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Adoption of Kanban in Procurement Process Risk Management in a Public Higher Education Institution

ABSTRACT

Objective: the study presents how the Kanban technique supported risk management in the procurement process of a higher education institution.

Method: Based on a case study, this qualitative and applied research used triangulation and collects data from two workshop, participant observation, and a focus group, offering results in a descriptive manner. Content analysis was also used, examining the narratives of research participants.

Originality/Relevance: this study offers an innovative empirical approach to the use of lean techniques in support of risk management in public administration processes.

Results: kanban made it possible to control and execute actions to mitigate risks efficiently. Of the planned action, 75% were carried out and resulted in reduction of threats, problem solving, optimization and efficiency in the risk management process.

Theoretical/Methodological contributions: The research contributes to the knowledge on risk management, specifically regarding the adoption of lean techniques to support participatory, transparent, efficient, and effective risk management, inherent to public processes.

Keywords: Keywords: Risk Management, Kanban technique, Public Procurement.

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1 INTRODUCTION

Risk management is a process consolidated in public and private organizations. Current research shows that this management is a critical success factor, as risks are inherent to any organizational process or activity (Berry-Stölzle & Xu, 2018; IBGC, 2017; IRM, 2018; Naseem, Shahzad, Asim, Rehman, & Nawaz, 2020; Shad, Lai, Fatt, Klemeš, & Bokhari, 2019).

Risk management in the public sector has become part of work, compliance, auditing, and corporate governance routines in Brazil (Brito, Pimenta, Souza, & Cruz, 2017; Ramos, Lima, Andrade, & Vasconcelos, 2019; Oliveira, Santos, Medeiros, Gurgel, & Silva, 2020). In this scenario, in 2018, the Brazilian Federal Court of Accounts (TCU) carried out an operational audit called *Exposição da Administração Pública Federal a Fraudes e Corrupção* (Exposure of the Federal Public Administration to Fraud and Corruption), to examine the prevention and detection mechanisms related to fraud and corruption in federal higher education institutions (IFES). The audit verified whether these mechanisms are compatible with regulation (TCU, 2018).

The audit conducted with 105 IFES showed that 15.24% had a fragility index for risk management controls and internal controls between 0.3 and 0.6; 70.48% had an index between 0.6 and 0.85; and 14, 28% of the institutions presented a fragility index between 0.85 and 1 (TCU, 2018). These results suggest that the IFES need to improve risk management controls and actions (Oliveira *et al*., 2020).

A key aspect of effective risk management is elaborating and implementing action plans, known as 'mitigation, control, and contingency action plans.' They are established considering the prioritization of risks according to their degree of severity and executed to mitigate the probability of incidents and reduce impacts in case of incidents (IBGC, 2017; IRM, 2018). Simplified tools must be adopted to improve the operationalization of these plans (Montezano, Costa, Ramos, & Melchiades, 2019).

The lean philosophy is recognized for offering several visual control techniques to minimize costs, reduce time waste, and improve work and the quality of processes (Liker, 2005). Kanban is a standout technique following the lean philosophy. It is a visual control technique developed in the 1950s, with the main characteristics of pulling production, controlling processes, and eliminating waste. Kanban can be applied in various departments or organizations due to its adaptability and flexibility (Lendínez, 2019; Matsuo & Barolli, 2020; Moura, 1989; Shamshurin & Saltz, 2019).

Based on the normative instruction jointly released by the Brazilian Ministry of Planning, Development, and Management and the Office of the Comptroller General (Instrução Normativa Conjunta 01/2016), a specific IFES implemented risk management in its procurement processes. The question raised in this implementation process was: How do we develop a mechanism to monitor and facilitate the implementation of risk action plans while analyzing the impacts of using such a mechanism from the users' point of view?

As suggested in the literature, the institution used the kanban technique to obtain better visualization and control while implementing its action plans. This research consists of a case study exploring the adoption of the kanban board in the procurement department of this IFES to support risk management in the bidding process.

This article is organized into six sections, including this introduction with the context, question, and objectives. The next section presents the theoretical framework supporting the research, followed by the third section showing the methods and characteristics of the study.

The fourth and fifth sections present the case study and the discussion of results, respectively. The sixth and final section exposes the limitations, implications of the research, and suggestions for future studies.

2 THEORETICAL FRAMEWORK

2.1 Risk Management

After the 2008 financial crisis, organizations changed how they managed their risks, moving from a perspective emphasizing financial risks (Morais, Pinto, & Klotzle, 2018) to a systemic approach, expanding the scope of risk management throughout the organizational structure (McShane, 2018). This new perspective has been gaining ground in organizations over the last decade, with management being understood as a continuous process, capable of identifying and mitigating events responsible for negative effects on work processes, affecting the achievement of organizational objectives (Berry-Stölzle & Xu, 2018; Santos & Coelho, 2018).

These events are permeated with uncertainties and reflect the risks all organizations are subjected to when implementing their processes. They can generate negative and positive impacts simultaneously. Events generating negative impacts are threats to achieving objectives and value creation; they can be evaluated in terms of likelihood of occurrence and impact (COSO, 2017; IBGC, 2017).

Risk events are classified as economic, strategic, financial/budgetary, legal, information and information technology, integrity, image/reputation, and operational/procedural risks (Naseem *et al*., 2020). This categorization facilitates risk management and mapping, prioritization, and allocation of resources. Different types of risk generate different impacts and, therefore, expectations regarding assessment and management vary (Saeidi *et al*., 2019; Santos, Loteri, & Ribeiro, 2019; Naseem *et al*., 2020).

From this perspective, all processes and activities of an organization involve risks (IBGC, 2017; IRM, 2018), so risk management applies to any of them in various areas, levels, and contexts, including specific activities, roles, projects, actions, and practices (IRM, 2018). Therefore, risk management has become part of organizational strategies and an essential component of organizational success (Pletsch, Silva, & Hein, 2020).

Organizations identify, analyze, and treat risks to maintain such threats at an acceptable level (organizations' risk appetite), ensuring the quality of the services provided and the fulfillment of their objectives (COSO, 2017; ISO, 2018). In addition, there are constant debates about the strategic benefits of organizational risk management (Berry-Stölzle & Xu, 2018; Naseem *et al*., 2020; Saeidi *et al*., 2019).

The work by Naseem *et al*. (2019) demonstrates that adequate risk management leads to team engagement and improvement of the organization's image (2020). Furthermore, Shad *et al*. (2020) add that risk management improves organizational sustainability, performance, and added value. Complementarily, Berry-Stölzle & Xu (2018) and Malik, Zaman, & Buckby (2020) present empirical evidence that risk management supports better decision making and is a critical success factor to improve organizational performance, increase value, and reduce cost.

The literature offers several risk management approaches. Enterprise risk management (ERM), Figure 1, is a framework with definitions, concepts, and principles that support the development of corporate risk management (Silva, 2015; COSO, 2017). ERM is a step-by-

step framework demonstrating the necessary components in risk management (COSO, 2017), namely: internal environment, objective setting, event identification, risk assessment, risk response, control activities, information and communication, and monitoring.

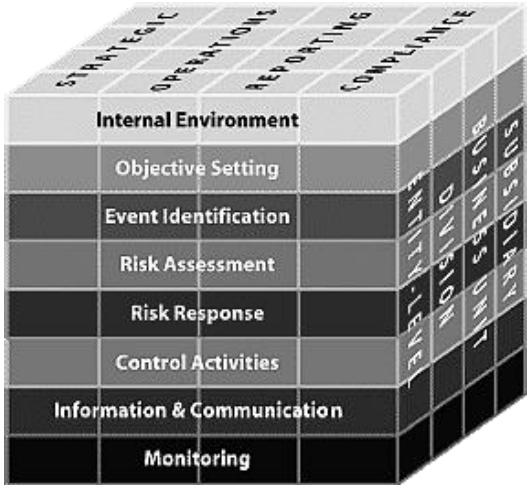

Figure 1. Cube COSO II
Source: Committee of Sponsoring Organizations of the Treadway Commission (COSO). (2017). Integrating with Strategy and Performance.

ISO 31000 (Figure 2) provides policies, guidelines, structure, and a process to plan, implement, manage resources, monitor risks, and disclose information to senior management by communicating and consulting, providing the organizational alignment necessary to create a system of effective risk management and control, considering essential the communication among stakeholders (IRM, 2018).

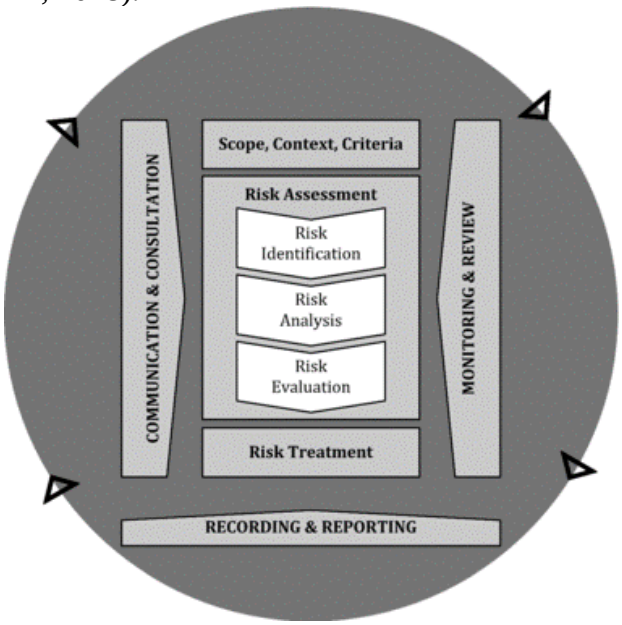

Figure 2. Risk management process
Source: Institute of Risk Management (IRM). (2018). *A Risk Practitioners Guide to ISO 31000.* London: IRM.

However, both risk management models lack details on how each step develops in practice. They also fail to provide tools to facilitate such development, and mitigation plans are not adequately addressed or thoroughly debated (Silva, 2015).

How action plans will be developed is at the discretion of each organization. In this sense, organizations must adapt management models to their specific risk context according to

their needs and risk appetite. The model must have applicability at all levels of the organization, establishing an effective risk management system (IRM, 2018), providing a holistic view of risks (Berry-Stölzle & Xu, 2018).

However, some challenges in risk management are perceived, among them: the lack of quality data and information about what is being executed (often dependent on spreadsheets and complex systems), and the lack of appropriate techniques or a coherent combination of techniques for identifying, analyzing, and treating risks. These challenges need to be overcome so that risk management can ensure maximum adherence to the organization (COSO, 2017; IRM, 2018; Montezano *et al*., 2019; Silva, 2015).

2.2 Risk Management in Federal Higher Education Institutions

The literature on risk management in the public sector has followed topics such as corporate governance and compliance (Sales, 2018). The subject is new for many public institutions, including IFES (Martins, Santos, & Alves, 2018).

From this perspective, internal controls play a fundamental role in risk management in public administration. Managers establish actions through such controls to monitor organizational processes ensuring that their goals are achieved (Beuren & Zonatto, 2014).

These actions refer to control mechanisms, i.e., control activities, policies, and procedures established and executed to reduce risks. They should be distributed and monitored across all levels and all functions of the organization. The controls include preventive and detection management elements that contribute to preparing action and contingency plans to address potential harmful events (COSO, 2017; IBGC, 2017; IRM, 2018).

In 2012, the Brazilian Federal Court of Accounts (TCU) created an indicator to assess the public institutions' maturity regarding risk management, aiming to intensify actions that improve governance, risk management, and internal controls. This assessment model considers four aspects: risk management environment, risk management processes, risk management in partnerships, and risk management results (Martins *et al*., 2018).

Against this backdrop, the IFES are continually under pressure to deliver quality education and value to society. There is a tendency in universities to adopt risk management practices, given the continuous standardization of guidelines and best practices regarding the implementation of risk management in these institutions (Ramos *et al*., 2019; Setapa, Mamat, Bakar, Yusuf, & Kazemian, 2020; Silva, 2015). Applying risk management concepts combined with internal controls is a fundamental requirement for internal administrative controls in public institutions (Ramos *et al*., 2019; Silva, 2015). Therefore, the role of internal audits in these institutions is clear. It acts to verify internal controls in the system of governance, risk management, and compliance (Sales, 2018).

2.3 The Kanban Technique

Visual techniques and tools are beneficial to organizations (Schmidt, 2020; Senapathi & Drury-Grogan, 2021) because they deal with communication devices used to quickly inform how processes should be performed through the just-in-time flow (Liker, 2005). A well-developed visual control system supports increased productivity, reduces defects and errors, helps keep deadlines, facilitates communication, improves information security, reduces costs, and usually offers employees greater control over their environment (Liker,

2005; Mojarro-Magaña, Olguín-Tiznado, García-Alcaraz, Camargo-Wilson, López-Barreras, & Pérez-López, 2018; K., A., Lanka, & Gopal, 2021).

For Moura (1989), visually controlling what is happening is a key aspect of the kanban technique, which occurs through the kanban cards. This technique provides a broad view of what is happening, at what stage, and what is ready (Bernardo, 2014; Shamshurin & Saltz, 2019).

Figure 3 shows the benefits of kanban when well implemented and adapted to the context of organizations willing to improve their processes:

Benefits	Authors
Standardization of processes and activities	Moura, 1989; Diebold, Theobald, Wahl, & Rausch, 2019; Pekarcikova, Trebuna, Kliment, & Rosocha, 2020; Senapathi & Drury-Grogan, 2021
Clarify the sequence of activities and processes, facilitating the visualization of what is happening	Moura, 1989; Mojarro-Magaña et al., 2018; Oliveira, Medeiros & Gurgel, 2018; Pekarcikova et al., 2020
Faster identification of some problems in activities and processes	Oliveira, Medeiros & Gurgel, 2018; Schmidt, 2020
More visual control over processes	Moura, 1989; Oliveira, Medeiros & Gurgel, 2018; Shamshurin & Saltz, 2019; Senapathi & Drury-Grogan, 2021
Elimination of activities that do not add value to the team or work	Bernardo, 2014; Braga, Naves, & Gomes, 2020
Group creation, facilitating the identification of similarities and collaboration	Mclean & Canham, 2018; Senapathi & Drury-Grogan, 2021
Improvement of team motivation and performance	Polk, 2011; Bernardo, 2014; Oliveira, Medeiros & Gurgel, 2018
Facilitating the coordination of work in a multi-functional team, allowing self-organization	Baik & Miller, 2014; Shamshurin & Saltz, 2019; Pekarcikova et al., 2020; Senapathi & Drury-Grogan, 2021
Development of competencies and cohesion for teams	Polk, 2011; Baik & Miller, 2014; Shamshurin & Saltz, 2019
Facilitation of information sharing and communication	Liker, 2005; Diebold, Theobald, Wahl, & Rausch, 2019; Matsuo & Barolli, 2020
Better time management	Mclean & Canham, 2018; Senapathi & Drury-Grogan, 2021
Support in decision-making	K. et al., 2021

Figure 3. Benefits of Kanban according to the literature

Kanban is gaining strength as a technique adapted into agile routines and practices of lean production in public and private organizations (Bernardo, 2014; Diebold, Theobald, Wahl, s& Rausch 2019; Senapathi & Drury-Grogan, 2021). In this aspect, kanban has gone through variations and adaptations when applied in different contexts (not just factories) to adapt properly to the specific reality of each organization (Shamshurin & Saltz, 2019). Thus, one of these variations is the kanban board, which is frequently used to measure and control workflow and processes, supporting advances in productivity and motivation (Oliveira, Medeiros & Gurgel, 2018; Polk, 2011).

Kanban also has a good level of adherence due to its high level of adaptability. Kanban does not offer considerable restrictions since it does not present implementation and management rigidity. Thus, the manager has complete freedom to make adjustments according to their needs (Majchrzak & Stilger, 2017).

The implementation of the technique alone does not provide the aforementioned benefits (Ahmad, Dennehy, Conboy, & Oivo, 2018). Without a holistic view of the application of these tools, the results are not guaranteed (Mojarro-Magaña *et al*., 2018). Different performances are observed depending on the context and the type of variation kanban goes through (Piplani & Ang, 2018). Therefore, techniques must orbit the kanban for continuous improvement and proper development of a productive system. Kanban is also constantly adopted and adapted in the public sector (Oliveira *et al*., 2018).

The emergence of new information technology systems led to the development and implementation of the electronic kanban. In this system, the boards are now virtual, which eliminates paper use and makes the process more reliable since all actions are recorded in the system (Meira, 2019). In addition to these benefits, the electronic system also makes it possible to attach files, create identifiers for the cards (which allows differentiating them by groups and facilitates their location on the board), improve time management, and help meet deadlines (McLean & Canham, 2018).

Research by Carvalho and Oliveira (2017) and Oliveira *et al*. (2018) demonstrate the advantages that kanban can bring to work processes and resource control in a state-owned enterprise. Another example of the application of kanban in public management is observed in work by Santos (2015), which aimed to solve practical problems using kanban, which has been continuously improved, providing increased visibility and monitoring of demands and process efficiency.

Thus, the current panorama of the adoption of kanban in organizations from different contexts, mainly in the public sector, shows the latent need of organizations to continuously search for easy-to-operate and straightforward techniques and tools to optimize and improve processes, reduce costs, and gain fluidity and agility to share information

3 METHOD

This qualitative research is classified as such since it analyzes experiences, interactions, and communications (Sampieri, Collado, & Lucio, 2013). From a procedural point of view, the research was developed based on a single case study of one of the projects carried out in the program *Desenvolvimento de um Modelo de Governança para Aquisições e Compras Públicas* (Development of a Governance Model for Public Procurement) (Sampieri *et al*., 2013; Yin, 2015). Also, it is considered applied research given its participatory nature in the production and use of knowledge (Thiollent, 2011).

Triangulation was used for data collection through a focus group, workshop, and participant observation. This approach was adopted to reduce inconsistencies and contradictions and offer greater depth to examining empirical evidence, supporting the case description. In addition, multiple reference points were included, increasing the reliability of results (Sampieri *et al*., 2013; Vergara, 2015).

Two workshops were developed to learn about the processes and their risks. The first was designed to map processes using the Business Process Management Notation (BPMN) and the BIZAGI software. The second workshop aimed to identify risks. The participants of the two workshops were all six employees working in the procurement department of the higher education institution studied.

In order to prioritize interventions in critical processes, it was observed that the most harmful process in the sector was the bidding – also the most frequent. The bidding was identified as the activity with more problems and negative impacts throughout the IFES macro procurement process. Therefore, a cause and effect analysis was conducted to understand the risks arising from the problems reported in the workshop identifying whether they were the root problem or a consequence of another more serious issue. After that, the risk events were identified, i.e., events that must be controlled regarding their likelihood of occurrence and potential impact of harming the process (Mishra, Rolland, Satpathy, & Moore, 2019).

This analysis resulted in 20 risk events. A meeting with employees of the procurement department was held to assess the likelihood and impacts of them. Weights from 1 to 5 were determined for each event, where 1 represents a very low likelihood or insignificant impact and 5 a very high likelihood and a critical impact. The procurement executors used the matrix

generated from crossing risk events likelihood and impact to classify risks. This matrix was based on the Institution's Risk Matrix shown below (Figure 4), prepared based on the ISO 31000 (which determines the institution's risk appetite) (UFRN, 2017):

Risk level		LIKELIHOOD				
		Very low 1	Low 2	Moderate 3	High 4	Very high 5
IMPACT	Critical 5	5	10	15	20	25
	Large 4	4	8	12	16	20
	Medium 3	3	6	9	12	15
	Small 2	2	4	6	8	10
	Insignificant 1	1	2	3	4	5

Figure 4. Matrix of risks of the Federal University of Rio Grande do Norte (UFRN)
Source: Universidade Federal do Rio Grande do Norte (UFRN) (2017). Resolution no. 76 of December 21, 2017. Provides for the Risk Management Plan. Natal, RN: Board of Directors.

After measuring the risk degree, it was possible to prepare action plans to mitigate risk events. Actions were elaborated and validated in meetings. The next step consisted of adapting the kanban for the management and realization of these actions. Thus, assumptions collected from the literature were adopted as benchmarking to identify the best way to use the technique with the available resources

The action plans were organized in the kanban cards and implemented between the end of February and the beginning of April 2019. Data were collected after this period and analyzed considering the status of the actions' implementation. A focus group was developed with the support of a semi-structured script to collect the employees' perceptions regarding the usse of the board. Of the six employees responsible for conducting these actions, only three participated in the focus group. The meeting was recorded and excerpts from the speeches of each employee were transcribed and later analyzed.

After the implementation, an analysis of the effectiveness of the risk mitigation actions was conducted. The level of residual risk was calculated (i.e., the degree of risk that remained after the development of the actions). This calculation was made as follows: the product of the risk likelihood and impact is multiplied with the following parameters: 0, 0.20, 0.40, 0.60, or 0.80 (Silva, 2015).

These parameters were then defined. If the action was poorly designed or implemented, the risk control was considered non-existent, multiplying its respective degree by 0. If the action had little influence on risk mitigation, it was considered to have a *weak* control, and the risk degree was multiplied by 0.20. When the action mitigated some aspects of the risk but did not cover all relevant aspects, it was considered to have an average control, and the risk degree was multiplied by 0.40. Actions supported by adequate tools and, although subject to improvement, mitigated the risk satisfactorily (satisfactory control), had their risk degree multiplied by 0.60. Finally, actions considered as best practice and mitigating all relevant aspects of the risk (strong control) had their degree multiplied by 0.80 (Silva, 2015).

The analysis was carried out after the conclusion of meetings and data collection. The kanban was analyzed descriptively, verifying how many actions were conducted during one month. In addition, with the transcription of the conversations held during the focus group, content analysis was performed, comprising three phases, namely: the initial exploration of the transcribed material, selection, coding, categorization of some excerpts according to the benefits of kanban as suggested in the literature, data tabulation and interpretation (establishing associations to obtain research results (Bardin, 2011; Vergara, 2015; Yin, 2015).

4 PRESENTATION OF RESULTS

From the analysis of the process and risk identification and assessment, the results show 8 very high and high risks, 8 medium risks, 1 low risk, and 3 insignificant risks. Based on this diagnosis, the risk mitigation action plans were prepared and validated with the entire team in the meetings. How the execution of these actions would be monitored was defined. However, a proposal to adapt the kanban technique using the online platform Trello was developed to support this execution (Bernardo, 2014; Moura, 1989; Polk, 2011).

In this adaptation, the risk levels of each action plan in the kanban were observed. Thus, four columns were created for the backlog to include the action plans that would be executed and three more columns to represent the flow. Each plan had its respective kanban card, and color labels indicated the risk levels. The columns were organized as follows: very high risks, high risks, medium risks, and low risks. Finally, the execution flow consisted of three columns: execution, restrictions, and completion. Figure 5 shows the adapted kanban.

Based on these definitions, follow-up routines were implemented (Oliveira *et al*., 2018), and actions were executed. As the action plans were carried out, the cards were moved between the columns. It should be noted that the implementation of follow-up routines is a critical factor that ensures adherence and adequate monitoring of this new practice in the sector (Silva & Lovato, 2016).

On the cards, in addition to the transactions, updates were made regarding difficulties faced, insights, and lessons learned to have a real-time, visual, and shared understanding of the status of individual actions, focusing activities for monitoring and control of value-added (Anderson & Bozheva, 2018). Employees have sufficient autonomy to decide what to do and how to proceed with the execution of actions (Anderson & Bozheva, 2018), as the decisions made regarding risks in this context tend to be more effective (Ávila, 2014).

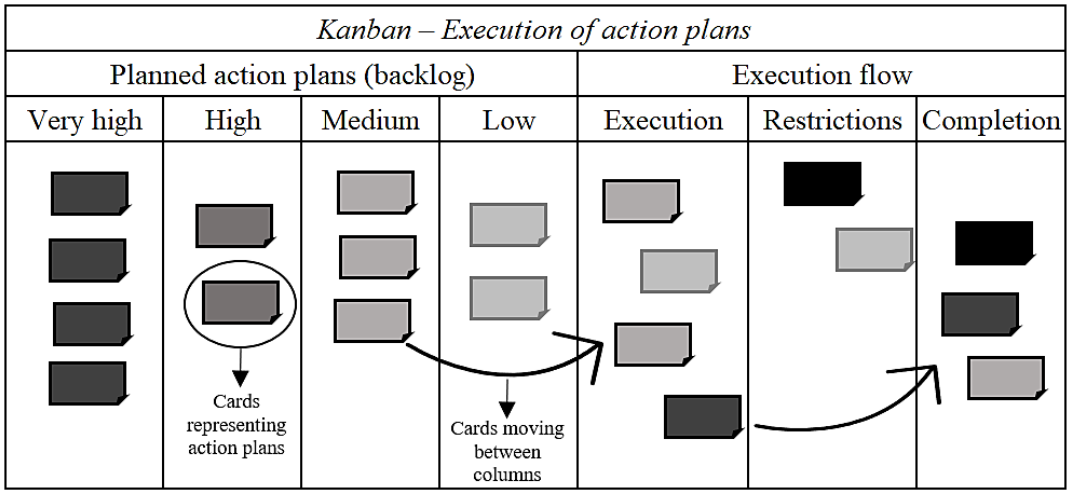

Figure 5. Kanban of risk mitigation action plans

After one month of execution, the kanban was analyzed to obtain a global status of the action plans. The four status of action execution were defined according to specific criteria: resolved, when the action was fully implemented; partially resolved, when only part of the action was carried out and was pending validation or a specific act from a third party; in progress, when the action was still being performed; and restriction, when the action could not be executed for some reason.

Thus, the actions in each execution status were assessed. Figure 6 presents the percentage of actions in each status:

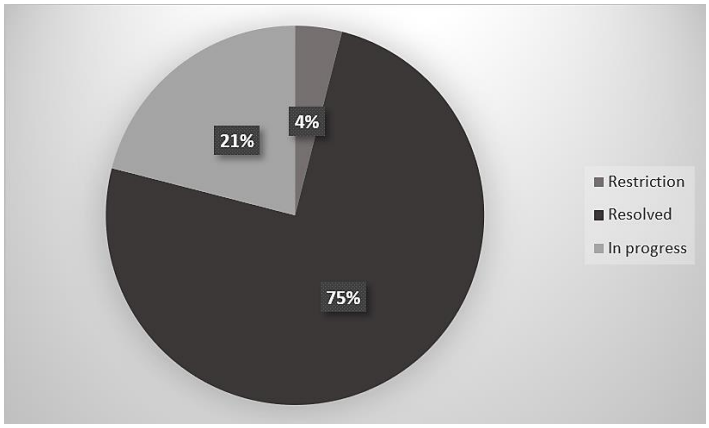

Figure 6. Chart of status of action plans execution

The results show that 75% of the action plans were successfully executed. In addition, approximately 21% of these actions were still in progress, and 4% had some restriction. Residual risks were also measured, identifying whether the risk levels decreased or increased. Figure 7 presents the risks before and after the execution of the actions.

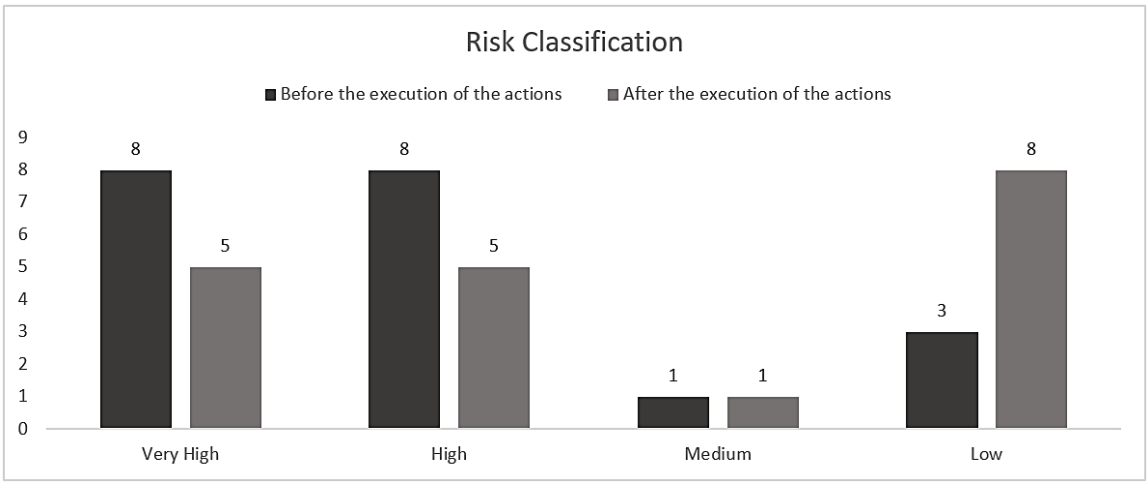

Figure 7. Risks before and after the execution of actions

Complementarily, Figure 8 below shows the sum of risk levels before and after execution.

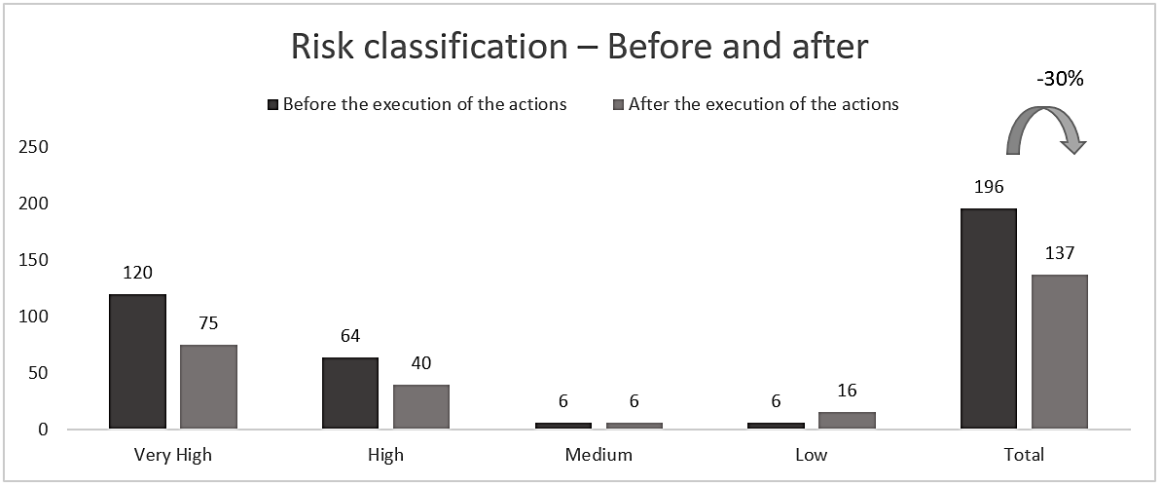

Figure 8. Sum of risk classification before and after the execution of the actions.

Figure 8 demonstrates that, after the execution of actions, it was possible to reduce the risk degree of the process by approximately 30%, considering that three high and three very high risks turned into low-risk events, while an event considered a risk before was fully resolved with the execution of actions. Therefore, risk management is more than planning actions against threats to reduce the likelihood of occurrence and consists of adopting contingency plans to reduce the impacts of materialized risk events (Mishra *et al*., 2019).

In addition to the analysis of kanban and actions, a focus group was held with employees to collect perceptions regarding the use of the technique. The following question was adopted to support the discussion in the focus group: do you think the kanban technique somehow facilitated the execution of action plans?

The participants' declared that kanban fulfilled its role in managing and facilitating the execution of action plans. They mentioned that the board contributed to increasing team motivation since everyone could visualize the process, promoting a sense of team accountability (Shamshurin & Saltz, 2019), and offering agility to problem-solving (Oliveira *et al*., 2018; Schmidt, 2020). The following excerpts support these findings:

> Yes, I liked the idea, it is to a certain extent innovative [adoption of the kanban technique], it increases engagement, people are more interested because you don't want to look bad [transparency]" (Participant 1).
>
> "Usually, we talk about how I could solve that problem, we even made suggestions among ourselves. Regarding the execution of the action plans, everything that we could resolve, we managed [to resolve]. We have Trello [kanban], right, where we update everything we do and the others also know, everyone knows what I'm doing" (Participant 3).

In addition, it was clear that kanban brought transparency and standardized processes, facilitating work coordination (Shamshurin & Saltz, 2019). This resulted in the simplification, control, and execution of action plans. It is worth noting that after applying the technique for risk management, the sector has been adopting the approach proposed for other initiatives to improve and monitor purchasing processes.

> "I really liked Trello [kanban] I liked all the tools, but the main one was Trello [kanban] and today we are using it for almost everything. It definitely improved a lot. I thought it was very good, made it simpler, assigning a card, a color according to the weights [risk levels]" (Participant 2).
>
> "Yes... I think the execution method was valid for me... we were very comfortable choosing [division of action plans] the format available in the Trello boards, it systematized our work, in addition to better visualization, we can follow the steps clearly and objectively."
>
> "It speeds up our work, right? It helps us move forward because we looked for information in several places, and today we have it there, centralized. The way we organize things improved a lot, noting was hard [to understand], it was so fast, it was so easy to fit in" (Participant 3).

Furthermore, since the focus group took place shortly after the first month of execution of the action plans, employees were asked why some activities were still in progress or restricted. Thus, it was identified that these plans were still pending implementation as they depended on third parties, i.e., another sector needed to act to comply with the full risk mitigation.

> "The problem I found in this execution is that it doesn't depend on us; we go to a certain point, right?! We did everything we could here. We can go only until a certain point" (Participant 2).

Furthermore, based on the analysis of the kanban board, the actions 'in progress' and those with 'restriction' were identified. After analysing them, it was observed that they would

move forward only after acts from the IFES top management. Thus, it is inferred that the performance of third parties in carrying out the plans must be observed for risk mitigation.

Thus, another benefit identified with using the technique for the execution of action plans is better dimensioning the work based on the equitable division of actions among employees. This occurred with the free choice and division of actions, evidenced in the following excerpts:

> "The division of action plans, each one was responsible for some of the action plans, this increased engagement" (Participant 1).
>
> "I really liked the division because each one was responsible for something" (Participant 2).
>
> For me, the way the action plans were executed was valid, with the division of tasks, something I really liked. We felt free to choose, so-and-so will do this, and so-and-so that! There was no discussion!" (Participant 3).

In addition, although the literature does not explicitly show the benefit of better work dimensioning (adequate balancing of work among employees), the lean philosophy advocates balancing production and continuous flow with kanban (Lendínez, 2019; Liker, 2005). However, the benefit of better work dimensioning when using the kanban technique in risk management can be considered a practical advance and a contribution to the literature.

Evidence observed in the study	Categories of benefits obtained	Comparison with other studies
"It increases engagement, people are more interested because you don't want to look bad [transparency]" (Participant 1). "It speeds up our work, right? It helps us move forward" (Participant 3).	More engagement and better team performance in the execution	Polk, 2011; Bernardo, 2014; Oliveira, Medeiros & Gurgel, 2018
"We have Trello [kanban], right, where we update everything we do and the others also know, everyone knows what I'm doing" (Participant 2).	More visual control of actions and activities	Oliveira, Medeiros & Gurgel, 2018; Shamshurin & Saltz, 2019; Senapathi & Drury-Grogan, 2021
"Usually, we talk about how I could solve that problem; we even made suggestions among ourselves. (Participant 2)	Fast identification and resolution of execution problems	Oliveira, Medeiros & Gurgel, 2018; Schmidt, 2020
"It definitely improved a lot. I thought it was very good, made it simpler, assigning a card, a color according to the weights [risk levels]" (Participant 2). "It systematized our work, in addition to better visualization; we can follow the steps clearly and objectively." (Participant 3)	Standardization and clear visualization of actions, activities, and workflows	Mojarro-Magaña et al., 2018; Oliveira, Medeiros & Gurgel, 2018; Diebold, Theobald, Wahl, & Rausch, 2019; Pekarcikova et al., 2020; Senapathi & Drury-Grogan, 2021
"Because we looked for information in several places, and today we have it there, centralized. The way we organize things improved a lot" (Participant3)	Easy coordination of teamwork	Baik & Miller, 2014; Shamshurin & Saltz, 2019; Pekarcikova et al., 2020; Senapathi & Drury-Grogan, 2021
	Ease of sharing information and communication within the team	Liker, 2005; Diebold, Theobald, Wahl, & Rausch, 2019; Matsuo & Barolli, 2020

Figure 9. Benefits to risk management when using *kanban*

Given these results, the benefits of using the Kanban board for risk management were evident. Thus, Figure 9 presents the study's empirical evidence, the categorization of the benefits achieved, and a theoretical comparison between studies that also realized these benefits from using the technique in different contexts. Finally, the next section presents important implications from the study's results.

5 DISCUSSION OF RESULTS

The research demonstrated that the adoption of kanban brought benefits and efficiency to the higher education institution's procurement department regarding the risk management in bidding processes. This technique was applied given the lack of methodological support to the teams on systematizing, ordering, conducting, and executing risk actions. Montezano *et al*. (2019) and Saeidi *et al*. (2020) argue that this support for execution is a key factor for risk management success.

In this scenario, Ramos *et al*. (2019) point out that determining and effectively managing risks in organizational processes is a dynamic and not very complex process. It is necessary to incorporate approaches that privilege action and effectively address threats (Ávila, 2014). This work contributes to risk management in the administration of higher education institutions aiming to bring significant development and progress, improving the institution's processes and results to society (Oliveira *et al*., 2020; Ramos *et al*., 2019).

The technique used enabled greater team engagement and participation in risk management. This element was an important factor because, given the complex nature of modern organizations and their rapid adaptation to internal and external environments, managers must be proactive in identifying and managing risks (Mishra *et al*., 2019).

The research revealed that the kanban's simplicity supported the entire risk management cycle in the process. This has important practical implications in defending the implementation of simplified approaches that consider the characteristics and complexities of organizations so that risk management can be appropriate and effective in these contexts, adding value (Naseem *et al*., 2020; Oliveira *et al*., 2020).

The use of the technique supports disseminating the culture of continuous improvement for risk management at IFES. Therefore, interventions in the kanban board are proposed, namely the limitation of the number of cards at each stage of the flow, sustaining a pull system; elimination of activities that do not add value; and the defense of continuous flow without pauses, reducing inventories (Anderson & Bozheva, 2018).

In addition, IFES managers must observe the benefits of this approach and review their practices and internal management controls based on the identification, assessment, and mitigation of risks (MP & MTFC, 2016). Thus, risk management in this context can be considered the basis for initiatives that result in the improvement and quality of university management (Ramos *et al*., 2019; Silva, 2015).

6 FINAL CONSIDERATIONS

This work presents how the adoption of the kanban board supported risk management in the bidding processes of an IFES. The execution and control of mitigation actions improved after using the kanban technique, which is demonstrated since 75% of the action were effectively carried out, resulting in fewer threats; workflow optimization and efficiency; improvement of team participation engagement, and performance; facilitation of information sharing and communication; agile problem solving; and greater visual control of actions.

Moreover, the benefit of better work dimensioning was an advance of this research to the literature.

The use of techniques based on the lean philosophy to support the execution of risk management action plans showed interesting results and advances for risk management. Kanban's simplicity supported the entire risk management cycle, bringing important practical implications in advocating the implementation of simplified approaches that consider the characteristics and complexities of organizations, especially in the public sector. The integration of risk management with other management techniques can be a successful strategy in this scenario. This can also support the diffusion of a culture of continuous improvement for risk management in public administration.

In addition, other practical implications are the attention that IFES managers and public managers, in general, must have about the benefits of this approach, aiming at the replacement of complex internal management practices and controls for simple techniques. As for theoretical implications, this work contributes to risk management in the context of university management, improving the institution's processes, and results delivered to society.

In kanban limitations include some actions that were not completed because they needed the involvement of third parties and the lack of availability of half of the employees of the procurement department during the focus group. In the research, limitations are evidenced as the study has restricted/limited conclusions because it is a case study.

Future studies can focus on the evaluation of the actions executed to verify their impacts on risk mitigation. Also, quantitative research exploring the application and evaluation of other techniques for monitoring risks (such as project management and 'agile') are welcome to contribute to the literature. Finally, future studies can examine the dynamics of team engagement when using techniques such as project management, 'lean', and 'agile'.

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Adoção do Kanban na Gestão de Riscos do Processo de Compras em uma Instituição Pública

RESUMO

***Objetivo**: apresentar como a técnica Kanban apoiou a Gestão dos Riscos no processo de compras de uma Instituição Federal do Ensino Superior.*

***Método:** a pesquisa é qualitativa, a abordagem utilizada foi o estudo de caso. A pesquisa adota a triangulação do workshop, observação participante e grupo focal para a coleta de seus dados. Esta pesquisa é aplicada e descritiva sob os seus resultados. Para a análise foi utilizada a Análise de Conteúdo.*

***Originalidade/Relevância:** trata de uma abordagem empírica inovadora quanto ao uso de técnicas lean em apoio à gestão de riscos nos processos da administração pública.*

***Resultados:** o kanban permitiu tornar o controle e execução das ações para a mitigação dos riscos eficientes, de maneira que 75% dessas ações foram realizadas, resultando na diminuição das ameaças, resolução de problemas, otimização e eficiência no processo de gerenciamento dos riscos.*

***Contribuições teóricas/metodológicas:** contribuições sob temática de Gestão de Riscos, especificamente quanto a adoção de técnicas lean para a sustentação de um gerenciamento participante, transparente, eficiente e efetivo dos riscos inerentes aos processos públicos.*

***Palavras-chave**: Gestão de Riscos, Técnica Kanban, Compras Públicas.*

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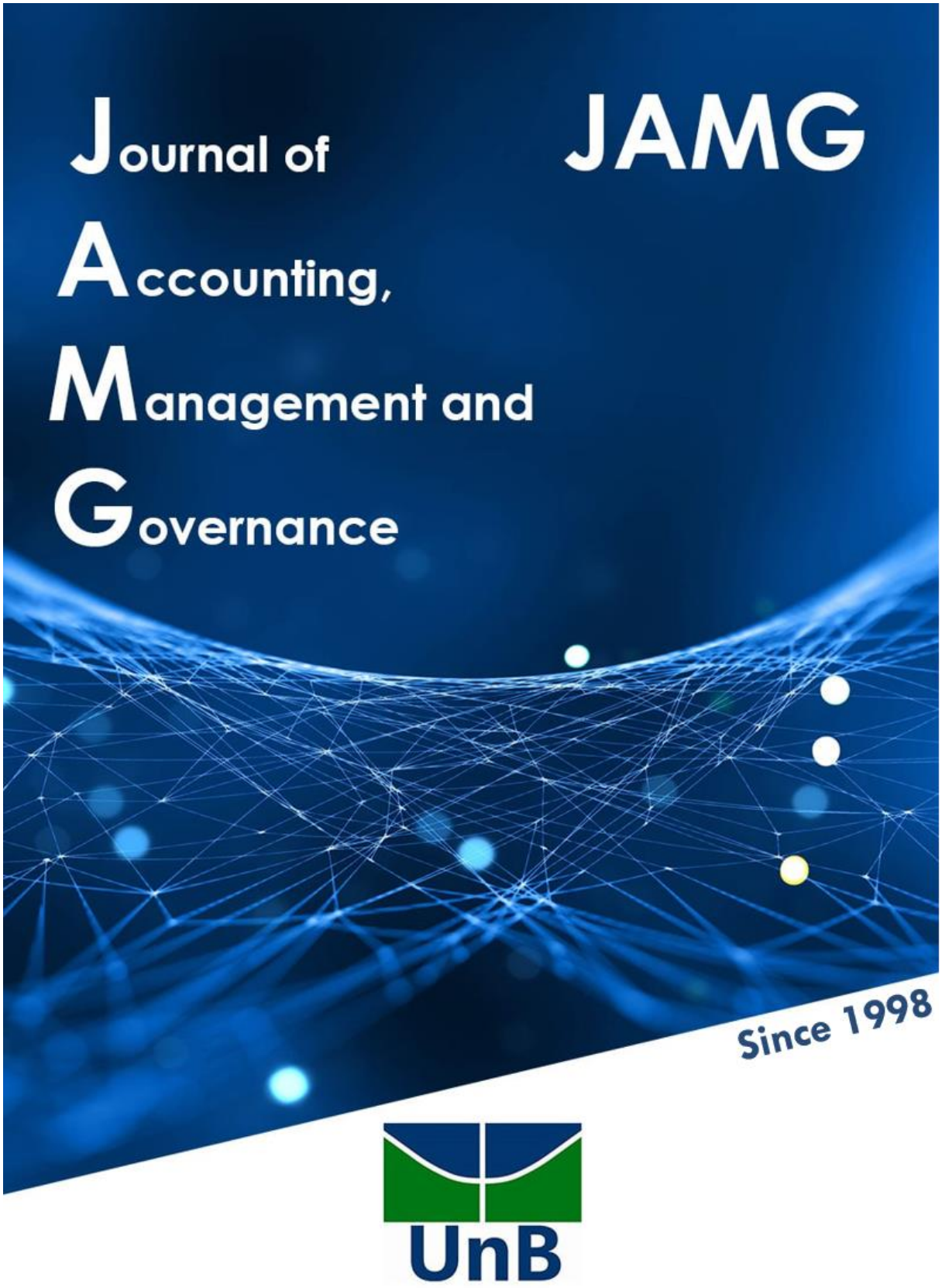
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