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Opportunities and barriers in the use of Toyota Kata: a bibliographic analysis

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ABSTRACT

There is a gap in the literature regarding the opportunities and barriers in using Toyota Kata routines, which clarify some obscure aspects of Toyota. Thus, the objective of this article is to identify, through a theoretical, mixed, descriptive and bibliographical research, carried out through a systematic literature review, the opportunities and barriers found in the use of these routines. As these aspects are very specific, our results suggest that the main barriers encountered in various contexts are: 1 - lack of direction and environmental preparedness (awareness), 2 - lack of value stream map, and 3 - lack of meetings Coaching Kata In addition, the main opportunities were: 1 - short cycles, 2 - knowledge sharing, and 3 - adaptability. Thus, it can be concluded that these opportunities and barriers not only in manufacturing make Toyota Kata deployment less natural, but can be solved with simple actions, so future deployments do not go through the same problems as well, future works can empirically prove whether or not they are recurrent.

***Keywords**: Toyota Kata. Opportunities. Barriers. Literature review.*

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1. INTRODUCTION

Throughout the years, companies aiming at eliminating their waste have constantly adopted the Lean approach as a way to reach this goal. However, these same companies, as seen in literature, have failed in not understanding that Lean is not a group of tools that can be copied in the way it is used in Toyota.

This approach, as it has in its essence non-visible things, such as routines, behaviors, scientific and systemic thoughts, among others, in a nutshell, ends up being a flexible and changeable framework, in a way to avoid and/or reduce waste, as well as, improve value delivery to the clients (ROTHER, 2010; LIKER, 2016).

The evidence in the literature capable of understanding and explaining why these initiatives of using Lean around the world result in failure are rare. However, some studies may begin to solve this mystery. Rother (2010) showed in this study two routines that the precursors of the lean approach uses in its everyday, capable of explaining in a detail form why most companies outside Japan end up getting frustrated in the attempt to use Lean as a group of tools. To Rother (2010) and Liker and Meier (2007), the base of all are the people, and how they can establish a culture of continuous improvement through routines and critical and scientific thought, acting everyday on the solution of problems and value aggregation.

However, even though Toyota Kata routines are treated and elucidated in current literature, even in embryonic form, there is still a gap regarding opportunities and barriers found in the implementation of such routines.

This way, this study aims at approaching and explaining which the main barriers and opportunities are in the usage of Toyota Kata routines, in order to enable future implementation of such routines to be more natural, diminishing the learning curve.

2. THEORETICAL REFERENCE

2.1 Toyota Kata

Toyota Kata is divided into two continuous and integrated routines that invariably make people who use them, foment the critical and scientific thought, and, this way, may learn new things each day.

Before describing and elucidating the concepts related to Toyota Kata routine, it is important to take a step back and explain primarily the concept of Kata.

In ancient Japan, the concept of Kata comes mainly in the basic, repetitive and standard forms form martial arts. However, some derivations from this concept may be found in Rother (2010, p. 32) and Rother and Aulinger (2017):

- A way to do something, a method or routine
- A standard
- A standard way of movement
- A pre-defined or choreographic sequence
- A usual procedure
- A training method or exercise
- A way to do something, a general standard
- A small and structured practice routine.

To learn, subsequently, how to combine these routines of individual practice are a way to develop competence in general or standard of doing something.

Although these definitions are adequate and similar, Rother (2010, p. 32, 33) explains a more appropriate Kata approach to Toyota vision, and that comes to meet this study, being “a way to maintain two things align or in sync with a third. [...] a Kata means a way to maintain your thoughts and actions in sync with dynamic and unpredictable conditions".

Another important point to be analyzed is that Kata routines are different from principles. While a principle helps in the choice, routine shows how something is done. This way, Rother (2010, p. 33, 34) points out some Kata principles, which are used to continuous improvement and adaptation, being them:

• The method works, in particular, in the process level. Being in the nature, or in a human organization, the improvement and adaptation seems to occur in the detail or in the process level. It may need to think and to plan higher levels, as in eliminate hunger or developing a small and lucrative car, but the changes that at the end of the day lead to improvement and to adaptation are, frequently, changes in details, having as base lessons learned in the processes.

• If the purpose is to improve each process daily, then kata is implied and inseparable from daily work in these processes. Kata routines have become a way in which we work throughout our day.

• Since human beings do not have the capacity to predict what is yet to come, the method that generates improvement and adaptation has neutral content, which means, it is applicable to any situation. The method, the procedure, is described, but the content is not.

• Once the judgment is not exact or impartial, the method is based, whenever possible, in facts and not in opinions or judgments. In other words, it is unpersonalized.

• The improvement method is beyond any possession of any leader. All in the organization work accordingly, regardless who is in charge at the moment.

Based on Kata definition previously described, and on the differentiation of principles from routines, the next step is to better understand what these routines are.

This way, to better detail these routines, they were divided in order to structure the knowledge explained by them.

2.1. Improvement Kata

First, the meaning of the word Kata must be understood, which means shape or standard. This way, Improvement Kata is a synonym for Improvement Standard, Rother (2010, p. 34) explains Improvement Kata as:

> [...] the repeated routine for which Toyota has improved, adapted and evolved. This Improvement Kata adjusts precisely to the announced attributes above and provides a highly efficient model of how people may work together in a group, which is, how to manage an organization.

Improvement Kata encourages the search for constant improvement, as shown in Figure 1. It may be understood that the search for constant improvement, which is, the relentless search for improvement, is a synonym for the search for perfection, and this way, Improvement Kata is used as a routine for the search of evolution in all the organization (WOMACK; JONES, 2004; OSONO; SHIMIZU; TAKEUCHI, 2008; ROTHER, 2010).

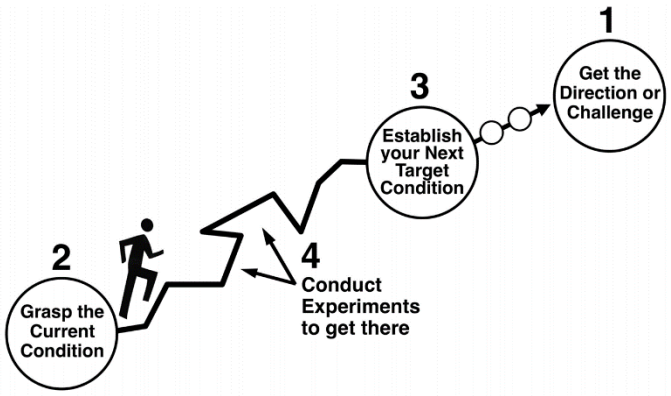
As shown in Figure 1, the routine starts with the challenge definition, this challenge is directly linked to the client's needs. The prioritization and definition of direction to follow has

made Toyota competitive throughout the years (OSONO; SHIMIZU; TAKEUCHI, 2008; ROTHER, 2010; ROTHER; AULINGER, 2017).

The definition of the direction to follow is very important so the efforts for improvement can reach the root causes of the identified problems. When the establish direction is uncertain the route to follow between Current Condition and Target Condition will be unpredictable (ROTHER, 2010; ROTHER; AULINGER, 2017).

The second step is the comprehension of the Current Condition. The comprehension will come through an understanding of the problematic, which means, the gaps of results. Identifying behaviors that allow for the problem to occur. The knowledge developed by the greater understanding of the problematic is shared to the following members of the organization, this way, preventing rework and everybody learns, diminishing the gap (ROTHER, 2010; ROTHER; AULINGER, 2017).

Figure 1 – Improvement Kata



Source: Adapted from Rother and Aulinger (2017).

The following step, as shown in Figure 1, is the establishment of the Target-Condition, which may be understood as the desired state in which the obstacles have been overcome. This target state must be tangible and clear for everyone in the organization, and whenever possible linked to the process, with quantified data to verify the improvement (ROTHER, 2010; EHNI; KERSTEN, 2015; ROTHER; AULINGER, 2017). In Toyota, the garget-condition is determined from the observation of the gemba, understanding the Current Condition of the process and connecting the process with the company's direction

Finally, the last part of the routine is the application of the PDCA cycle continuously, in order to resolve all the obstacles in the way for the daily search to leave the Current Condition to the Target-Condition. It is important to highlight that usually the way to go through between the Current Condition to the target is obscure (ROTHER, 2010).

Invariably, the reality, being in Toyota or any other organization, will hardly be linear or predictable. This way, a method capable of attending all types of problem in a structured form is needed, that why the usage of the PDCA (ROTHER, 2010).

2.2. Coaching Kata

With a better understanding about the routine of Improvement Kata, the next step will be the detailing of Coaching Kata routine, which Toyota uses to share and strengthen the philosophy of continuous improvement (ROTHER, 2010).

As previously described, Improvement Kata is responsible for fomenting the continuous improvement in all organization. Thus, Coaching Kata is responsible for clarifying Improvement Kata for all in the organization, and also, to share the gained knowledge (OSONO; SHIMIZU; TAKEUCHI, 2008; ROTHER, 2010).

The routine of Coaching Kata for Toyota is the way in which the Coach helps and shares his/her knowledge to the apprentice, in order to make him/her capable of thinking scientifically and learning the way Toyota to solve the problems, so that, in the future, the apprentice can have the competence to be a Coach (ROTHER, 2010).

This routine suggests that the apprentice share with the Coach all the actions performed, and lessons learned during the search for the Target-Condition, in a way that the understanding of the apprentice about the improvement routine becomes holistic. With that, the knowledge is shared and spread. Since everyone in Toyota has a Coach, the relationship between Coach and apprentice follows the principle of Yokoten, which means, the transversal sharing of the acquired knowledge, in order to reach the main benefit of routines, which is learning (OSONO; SHIMIZU; TAKEUCHI, 2008; ROTHER, 2010).

To apply this routine successfully, an internalization is necessary. Toyota manages this by using the Coach's figure, where everybody in the company has one. This approach is

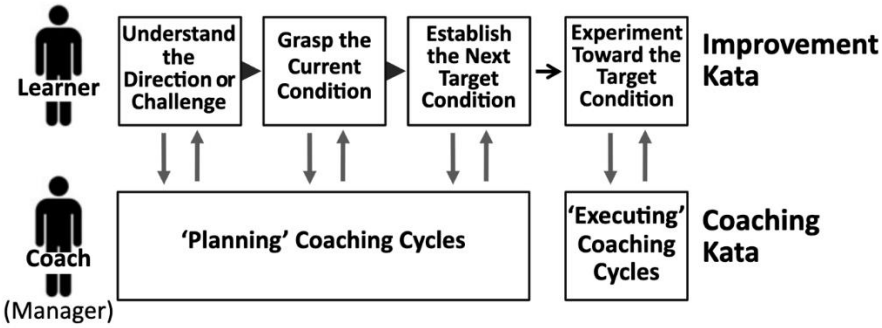
extremely valuable because it supports the following learning principles (LIKER; MEIER, 2007):

- ✓ Small steps are given through a long path,
- ✓ The Coach is responsible for sharing knowledge
- ✓ The process of learning is through hands-on practice,
- ✓ The learning of PDCA cycles are posterior standardized

Figure 2 explains how the two routines are intimately linked. These connections are given mainly during the application of PDCA cycles, where 5 questions should be answered.

In this moment, the interaction between apprentice and Coach is more intense, due to the daily steps of PDCA, which are analyzed and measured, with the purpose of determining how the learning process by the apprentice is being developed in the search of the Target-Condition, and what the reactions of the apprentice facing the obstacles are. (ROTHER, 2010; ROTHER; AULINGER, 2017).

Figure 2 – Relation between Improvement Kata and Coaching Kata



Source: Adapted from Rother (2010).

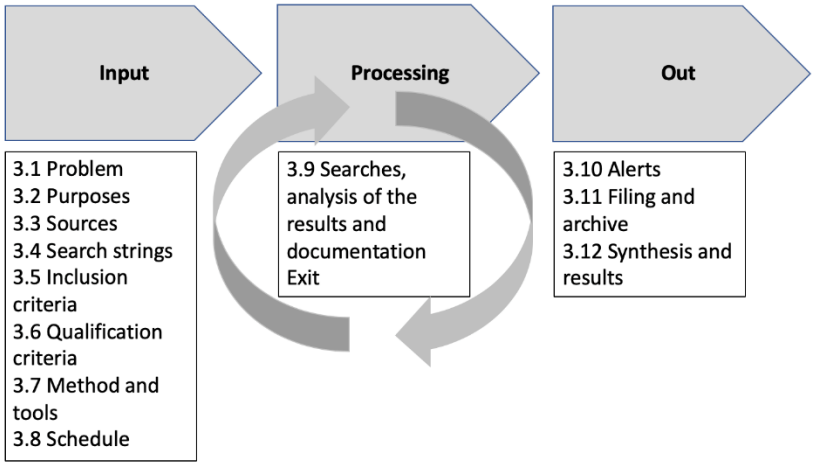
With the concepts of Toyota Kata being explained, their relationships, their respective operations and illustrations, the following topic aims at elucidating how the methodology procedure of the research occurred.

3. METHODOLOGICAL PROCEDURES

This methodology will be based on a Systematic Bibliographic Review (SBR). Through the SBR, studies found in the literature will be analyzed referring to the topics of the present article associated to Toyota Kata.

This way, this topic details the development of SBR. As seen in Figure 3, the SBR has steps for its application, and those will be detailed to clarify the findings.

Figure 3 – SBR Roadmap



Source: Adapted from Conforto, Amaral and Silva (2011).

3.1. Problem

Question of the study: what are the main opportunities and barriers found in the use of Toyota Kata routine?

Hypothesis: the main barriers and opportunities in the use of Toyota Kata are directly linked to the lack of behaviors and lean habits of people, as well as the low Lean culture.

3.2. Purposes

The purposes raised by the SBR were the following:

- ✓ Identify studies that implemented Toyota Kata empirically.
- ✓ Identify barriers and opportunities in the implementation of Toyota Kata routine.

3.3. Primary sources

The primary sources for this study were the following: Scopus, by being the largest base of knowledge currently indexed, Web of Science (WOS), by being one of the most recognized bases of knowledge in the academic world and Capes Periodicals Portal, since it is a reference base of knowledge in Brazil. Besides that, searches were performed in physical library in order to complement the cited literature by the authors of the preliminary results.

3.4. Search strings

After the analysis of the primary sources, the search strings were defined in a way not to limit the research base, being used: (kata) AND (improvement OR coaching) AND (Toyota).

3.5. Inclusion criteria

Due to the problem of the research and aiming at finding studies that involved the theoretical part regarding Toyota Kata routine, as well as the empiric part of its application, the criteria regarding inclusion of studies at first is the goal of traditional revisions, research-action and case studies.

These studies are from either periodical, conferences, conceptual and referred books on the theme. Since the themes are still new, it was chosen to include only studies that were submitted to peer review. The selected languages were English and Portuguese.

At last, as exclusion criteria, it was chosen to withdraw studies that mentioned Kata linked to martial arts, medicinal areas, or other areas that applied ancient Kata, not the routines Toyota Kata used by Toyota.

3.6. Qualifying criteria

Regarding qualifying of the studies, it was chosen to identify the quantity of citations, the JCR factor, as well as the Qualis-Capes of the periodical/event of the publication in order to identify if these were more or less relevant. These items are in the RBS file for better identification.

3.7. Method and tools

The search method and the used tools followed an adaptation of Conforto, Amaral and Silva (2011), to better understand the results. Only one file was used to facilitate all management. This file was separated by 3 spreadsheets in order to characterize the RBS filters, the same way it is done in the Mendeley tool (2018).

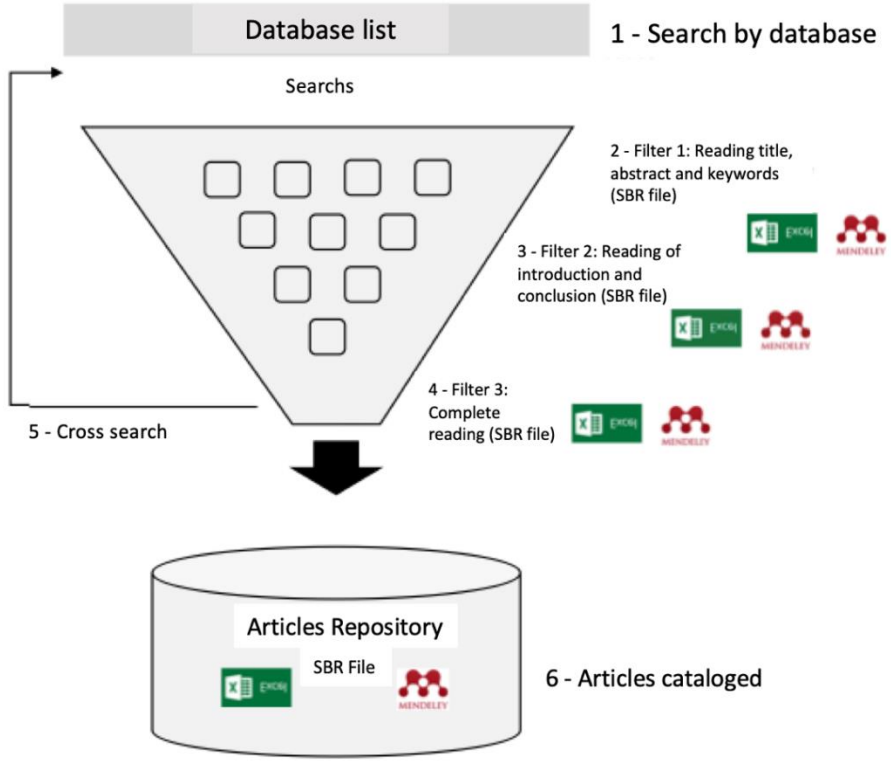
3.8. Schedule

For this revision it was established a period of 12 months for finishing, starting from March 2017.

3.9. Search, analysis of the results and documentation

The search steps, analysis of the results and documentation follow a 6-step flow adapted from the method proposed by Conforto, Amaral and Silva (2011), according to Figure 4.

Figure 4 – RBS Process



Source: Adapted from Conforto, Amaral and Silva (2011).

In the first step, the searches are performed in the steps 1 and 5. In the second step, the reading and analysis of the results are performed, steps 2, 3 and 4. In the third step, steps 2, 3, 4 and 6 steps are performed and also the study registry resulting of each filter.

The data registered in the RBS file and using the Mendeley (2018) tool are important to refine the search and subsequently will be useful for the theoretical argumentation, sum up basis of the theory and for the screening of the sources.

3.10. Alerts

In order to maintain this theme updated after the ending of the schedule, alerts were inserted in the already cited bases regarding the studied themes that went through the three RBS filters, so that whenever a relevant study was identified in this base, it was possible the knowledge and posterior study of it.

3.11. Registration and filing

The registry and filing of the studies submitted to the RBS filters was performed in the RBS file and in an analysis tool (MENDELEY, 2018), in order to guarantee their registration and screening.

3.12. Synthesis and results

This step has the purpose of explaining the knowledge over the issues addressed that were found during the application of the RBS. The search was developed through an oriented RBS regarding search on theory and practice of Toyota Kata routines. The keywords previously described were: "kata", "improvement", "coaching" e "Toyota".

This way, the first research was performed using Scopus, WOS and Capes on April 3rd., 2017, using the following filter of keywords: "kata". The sample of results showed 901 studies in the Scopus base, 584 in the WOS and 27139 in Capes.

After this result, the following keywords were inserted to continue the search: "improvement" or "coaching" or "Toyota". With that, the search came up with the following results: 43 studies at Scopus, 22 in the WOS, and 15 from Capes, totaling 80 articles.

This way, the article upload was performed using a specific tool (MENDELEY, 2018), to exclude possible duplicated results, totaling 63 articles for the analysis. Then, the filters that support RBS were performed.

Filter 1: Analysis of the title, abstract and keywords, to identify the connection with the desired themes, remaining after this step only 15 articles with the respective compliance to the purpose of the present article. The exclusion criteria used was to withdraw articles that mentioned Kata as a martial art, as well as studies regarding medicinal areas, and other areas, that did not refer to the purposes of this present study: the Toyota Kata routines. Since after this filter many studies were withdrawn, it was chosen to mention the 15 remaining, being the following: Casten (2013), Ehni and Kersten (2015), Iberle (2015), Kersten, Ehni and Hein (2015), Light (2015), Masai, Parrend and Zanni-Merk (2015), Merguerian (2015), Reverol (2012), Sagalovsky (2015), Soltero (2011), Soltero (2012a), Soltero (2012b), Tillmann, Ballard and Tommelein (2014), Toivonen (2015), Villalba-Diez, Ordieres-Meré and Rubio-Valdehita (2016).

Filter 2: Reading of the introduction and conclusion. After the complementary reading of the introduction and conclusion, another article was withdrawn, (Light, 2015), since it did not mention the use of Toyota Kata routines.

Filter 3: Finally, after the first two analysis, the last step was the complete reading of each article to confirm the compliance to the researched themes, remaining only 11. In this phase, the purpose was to withdraw the studied that did not explain any type of opportunity or barrier in the use of Toyota Kata routine. In this point, the following articles were removed from the study: Kersten, Ehni and Hein (2015), Masai, Parrend and Zanni-Merk (2015), Sagalovsky (2015).

Facing the results, Table 1 shows in an objective way a summary of RBS regarding the desired aspects in this study.

Table 1 – RBS Summary

Authors	Year	Implementation model	Opportunities	Barriers
Soltero, C.	2011	None	Adaptability; Integration between TWI and Toyota Kata	Lack of a value screening flow
Soltero, C.	2012a	None	Foment an innovation culture through all the organization; Approach continuous improvement, being bias on the innovation to the external client	Lack of experimentation with the client; lack of value screening flow
Soltero, C.	2012b	None	Creative inspiration; Standard process of problem solution; Improvement in behavior patterns; Impact of the improvement; Short cycles in the use of Improvement Kata	Lack of value screening flow
Reverol, J.	2012	None	Implementation of Coaching Kata which may facilitate implementation of other Katas; The pre-work may significant the success of the implementation of the Toyota Kata routines; Develop more adaptable and valuable collaborators to the organization	Prepare the company's strategy and identify the value chain before applying Toyota Kata; Appropriate time for the coach and apprentice work Coaching Kata; not follow the routine steps of Toyota Kata as proposed in the literature
Casten, et al.	2013	None	Sharing of knowledge; Learning routine and constant improvement; Development of leaderships; Adaptability	Preparation of the environment in the construction industry is different and even outlooked; compared to the environmental of manufacturer; Need of greater experimentation of Toyota Kata routines
Tillmann, P; Ballard, G; Tommelein, I.	2014	None	Collaborative environment; Development of leadership; Creation of an environment with psychological safety	Lack of consensus in the team in the use of routines and methods; Conflict of interest between those who support and those who do not support the initiative
Toivonen, T.	2015	None	Oppose the cognitive prejudice; Creates alignment in the organization from strategic level to operational level; Involves the staff through common challenges and frequent success regarding it; The common approach , the improvement and managing facilitates collaboration effective collaboration in all organization;	Creates pressure on the Coaches, who should be very competent in the method of teaching to make it accessible for all in the organization. The amount of work to create a sustainable level of competence and support culture.

			Fractal implementation allows the usage of collective intelligence in the organizations for continuous improvement techniques; A bigger number of more creative ideas to solve problems; A systemic approach to understand the efforts of improvement to the intangible aspects, which are currently more important in industries; A systemic approach to many of the difficult parts from Toyota Kata routines, how to comprehend the current situation and choose the right challenge	
Merguerian, et al.	2015	None	Apply Toyota Kata first in the process that aggregate value; Automatize the collect and the process to improve the exposed indexes.	Collect data manually; Manual processes; Not all the collaborators were included for the cost estimate
Iberle, K.	2015	None	Short steps in the PDCA cycles fit better in the workload of people; Coaching meeting 2 to 3 times a week; The questions in the coaching Kata push the coach and the apprentice in the right direction.	Low quality in the formation of hypothesis; Lack of consistence in describing knowledge; Meetings not being short and in regular schedule; Lack of constant meetings between coach and apprentice; Lack of verifying in the gemba; Coaching meeting only once a week
Ehni, M; Kersten, W.	2015	Rother (2010) and Bleicher (2011)	Definition of target-condition; Using Hoshin Kanri; Using value flow map	
Villalba-Diez et al.	2016	None		Lack of using PDCA in systemic form

Source: Elaborate by the authors (2019).

As seen in the RBS summary, it can be identified two main points for analysis and use of this study, being them: the opportunities that were related during the use, as well as, the barriers that were found.

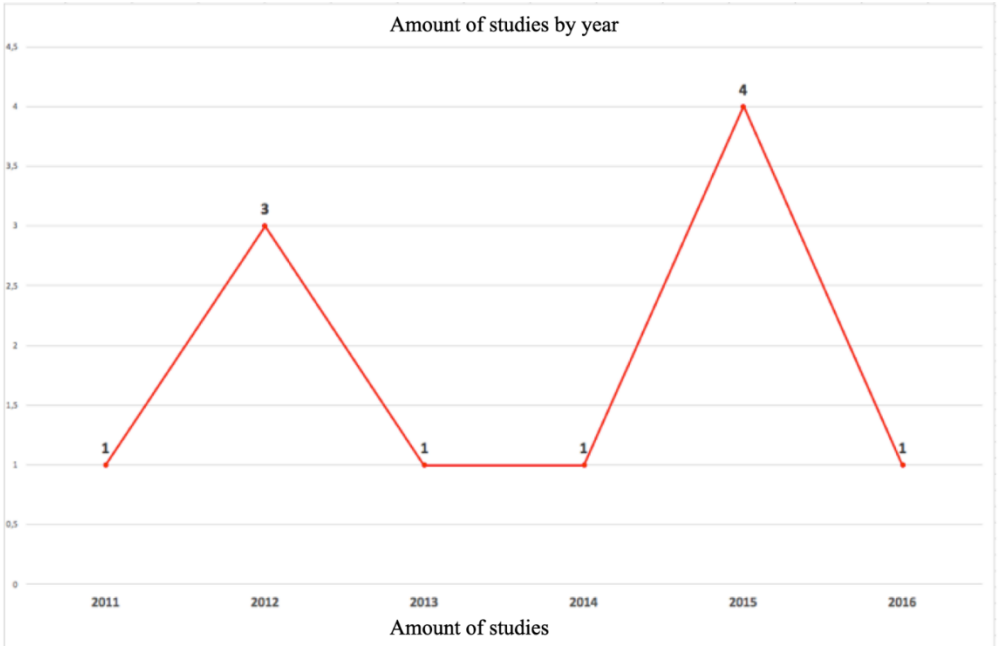
4. RESULTS

According to the RBS studies, Toyota Kata when applied is a continuous improvement mechanism within the organizations (REVEROL, 2012). It involves people in a routine of problem-solving, which improves the number of suggested solutions and consequently, the

probability of prioritized success (TOIVONEN, 2015). Some characteristics allow the success from Kata initiatives, which are the focus on processes, the use of metrics and the definition of the correct challenge (IBERLE, 2015).

As seen in RBS, through Figure 5, the studies that approach Toyota Kata implementation and their opportunities and barriers are quite recent, having their peak in the year 2015.

Figure 5 – Studies by year



Source: Elaborated by authors (2019).

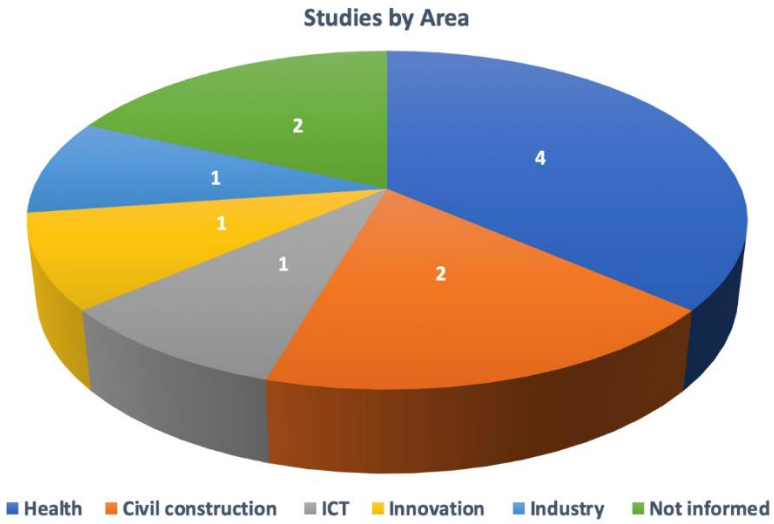
In the area of TIC there is pressure on the trainers of the team, considered as a barrier, but the company's alignment goes from the strategic level to operational level, which can facilitate the implementation of Toyota Kata.

In the area of health, the main difficulty is in the non-automation of the processes and data collection, the opportunity is the clear prioritizing of the processes.

Regarding Innovation, continuous improvement is part of the culture, being a great opportunity, but the lack of a Value Flow Map (VFM) complicates a systemic look over the organization.

Figure 6 shows which are the main areas where the review studies were found. Thus, as can be seen, the area where Toyota Kata's application stands out most is health.

Figure 6 – Studies by area



Source: Elaborated by the authors (2019).

Facing the RBS summary, as well as the found results, it can be verified that the theme is relatively new and still little considered in the literature. The found studies, as seen, are not summaries of only a market segment, but the main application of the Kata routines are more frequent in the areas of health and industry, maybe because these areas are the ones that most apply Lean in a general way in all the world.

5. DISCUSSIONS

Based on the found results, the next step is to discuss about them in a way to generate scientific contribution on the respective themes of this study.

This way, in the study of Tillmann, Ballard and Tommelein (2014), the authors approach the introduction of the lean concepts and the compliance of all the members of the staff, introducing the lean behaviors through tutoring, using the Toyota Kata routines. The authors mentioned that to develop the desired lean behaviors in the team was one of the main purposes of this intervention, which included: (a) to create a capacity to solve problems in a guilty-free

environment; (b) to focus on learning and continuous improvement; (c) Capacity to recognize problems and to work on the solution as a team; and (d) to unite learning with action.

Tillmann, Ballard and Tommelein (2014), hypothesize four possibilities of cause and effect with the final purpose of changing the behavior of the team through Toyta Kata routines, being them: (a) opening of the team for change (acceptance to get involved in the effort of the research); (b) change in the use of language; (c) change in the comprehension (capacity to understand the problem systemically considering the contribution of other members); and (d) change in the behavior (attempt of the team to unite learning to action).

Basing on these four hypotheses, the authors applied Toyota Kata routines in order to verify the behavior in each one of them, and then validate them or not. Basing on the application of the routines, the authors came to the following results: 1) it is important the compliance of the more relevant interested parts in the developing of efforts of continuous improvement; 2) to apply practices that aggregate value to the respective teams through mentoring and coaching is fundamental; 3) frequent meeting with the team help in the identification of the problems quickly, compliance and improvement in planning; and 4) the solution of problems when it is performed hand-on with the team allows better learning (TILLMANN; BALLARD; TOMMELEIN, 2014).

In the same way that in the study of Tillmann, Ballard and Tommelein (2014), the study of Casten *et al*. (2013), also contemplates the use of Toyota Kata routines in the area of Lean Construction. The authors in that study had a smaller focus than the study of Tillmann, Ballard and Tommelein (2014), however, the intention was to improve significantly the production environment conditions at the level of the staff, using for that the Toyota Kata routines. The main purpose was to make clear for the team the vision of the current state of the team and the desired state, regarding the work environment in which they were inserted.

With the application of the Kata routines, the authors obtained significant results not only in the clear vision between point “A” and “B”, as well as the improvement of the abilities, in the mindset and the culture of the involved team. However, they presented three very clear challenges, being them: 1) to provide technical teams with high quality attributions; 2) to provide to the team a safe work environment; and 3) to promote a high-quality working area To each of one of these challenges, their respective conditions were established, current and target,

to posterior perform the experimentation in the direction of the Target-Condition (CASTEN *et al.*, 2013).

As direct results the authors mentioned the following: a) the implementation of Toyota Kata is not delegated, which is, should be leaded by the senior leader with full support and comprehension of the concepts of the view of production, current conditions, condition-target, the Kata itself and the necessary time to put it in action; b) whether an organization chooses to incorporate or not Toyota Kata in its organization, it is strongly suggested to define and to align the company to the vision used by Toyota; c) reserve some time to audit and fully understand the current conditions of the production environment and processes of product assembling. Only having first hand a vision of the production and a solid comprehension of the current work conditions is that a company can start defining challenges and/ir target-conditions that are at service of the vision itself; d0 to standardize the expectations and to create conversations around the target-conditions, in opposite of pressure and anxiety over the vague purposes of performance. Katas provide structure to break barriers to coaching and to collaborative intervention and, at last, a standard way of thinking and talking in all organization; e) Katas create a new level of awareness and feedback (through a continuous "go and see"). This takes to new, more serious and collaborative discussions regarding what should be done and the commitments to do so; f) The satisfaction of the assumed commitments between team and management gives credibility to all Kata concept; g) Katas clearly provide a positive way to remove lack of transparency between team and management regarding continuous improvement in a new and refreshing way. The conversations and habits created by the initial Katas use have created a very positive environment and improvement in processes culture (CASTEN et al., 2013).

In the work of Toivonen (2015), the author approaches the integration of practices of TRIZ Toyota Kata routines for continuous improvement. The author explains five direct purposes that intends with the application of TRIZ with Kata routines, being them: 1) to offer a holistic and systematic way so that an organization pursuits the organizational vision in all the organization levels with all the participants; 2) to align the vision and common challenges to the individual activities of improvement and innovation; 3) to offer an effective and systematic way of teaching and training the method so that everyone in the organization

participate in a sustainable way in the efforts of improvement; 4) to generate creative improvement, using the resources effectively and offering significant benefits regarding the anterior solutions; 5) to allow a rapid validation and implementation of innovating ideas.

This way, Toivonen (2015) relates the main pros and cons of the integration of practices with the routines in the context of improvement and innovation, as followed: a) a higher number of more creative ideas to solve problems; b) a systematic approach to understand the efforts of improvement to intangible aspects, which are each day more important in many industries nowadays; c) a systematic approach to many of the difficult parts in Toyota Kata, such as comprehending the current situation and choosing the right challenge; d) ads more complexity when compared to the traditional Toyota Kata model; e) pressure on the Coaches, who should be very competent in teaching the method in order to make it accessible for everybody in the organization; f) the quantity of work to create a sustainable level of competence and culture of support.

Reverol (2012) relates the importance of using the Coaching Kata routine to implement other types of Kata, such as improvement, solution of problems, among others. However, the author takes a step before, and explains also the importance of the definition of an adequate strategy of the organization. In the words of (2012, p. 2) “trying to implement continuous improvement in an organization without having a clear and defined vision is like driving your car without knowing your destination: you are only wasting gas”.

Another important point that some authors approach is the use of value screening flow, in order to make visible and clear the current state of the process. This way, the process can be evaluated in the intention of creating the desired effect, which will be the challenge of this process (REVEROL, 2012; EHNI; KERSTEN, 2015).

To some authors, the Coaching Kata routine can be seen as an accelerated learning way that supports improving performance. The author reveals that it is crucial for any organization that the search for the incorporation of the continuous improvement culture the implementation of Coaching Kata, as well as the pre-work, cited by the same author, being it the clear definition of vision (Hoshin Kanri), as well as the department challenges (MFV) (SOLTERO, 2011, 2012a, 2012b; REVEROL, 2012; EHNI; KERSTEN, 2015).

In addition, Reverol (2012) states that management should certify that the desired change was communicated and properly managed, as well as that both Coach and Apprentice have time to act in the Kata routine activities, preferably daily. The author finishes by saying that the well-succeeded implementation based on this proposition, will create more valuable and adaptable workers that can change the organization for the best.

Merguerian *et al.* (2015) applied Kata routines in the area of health, also known as Lean Helathcare. The authors applied the routines in order to improve the results of operational efficiency, as well as, the value of clients of the clinic in which they work in. This delivered value was measured through two variables: the quality of the service in each step of the clinical preparation, measured through the time delivered through the time to perform a duty, the number of attended patients, the time of aggregated value (present time with the patients), and Family Experience Scores - FES; and the cost based on the activity and time (Time-Driven Activity-Based Costing – TDABC), both measured by patients.

Using Toyota Kata routines in the process of clinical preparation, Merguerian *et al.* (2015) achieved expressive results in the desired indicators, reducing in 69% the operational costs of preparation, as well as improving the FES from 60% to 78%. However, the authors stated that to improve the indicators even more, for instance, the FES to 90%, the application of Kata routines should involve more the interested parts, as well as, serve as method to automate the process and the data collection from it.

Soltero (2012a), relates the adaptation of Kata routines in the innovation of products and services, using the same basis from the routines, but focusing on the client, instead of inner improvement. Another important point that makes the use of Kata different for innovation is the choice of which obstacle should be primarily pursuit. Improvement Kata can act on any identified obstacle, meanwhile innovation Kata suggests the choice of bigger/worsen obstacles in order to quickly attack what could generate more value to the client.

Another added point to innovation Kata is the registry from learning related to the fifth question of Coaching Kata, so that lessons learned can be posterior reviewed, if necessary. At last, the author states the importance of frequency in using the Toyota Kata routines, especially Coaching Kata, which suggests a daily use in order to change the habits of the involved in a more effective way (SOLTERO, 2012a).

To Soltero (2011, 2012b), Reverol (2012) and Ehni and Kersten (2015) the key to the success of the application of Toyota Kata routines are the following: 1) using Hoshin Kanri to define a long term vision; 2) before initiating improvement Kata, there should be a MFV of the current and desired state; 3) daily Coaching Kata sessions.

The success factors are important to make the routines be a modified to the Lean culture, since without them, Lean is simply a group of tools. In addition, Kata routines promote creative inspiration, since provide how to improve and, offer to people a different way of solving problems, as well as, generate additional benefits, such as, positive behavior patterns and improvement impacts (SOLTERO, 2011, 2012b).

In the study of Iberle (2015) the author mentions some very consistent points for reflection, in order to characterize how the application of Kata routines in the Information of Technology (IT) environment was, in addition to the Scrum, being them: although most people remembers the scientific method (approached in this case by the PDCA), very few manage to compose a hypothesis; when their learning is not related, people do not realize that many times the next step would change, basing on the acquired learning, if the meetings were not regularly and short, people would not reunite (Coach and Apprentice), and with that the process was interrupted; when the last question of Coaching Kata was not asked, the apprentice would try to take bigger steps; in the Coaching Kata meetings, with duration of 2 to 3 times a week were better enjoyed than once a week; and finally, the Coach does not have always to know the right answers, since the 5 questions of Coaching Kata will push Coach and Apprentice to the right direction.

In addition, Iberle (2015) related some advantages that Kata routines incorporated in the same way that agile methods, being them: they use simple and agile methods that were approved to handle uncertain well; cadence, time box and interactive planning; the steps of PDCA divide the work into very small portions, which provides quick and crucial feedback to work in an effective way before doubts; The Storyboards, act as visual panels, providing visibility to status in a simple way; the leaders have sufficient visibility in the system so they can see where help is needed to improvement happen, but the real decisions happen in the level of the process where people are most familiar with; improvement Kata choices are conducted by data withdrawn from the processes.

Villalba-Diez, *et al*. (2016) relate some differences in the construction of a Lean Pattern of Learning, between Kata and PDCA, which itself is a mistake, since Kata routines make use of PDCA in a systemic and continuous form, as established by the method itself.

Another mistake in the study is the search for separating Kata from Nemawashi. The authors explained that to have operational learning, the first mandatory step is the consensus or "systemic align", even though it is not part of the classic Operational Learning to prove such statement (VILLALBA-DIEZ *et al*., 2016).

The authors are mistaken when affirming that, since the way the routines establish, they can be used with Hoshin Kanri, which uses Cacthball precisely for this alignment. This way, it is guaranteed that everybody in the organization knows and agrees with the direction of the company, since they are the people, from management to working class, that integrate to guarantee strategic alignment. (ROTHER, 2010).

It is clear from the results that opportunities and barriers are faced and vary according to the area in which the routines are applied, however, some of them are similar, which suggests that regardless the market segment, they tend to repeat unless some action is performed.

Finally, it can be discerned future studies regarding the application of the routines in the same areas of business, in order to verify is the opportunities and barriers faced in the studies mentioned in this present study, are confirmed in new applications, as well as which sort of actions can be applied, so that the same problems are not present and which benefits can be found with the application of the routines.

6. CONCLUSION

According to the study, following a very well-structured and careful method of search, it could be stated and explained knowledge regarding opportunities and barriers in the usage of Toyota Kata in different market context.

Facing these results, it could be stated through the summary, that among all the related barriers, three mains were: lack of direction; lack of value flow map and lack of constant meetings with the involved people. In addition, among the explained opportunities, the three mains were: collaboration, learning and continuous improvement.

This way, this study contributes to the state of art regarding the problems and the related opportunities mentioned by previous empiric studies, in order to demonstrate to the reader and mainly, to those who intends to make use of Toyota Kata routine, which are the possible obstacles that one can find, and this way, how to overcome those naturally, so that one does not face the same problems described in the previous studies.

To perform this study, the main difficulties found were the few available literature on the them, since it is a relatively new subject in the literature, as well as, the great number of contexts in which related studies were applied, which can, in a way, generate expectation on future Toyota Kata implementations with the same opportunities and barriers occurring, in case that the precise care was not taken.

As future studies, besides contemplating other bases of knowledge, as for instance Science Direct, it could be verified empirically that if the opportunities and barriers are also found, even when the appropriate care is taken, or even if such opportunities and barriers are driven from the way that the usage is done, since it can be done in different context. In addition, what could the actions be, capable of reducing barriers, as well as, what benefits can be found with the usage of Kata routines.

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