss.

Concept of Waste
Waste activities are those which absorb resources and not create value.\(^\text{30}\) In the manufacturing point of view, seven types of production waste need to be considered. In administrative processes, such as product development and patent development the numbers of waste types can be expanded to ten: waiting, transportation, motion, unnecessary processes, inventory, overproduction, defects, reinvention, lack of discipline and limited information technology capability.\(^\text{32}\) For the types of waste mentioned above there are the following levels: a) waste that can be rapidly eliminated; b) waste that cannot be immediately eliminated and must be tackled at its origin in a broader system level; and c) waste originating from specific management policies.\(^\text{33}\)

The Delta Company is a subsidiary of one of the largest manufacturers of home appliances in the world, and it has led the Brazilian market in various segments. This market leadership is attributed to the strong and constant investments and incentives aimed at innovating and expanding the intellectual capital of the company over the years. However, maintaining and even expanding this advantage over its main competitors requires, in addition to these investments, the constant search for continuous improvements in various processes of administrative management, new product development and innovation.

Specifically, in the process of product development and innovation, one of the metrics adopted by the company to measure progress in the field of industrial property is the number of patent applications made each year. The activities associated with the PAFP carried out at the company investigated proceed through a "pull system" in which the client of the process, in this case the top management of the company, determines generation goals in terms of
industrial property based on strategic information related threats and progress of its main competitors. These goals are deployed in various areas of the company which set goals for its group of engineers and designers, that is, the potential inventors, to be achieved within the development projects carried out each year.

These goals are generally set in terms of the number of Inventive Technical Solutions (ITS) to be submitted and approved by the Patent Evaluation Committees (PEC) for each site and in terms of the number of patents to be effectively deposited in their countries of origin.

The ITS form is standardized by the company and on it inventors describe technically any potentially patentable idea. The ITS form contains basically a description of the idea, the solution currently used, the benefits for the company and its consumers and other information, such as drawings, laboratory test results, financial studies, usability tests and the results of searches conducted by the inventor(s) on previous registrations in patent databases available on the internet. After being submitted and passed by the PEC, the idea is likely to be forwarded to the patenting process and incorporated to its portfolio of patents, provided that it is aligned with the strategic objectives of the company in relation to its plan to develop products and technologies. For a clearer and more objective description of the PAFP of the Delta Company, a flowchart of the current activities in various areas inside and outside the company was devised, as shown in Fig. 3.

The data relating to the process time (PT), lead time (LT) and waiting time (WT) of each activity during this process and the value of the activities according to the criteria have been identified by Hines and Taylor 2000. These activities associated with the process of transforming an ITS into a patent are performed in several areas of the company and completed with research activities related to previous registrations, litigation support and preparation of the final text of the patent held by outsourced companies providing specialized services in the area of patents.

Fig. 3− Flowchart of the current activities in various areas inside and outside the company
In the PAFP established by Delta Company the PEC is a key element in the evaluation, approval and forwarding involved in the ITS patenting process. This committee is a multidisciplinary team formed by the company's own engineers with extensive experience and they represent diverse areas of the Product Development and Technology Center of Delta Company. The area of patents is comprised of a group of people responsible for managing the patent portfolio. Their principal activities are the management of the maintenance of patents already granted, referrals and business relationships with the providers of services in patent law suits.

**VSM in its Current State and Identification of Waste**

The flow of Delta Company’s PAFP begins with the setting of annual targets and based on these the inventors start exploring ideas and composing ITSs to submit to the PEC. Once approved, an ITS is directed to the area of patents of the company which hires the services of a patent office to configure the application and submit it for filing. Based on the steps shown in the PAFP flowchart, its VSM in its current state is shown in Fig. 4. Besides the processing times (PT), lead time (LT) and waiting time (WT) the rates of completeness and accuracy (C&A) of information or waste associated with each activity were also identified.

Table 1 shows the activities that make up the current VSM of Delta Company’s PAFP. However, we know that the time duration of activities varies for each patent. In this sense, based on the history of time spent on each activity by the company in developing its patents was estimated through a beta statistical distribution the expected time for each activity, including the cycle time (CT). This table also contains the rates of completeness and accuracy of information used to evaluate the FPY (First Pass Yield), a factor that characterizes the overall efficiency of the process.

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Fig. 4− Current value stream mapping of Delta Company’s PAFP
Analysis of Waste in the Value Chain and Proposals for Improvement

- W1: Complementary activities – The activities 1 and 2 considered as VA can be performed together. Proposal for improvement: combine the two activities reducing the global PT and LT.

- W2: Wait and inventory: Between activities 2 and 3 there is a wait which can take up to four weeks with the formation of ITS stock for analysis, because the PEC only meets once a month for two hours. Hold two PEC meetings of one hour per month, halving the average waiting time and inventory. This increases the flow capacity of that which appears to be the only point where there is the formation of an in-process inventory.

- W3: Non-approval of an ITS – Activity 3 was evaluated as an NNVA. However, in rare cases an ITS is rejected because it does not meet the requirements and/or may not be aligned with the strategic objectives of the company in terms of product development or technology. Proposal for improvement: conduct training for engineers and designers in order to better prepare them for the requirements associated with the correct completion of the ITS form and guide the focus of the development of ideas.

- W4: Looping due to faulty or incomplete information – With a slightly higher frequency than in the case of W3, the PEC requests modifications to the ITS due to insufficient or poor quality information. Proposal for improvement: arrange systematic training for engineers and designers.

- W5: Waiting time – Activity 6 is an administrative activity with a low PT, however, currently there is a long LT due to waiting. The
wait is due to the time and date of the PEC meetings. These meetings take place on Fridays in the afternoon and end at the end of the day. Thus, the person responsible for activity 6 can perform it only on Monday of the following week. Proposal for improvement: anticipate the day of the week and change the CAP meeting time to the morning, enabling the delivery of approved ITSs to the providers on the same day.

- W6, W7 and W11: High process time – Activities 6, 7 and 11 are considered value-adding activities and they occur in the provider’s office. Thus, the internal PT is unknown. Proposal for improvement: taking as a basis the variation in the LT observed for a large group of ITS, clearly there is an opportunity to significantly reduce this time by means of specific actions taken to negotiate with current suppliers or find other suppliers.

- W8: Unnecessary activity – Activity 9 of the type NAV, despite having no significant LT, is not required. Proposal for improvement: the patent office sends the draft directly to the inventor(s) and a copy to the person responsible for the patent sector of Delta Company.

- W9 and W10: Faulty information and repetitive loops – Between activities 8 and 10 loops occur due to faulty information and a lack of standardization of the procedures carried out by the inventor and supplier. Clearly, only one looping between the two activities is expected, because it is a refinement for the preparation of the final text of the patent. The occurrence of more than one loop is considered waste. Proposal for improvement: draft checklist and conduct training for inventors with the participation of suppliers in order to clarify "what" the ITS should contain and "how" it should be written so that successive loops can be avoided.

**Future State VSM and Waste Reductions**

Based on the current VSM of the Delta Company's PAFP and the analysis related to identifying waste, the VSM was redesigned for a future condition considering the waste had been minimized by introducing changes or identifying potential changes and estimating the associated values. In this future state of the VSM of the Delta Company's PAFP, the number of activities in the value chain has been reduced from 12 to 10, as shown in Fig 5. Table 2 gives the redefined values for this new condition.

**Value Ratio of PAFP and Cycle Time**

The value ratio evaluates the time required to perform a chain of value added (VA) activities and is calculated by the expression:

$$\text{Value Ratio (VR)} = \frac{\text{Time required for value added (VA) activities}}{\text{Lead time (LT)}}$$

Based on the data in Tables 1 and 2, the value ratios for the current and future states (84.36% and 85.98%, respectively) are obtained and verified an improvement in the latter case.

In relation to the cycle time (CT), there was a decrease of approximately 45% (from 3.37 months to 1.85 months), mainly due to a considerable reduction in the waiting times. This can be observed in Fig 6, which shows a comparison between the times for the current and future states.

**Improving the Quality and Efficiency of the Process**

A series of actions, such as the training of inventors, standardization of documents and procedures and the awareness and commitment of people involved in the process, will allow an increase in the quality and completeness of the information and, thus, reduce the rates of reworking and non-approval of an ITS. With the proposed improvements in key value added (VA) activities the FPY is expected to increase from 44.32% to 85.74%, significantly improving the efficiency of the Delta Company’s PAFP.

**Results Achieved with Implementation of the Proposed Improvements in the Delta Company’s PAFP**

In this section, the results obtained with the implementation of the improvements proposed after identifying the waste in the current value stream mapping of the Delta Company PAFP are present.

- W1: Complementary activities - the proposal to join activities 1 and 2 was successfully applied considering the maturation of the process and people involved, as well as the inventors, ensuring the expected return;

- W2: Wait and inventory: the proposal to hold two monthly PEC meetings lasting 1h, instead of one monthly meeting lasting 2 h, considerably reduced the stock ITS, allowing a better balance of activities and flexibility in the dates for the submission of the ITS.

- W3: Non-approval of an ITS - With the introduction of a program for carrying out specific
regular training on how to search for previous registrations of patents, technical analysis and writing requirements for correct completion of the ITS form, the rates of non-approval fell to virtually zero. Furthermore, mechanisms for the verification and guidance for alignment of the ITS to the strategic objectives of the company were introduced to power its portfolio of patents;

- **W4:** Looping associated with faulty or incomplete information - The proposal to conduct training for the existing and potential inventors aimed at improving the development of an ITS had the desired effect. Moreover, in parallel, the Delta company introduced a computerized system providing an electronic version of the ITS form, which contributed to further reducing undesirable looping with the availability of fields which aid the completion of the form;
  - **W5:** Waiting time - The proposed anticipation of the day of the week and change in the frequency/duration of the PEC meetings, moving it to the morning, provided the expected gains;
  - **W6, W7 and W11:** High process time - The time of the relationship with current suppliers allowed closer contact and negotiations to take place aimed at significantly reducing the times associated with the development of an ITS and the preparation of the drafts for the patent applications, as well as the costs. Thus, it can be stated that the objectives were reached;
  - **W8:** Unnecessary activity - the proposal that the offices send the drafts for the patent applications
<table>
<thead>
<tr>
<th>ACTIVITIES</th>
<th>Area</th>
<th>PT</th>
<th>LT</th>
<th>VA</th>
<th>NNVA</th>
<th>NVA</th>
<th>WT</th>
<th>CT</th>
<th>FPY</th>
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<td>4.50</td>
<td>4.00</td>
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<td>0.35</td>
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<td>9 Patent text finalization</td>
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Total numbers 138.81 147.35 126.69 20.66 0.00 1.188.21 1.335.56 85.74%

Fig. 6– Application of VSM tool to Delta Company’s PAPF – Effect on the associated times
for technical approval directly to the inventors was not implemented. The company considered it important that the document continues to pass through the CPO for cost control.

- W9 and W10: Faulty information and repetitive loops - conducting training and the introduction of the computerized system required better discipline from the inventors in performing analysis tasks and sending any missing information, which resulted in a drop in the number of loops with a tendency towards even greater improvement.

Conclusion

The VSM was very useful for the investigation of the Delta Company’s PAFP, since it greatly helped the analysis process and the identification of opportunities for improvement. In this study, it was noted that the PAFP of the company investigated already had a high percentage of value added activities (around 84.36%). However, it was possible to propose and implement changes in order to further extend this performance, resulting in a value ratio of 85.98%.

Regarding the cycle time of the PAFP, the identification of several opportunities for reducing it was done, particularly those related to excessive waiting times between activities. Other factors included the lack of discipline and training of the inventors, inadequate frequency of the PEC meetings and excessive delays associated with the suppliers preparing the preliminary draft and the final text of the patent. The results of this study and their implementation provided excellent gains, reducing the ITS processing cycle time, with a patent being filed within 1.52 months improving the company’s potential to expand consistent size and strength of its patent portfolio.

Beyond the scope of the proposed objectives, a clear view of the value chain of the Delta Company’s PFPA was obtained. This indicated that the current structure can cope with the increasing demand for patent applications, because the processing capacity could be increased from 35 to 45 ITSs per year with an increase in the frequency of the PEC meetings. The exercise of applying the lean approach by using the value stream mapping tool in Delta Company verified that this is an important tool, enhancing our understanding of this value chain, in particular, allowing a rethink of the structured process as a whole, with its restrictions, unnecessary activities, inadequate flows and opportunities for improvement.

References

12. Kim Y K et al., Appropriate intellectual property protection and economic growth in countries at different levels of development, Research Policy, 41 (2) (2012) 358-375.
29 Rother M & Shook J, *Aprendendo a enxergar: Mapeando o fluxo de valor para agregar valor e eliminar o desperdício* (LeanInstitute Brazil, São Paulo, Brazil), 2003.
34 Schneider C, Fences and competition in patent races (*Centre for Economic and Business Research, Copenhagen Business School, Denmark*), 2005.