Application of Focus Groups and Learning Cycles on the A3 Thinking Methodology: the case of increasing machinery capacity at a steel plant

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Abstract

In recent years, companies have felt the need to expand their markets and their production capacity. One of the main methods used to acquire the necessary information in order to provide effective solutions is the A3 methodology. Therefore, this work aims to propose a complementary method to A3 for information collection, data analysis and knowledge capture and sharing to facilitate problem solving in a general framework. The incorporation of this method to the A3 methodology aims to minimize the difficulties identified in the literature focused on continuous improvement processes. The method comprises combining triangulation techniques utilizing Focus Groups for surveying qualitative data and the approach called LAMDA (Look-Ask-Model-Discuss-Act). The application of this method will be illustrated by means of a case study of a company in the steel industry, which is struggling to meet the demanding production volume in one of its workstations, becoming a production bottleneck due to existing losses.

Keywords
A3 Method, Focus groups, LAMDA

1. Introduction

To acquire the necessary information in order to provide effective solutions to problems, one of the main practices for identifying and solving problems is the A3 methodology, which has its origin in (Japanese automotive manufacturer headquartered in Toyota, Aichi, Japan) Toyota Motor Corporation Production System (Sobek II and Jimmerson, 2006) and widely uses quality tools (Campos, 2004). Despite being recognized as an aid tool for troubleshooting (Silva and Junior, 2011), the study by ISI (2010) has shown that none of the approximately 21,000 scientific articles focused on continuous improvement processes were specifically about the A3 methodology.

In addition to being already used in the manufacturing and services industries, there are also studies about the application of the A3 methodology in health care organizations, veterinary hospitals, aerospace sectors and in product development (Kimsey, 2010). Due to the these different applications, there is not a unique way for the A3 report, but it is possible to obtain a logical framework to plan, do, check and act, which is the PDCA approach (Plan-Do-Check-Act) (Filho and Calado, 2013). Among the advantages in its use is the fact that it is a communication tool that follows a logical, visual and standardized structure, assisting in the improvement of skills and knowledge of the individuals in the organization from the resolution of problems (Sobek and Smalley, 2008).

However, there are some limitations in the application of the A3 methodology. Oliveira and Nodari (2010) highlight some difficulties in its implementation, such as the tendency to omit steps in the analysis of the problems, incorrect identification of the problem to be solved, the collection of information relating to the situation in which the problem occurs and the capture and sharing of knowledge gained (Saad et al., 2013a). It is also noted that there are different perspectives on the same problem. This is due to the fact that each individual has their own assumptions, which vary according to their education and culture, hindering a consensus on the possible causes (Arantes, 2013).

This study aims to propose a complementary method to the A3 information collection, data analysis and capturing and sharing knowledge to facilitate problem solving in a general framework. The incorporation of this method minimizes the difficulties identified in the literature focused on continuous improvement of processes. The method comprises combining triangulation techniques utilizing Focus Groups for a survey of qualitative data (Ribeiro, 2003) and the approach presented by Ward (Domb and Redeka, 2009) called LAMDA (Look-Ask-Model-Discuss-Act), which was originally designed for cycles of knowledge creation applied in product development processes (Saad et al., 2013a). The application of this method will be illustrated in a case study of a steel company, which is struggling to meet the production volume demanded in one of its workstations. Thus, in order to identify the problems and design the solution and reflection processes, Focus Groups are applied in the phases of information gathering, planning and data analysis and the LAMDA learning cycle is applied at the end of the process, combining both to the A3 methodology.

2. A3 Methodology

The A3 methodology was developed by Toyota in the early 1960s as a technique to solve problems and promote continuous improvement, with strong influence on the results obtained by the company in the last 50 years (Saad et al., 2013a; Arantes and Giacaglia, 2013). Based on the 13th principle of the Toyota Model ("Make decisions slowly by consensus"), the A3 is a tool that describes how consensus on complex decisions can be efficiently achieved (Bassuk and Washington, 2013). The aim is thus to make that all people facing the problem, challenge or project see the issue to be resolved through the same lens: a single A3 sheet of paper (Ferro, 2009). It is a powerful tool that directs the problem solvers to a deeper understanding of the problem or opportunity, generating new ideas on how to tackle the problem (Sobek II and Smalley, 2008). It also provides learning and accumulation of knowledge, helping people learn how to learn (Silva and Junior, 2011). Thus, the concern is not only about the problems but also about the process of problem solving, in order to make it transparent and understandable, enabling the dissemination of knowledge throughout the organization (Filho and Calado, 2013).

A3 methodology allows that only the most critical information be shared, avoiding long reports which are difficult to view. Another key issue relates to a significant change in the people's mindset, since it aligns the efforts to organization's goals (Arantes and Giacaglia, 2013), and, therefore, a high level of involvement for obtaining results is important (Kimsey, 2010). According to Loyd et al. (2010), the differential of the A3 thinking is that it is not the format that matters, but the process that guides the user. Thus, there is no single way to report, but it is possible to obtain a logical structure for the PDCA (Filho and Calado, 2013). This cycle is so fundamental in Toyota's management philosophy that the A3 thinking is incorporated as a communication methodology that reinforces PDCA at all levels of the organization. The report, which must be read from the upper left to the lower right, shows on the left side the steps for planning, while the right side refers to the steps for Do, Check and Act. Numerous advantages and disadvantages with respect to the A3 method are mentioned in the literature (Oliveira and Nodari, 2010; Arantes and Giacaglia, 2013; Brandi et al., 2012; Sobek II and Jimmerson, 2006), as consolidated in Table 1.

Table 1: Advantages and disadvantages of the A3 methodology

Advantages	Disadvantages
It generates knowledge in all steps	There is a tendency to skip steps
It is transportable and easy to pin anywhere	It does not prevent participants to go straight to what they consider to be the problem
It standardizes a troubleshooting methodology	It allows participants to shape the report to fit what they believe to be the problem
It enables the solver to be even closer to his workstation	It raises insufficient data to support the arguments for troubleshooting
It is possible to arrange on a single sheet all the necessary information	The improvement standardization process is usually neglected by problem solvers
It forces a logical reasoning to the problems	Systematic dissemination of improvements and learning is difficult
It does not require major technological resources	It does not guarantee the existence of a reflection process over errors

3. Proposed Method

The methodology proposed in this work follows the A3 report approach including Focus Groups techniques (Ribeiro, 2003; Oliveira and Freitas, 1998) in the planning step and problem analysis, and the use of the LAMDA learning cycle (SAAD et al., 2013a), aiming to fill the gaps found in section 2. Therefore, the methodology includes five macro steps, which are divided into smaller steps. Note that the inclusion of the LAMDA learning cycle in the A3 report is called A3LAMDA. In addition, macro steps from 1 and 4 belong to "knowledge creation" step and macro step 5 deals with the "Capture of knowledge" step, as shown in Table 2. Along the proposed methodology application, greater focus will be given to techniques incorporated to the A3 report, since they represent the main contribution of this method.

Table 2: Proposed method’s macro steps and tools

Knowledge step	Macro step	Step	Tools	Reference
Creating knowledge	1. Planning	a) Context	Graphic tools	Ferro (2009)
		b) Current scenario	Focus groups, quantitative and qualitative analyses	Ribeiro and Newmann (2012), Tortorella et al. (2008), Neves (1996)
		c) Purpose	Graphic tools	Bassuk and Washington (2013), Brandi et al. (2012), Dyna et al. (2012)
		d) Cause analysis	Ishikawa, 5 whys	
	2. Do	e) Action plan	5W2H	
	3. Check	f) Indicators	Graphic tools	
	4. Act	g) Follow up		
Knowledge capture	5. Reflect	h) Reflection	AAR, interviews, one-point lessons	Ulonska and Welo (2013), Saad et al. (2013b), Domb and Radeka (2009)

The first step refers to problem contextualization, which is aligned with senior management’s objectives and defines the problem to be addressed by the problem solvers. Step (b) presents the current scenario analysis and involves four complementary stages: (i) observe the workplace; (ii) collect quantitative data, which will support the hypotheses formulation; (iii) qualitative research with people involved in the problem (Ribeiro and Newmann, 2012; Neves, 1996); and (iv) triangulation, in order to compare and complement the analysis (Tortorella et al., 2008). In Step (c), named purpose, the desired condition is set and agreed with the leadership. The cause analysis, which refers to step (d), problem’s direct causes are investigated and root causes raised. Such analyses are performed using the Ishikawa diagram tool (Bassuk and Washington, 2013; Brandi et al., 2012) and should include the participation of team members and leadership. Next, in step (e), a 5W2H (what, why, where, when, who, how, how much) plan is defined in order to act on the identified root causes (Dyna et al., 2012). Once the objectives and action plan are outlined, step (f) establishes the indicators that will be used to verify the effectiveness of the countermeasures and monitor their impact on desired goal. In step (g), a follow up routine must be agreed so any needed correction can be addressed. Finally, step (h) comprises a reflection about the work done and how to capture the knowledge generated so far, which is the structured based on the LAMDA cycle (Ulonska and Welo, 2013). It is noteworthy that this field can and must be completed at any time during the implementation of the steps. It is also important to document not only what went well but also what did not work as expected through brainstorming sessions (Domb and Radeka, 2009). This debate includes the participation of individuals involved in the problem solving process and it is documented using two reflection methods: (i) after action review (AAR), which registers learning from actions that were not successful (May, 2007); and (ii) one-point lessons, which assist in standardizing the knowledge generated from the actions that have met expectations (Saad et al., 2013b).

4. Case Study Results

The study demonstrates the application of the proposed method in a steel company in the machinery restoration department, where a machine overcapacity demand was forecasted for the upcoming months. The current scenario was initially defined based on 2-week observations at the workstation in two different shifts. Each operator's way of working was observed, besides the main losses occurred during the period. Significant differences were found from the observations, such as: (i) night shift presented fewer interruptions because there are no stops for meetings and less people; and (ii) experienced operators are approximately 10 minutes faster during machine changeover than newer operators.

Then, based on the collected quantitative data (delivery service, output and machine downtime) shown in Figure 1, the arguments for the hypotheses formulation were developed and the semi-structured questionnaire established in order to support the focus groups analysis. The qualitative data were grouped and compared to quantitative data for triangulation, whose results are presented in Table 3. From 19 possible causes for the problem, only 5 were identified in both qualitative and quantitative analysis.

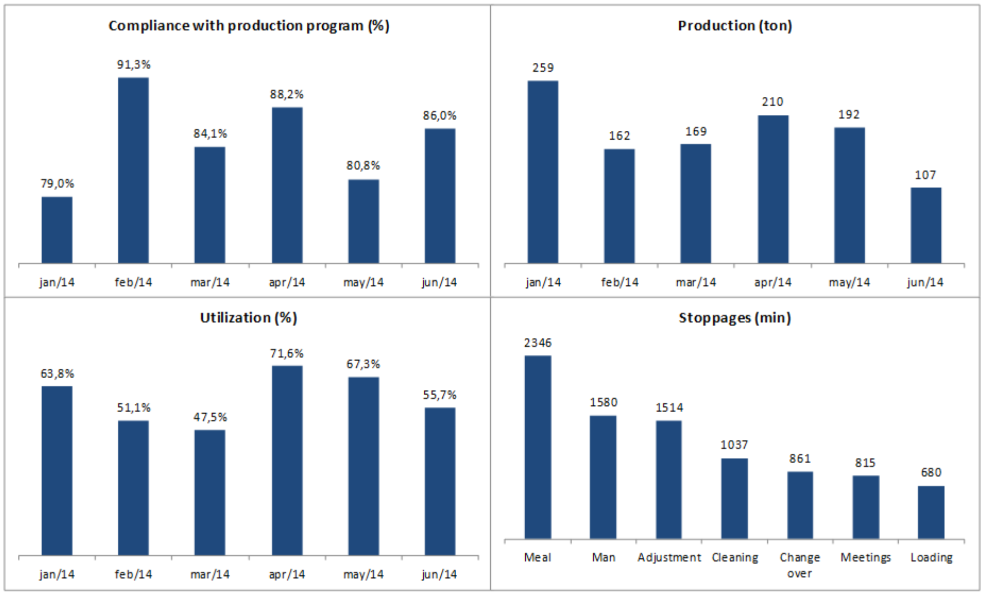

Figure 1. Company indicators

Considering both current situation and strategic plan, the goal for increasing the delivery service was set from 85% to 90% as shown on Figure 2. Further, 24 direct causes of the problem were identified, being 2 of them related to raw material, 2 to labor, 8 to machine, 2 to measurement, 10 to method and 9 to environment. Thus, an action plan was addressed, based on 5W2H tool, with completion proposed for within five months. This plan was reviewed by all participants, so that everyone agreed with the planned actions and the deadlines set. Regarding the indicators to track project results, fulfillment of production orders and equipment availability were chosen and monitored by the workstation leadership during three months after completion of all actions.

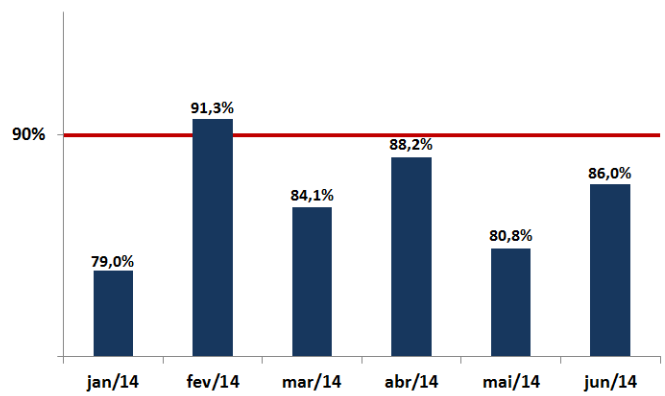

Figure 2. Observed and target delivery service

Table 3: Qualitative and quantitative data triangulation analysis

Possible causes of the problem	Focus groups (qualitative)	Indicators (quantitative)
Important items were not available in stock for exchange for maintenance	X	X
The machine must be stopped so that the material is taken to be cut with a saw	X	
The exchange is time consuming	X	X
The material usually gets from the previous process with warped tips	X	
There is no container to put scraps in and it is necessary to take the scraps for disposal every time they appear	X	
The machine must be stopped so that each beam is taken to the packaging area	X	
The current device does not facilitate the exchange of the edging wheel (time and safety)	X	
Lack of preventive maintenance	X	X
The registered processing times do not match reality	X	X
Difficulties for fixing the prism during the exchange	X	
Movement time loss to get the necessary tools during the exchange	X	
Often the crane is not available	X	X
Any material movement should be done with the crane	X	
High occurrence of the need to pass one more time than what is indicated by the standard, because of the quality of the material coming from the previous process	X	
The table and prism height adjustment must be reset during the process	X	
Fine adjustments are made according to the operator's sensitivity and experience	X	
Shearing of the splined shaft of the traction pulley of the edging wheel of the machinery restoration	X	
Breaking the cardan shaft	X	
Wear and tear of the ball bearing of the edging wheel	X	

Finally, a reflection over the positive and negative outcomes was consolidated. At the end of each step, AAR meetings took place with all participants to review the activities carried out so far. The main positive aspects noticed were: (i) implement preventive maintenance and (ii) delegate certain tasks to other machinery operators. The negative aspects highlighted were: (i) actions that require high level of investment and (ii) critical amount of actions targeted within the deadline. Knowledge dissemination was done through the elaboration of one-point lessons for each relevant improvement implemented during the process and posted at point of use, so operators could consult them whenever needed.

5. Conclusion

This study was intended to complement the A3 troubleshooting method, by implementing two other methods: focus groups and the LAMDA learning cycle. From these approaches, it was sought to solve the capacity problem of two machines of a steel company. The work performed showed positive results, not only for achieving the proposed objective, which was about a 90% increase in compliance to the program, but also for having satisfactorily enhanced the usual problem solving framework presented in literature. The proposed approach to the A3 report was more concise and comprehensive, allowing different views and perspectives to be considered to understand the problem and find solutions through focus groups method. In addition, the development of a structured questionnaire for the interviews encouraged the participants to present their opinions regarding the problem hypotheses.

Considering that knowledge management is based on the management and sharing of all information assets, the use of the LAMDA learning cycle was essential to capture and share the knowledge acquired during the problem solving process. It allowed not only the reflection on the aspects that have worked or not, but to understand how to do the next work differently. However, some difficulty was found in bringing together all members to report the completion and/or discussion of the different method steps.

It is noteworthy that, unlike the usual applied method, A3 reports do not require major technological resources, and can be sketched with pencil and paper; there is no need to access computers to manage data. This has enabled the leadership to be as close as possible to the job site and the operation and maintenance to have easy access to data.

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Biography

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