



Cultivating efficiency in human resource management: The integration of Lean concept and IT solutions for operational enhancement

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Abstract

Improving HRM operations, especially in large enterprises, requires efficient monitoring of issues and documenting individual accomplishments. This study aims to enhance these processes by integrating Lean principles with IT solutions to address inefficiencies, particularly in task recording and achievement tracking, thus advancing real-time data interconnectivity objectives. The study begins with an examination of existing operations, proceeds to analyze the process, and identifies waste while determining the value of activities. Solutions are then proposed using the ECRS technique to improve operational effectiveness. The ECRS technique for lean implementation involves utilizing 'eliminate' for non-value-added (NVA) activities, and 'combine', 'rearrange', and 'simplify' for value-added (VA) and necessary but non-value-added (NNVA) activities. After implementing these strategies using Microsoft Planner and Microsoft Power Apps, the time needed for monitoring critical issues is reduced from five days to two per week, along with streamlining the process from seven steps to five. The new application offers updates in real-time and enables staff to independently view their achievement records. Embracing the Lean approach and IT solutions, unnecessary tasks are eliminated, resulting in a reduction of the coordinators' workload.

Keywords: Human resource management, Lean, ECRS, IT solutions

1. Introduction

In the realm of Human Resource Management (HRM), it is crucial that employee responsibilities align with the company's strategic objectives and one significant aspect of HRM involves evaluating employee performance [1]. To ensure the prompt resolution of vital issues, it is essential to effectively monitor the progress of assigned tasks. Additionally, upon project completion, those responsible for addressing critical matters should document their accomplishments. This documentation plays a role in performance evaluations that influence job advancement and rewards [2].

This study focuses on a significant Thai enterprise, currently in the process of converting its administrative operations to digital formats to increase its operational efficiency. Nevertheless, within the HR division, the staff encounters a challenge in tracking the real-time status of projects allocated to individual employees. This can pose complications, particularly when pivotal issues arise during project execution. These critical issues encompass tasks across divisions that can result in adverse repercussions if left unresolved. For instance, in the organizational asset management division, a critical issue might involve effectively handling residual assets across branches. Consequently, it becomes imperative to closely monitor and promptly address these critical matters, a task that the existing operations are unable to fulfill. Therefore, the main goal of this research is to improve the method of monitoring key problems in HR management by utilizing information technology (IT).

Furthermore, there is a need for the company to document employee accomplishments for annual performance assessments. Nevertheless, the current approach to recording achievements within the case study company primarily relies on manual procedures, and the dissemination of this information among relevant stakeholders presents challenges. Consequently, the secondary aim of this investigation is to implement IT solutions to enhance the efficiency of this documentation process.

Before creating an IT solution, it's essential to grasp the current workflow and the tools in use to pinpoint their strengths and weaknesses. If any workflows do not function optimally, they should be improved before moving on to solution design. This study primarily focuses on applying the Lean approach, widely used to enhance manufacturing and service operations, to improve existing processes before embarking on IT solution development. After applying the Lean concept to streamline workflows, subsequent development and implementation of solutions can be performed more efficiently.

The integration of lean practices with Human Resource Management (HRM) holds immense potential for improving organizational efficiency, reducing waste, and enhancing productivity. However, existing literature underscores a significant gap in the integration and collaboration between lean and HRM disciplines, indicating a crucial need for further research in this area [3]. Particularly, scarce is the exploration of lean and digitalization within HR contexts. Therefore, this study aims to address these gaps by highlighting the synergistic benefits of incorporating Lean principles and digitalization into HRM practices. By showcasing how these strategies can eliminate redundant tasks and optimize operational flows, this research underscores the importance of integrating Lean principles into

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digital transformation strategies. This approach not only enhances organizational efficiency but also ensures that digital initiatives effectively align with lean principles, ultimately maximizing operational effectiveness and minimizing inefficiencies.

The structure of this paper is outlined as follows: After the introductory section, Section 2 provides a summary of literature reviews, followed by Section 3, which delineates the methodology utilized. Section 4 provides the results. Section 5 dives into the primary discoveries and presents the study's conclusions.

2. Theoretical foundation and literature reviews

2.1 Human resource management

Human Resource Management (HRM) encompasses various tasks including employee recruitment, orientation, training, skill development, performance evaluation, compensation and benefits administration, motivation, fostering labor relations, adhering to labor laws for safety, welfare, and health, all according to the relevant state or country regulations [4-6].

Performance appraisal, also known as performance review, performance evaluation, career development discussion, and employee assessment, is a process for documenting and assessing an employee's job performance [7]. It specifically involves evaluating how well an employee has performed their assigned duties and responsibilities. The evaluation primarily focuses on the outcomes of the employee's job performance rather than their personal qualities.

2.2 Lean concept, process analysis and waste identification

Within the framework of Lean principles, the primary goal is to maximize operational efficiency by minimizing waste. Essentially, the operations of any system can be categorized into three types of activities: value-added activities (VA), non-value-added activities (NVA), and necessary non-value-added activities (NNVA) [8]. The core idea of Lean focuses on eliminating NVA, while also reducing NNVA and VA, ultimately resulting in a decreased overall processing time for the entire system. Foundational tools utilized within the framework of Lean encompass elements such as the identification of seven wastes, value stream mapping (VSM), and Eliminate-Combine-Rearrange-Simplify (ECRS) technique [9].

ECRS is a powerful yet simple employed to enhance processes, particularly subsequent to the classification of operations or activities into VA, NVA, and NNVA categories. Adopting the ECRS approach allows for the elimination of NVA activities while simultaneously reducing both NNVA and VA activities by combining, rearranging, or simplifying operations.

Process analysis is a critical component of Lean Management, focused on optimizing workflows and eliminating inefficiencies. Central to this analysis is the use of flow process charts, which visually represent the sequence of activities within a process. These charts aid in understanding the flow of work, identifying potential bottlenecks, and highlighting areas for improvement [10].

Within the context of Lean Management, waste is defined as any activity or resource that does not contribute value to the end product or service. Process analysis, particularly through flow process charts, plays a crucial role in identifying waste within organizational processes [11]. By visually mapping out each step in a process, organizations can pinpoint non-value-adding activities and inefficiencies, laying the groundwork for targeted improvement initiatives.

Recent literature highlights the growing interest in process analysis and waste identification. Cannas et al. [12] advocate for utilizing process analysis and lean manufacturing tools during kaizen events to enhance assembly processes, emphasizing the elimination of non-value-added activities. Similarly, Srisuk and Tippayawong [9] apply Lean techniques to streamline the raw material picking process in a sewing machine factory, resulting in waste reduction and enhanced productivity. Despite these advancements, research on process analysis within the lean framework in human resource management remains limited.

2.3 Systems development life cycle

The system development cycle is a technique employed in software development [13]. It consists of the following steps: identifying and gathering requirements, developing and designing software, and testing and maintaining software [14].

IT solutions are valuable instruments for enhancing operational efficiencies within the service sector. The synergy between IT solutions and the Lean concept yields the potential to enhance the processing time of diverse systems. As demonstrated by the previous work [15], through the integration of the ECRS technique into the shipping process, manual tasks were eliminated, and the introduction of a barcode system led to streamlined operations. This barcode system not only contributed to the reduction of processing time but also played a role in minimizing human errors. Similarly, the integration of IT solutions has yielded improvements within the healthcare sector [16]. Specifically, addressing the issue of delayed treatment protocols for numerous patients, the identification of VA, NNVA and VA activities paves the way for proposing an IT solution. This solution aims to shorten support operations, thus reducing the delay in the treatment process.

The application of the Lean concept extends to the realm of Human Resource Management (HRM) [17]. Specifically, implementing Lean techniques provides an optimal avenue for HR professionals to effectively integrate all relevant human resource systems within the organization, ensuring a comprehensive understanding and active involvement of relevant HR experts.

Previous research has combined the Lean concept with IT solutions to enhance HRM operations. For example, an IT solution incorporating artificial intelligence (AI) is integrated into the employee recruitment and selection process, which is known for its repetitiveness and time-consuming nature [18]. Consequently, the introduction of IT solutions leads to the elimination and simplification of unnecessary tasks.

The implementation of the Lean concept aims to enhance HRM efficiency consisting of processes, tools, and criteria for work efficiency evaluation [19]. The synergy between Lean approach and HRM leads to an upsurge in organizational performance. Additionally, the evaluation and measurement of employee effectiveness are more accurately executed, aligning with the strategic objectives of HRM.

Therefore, considering the advantages elucidated in earlier studies, this research proceeds to introduce the application of the Lean concept through IT solutions within the HRM sub-process. The subsequent section outlines the methodology employed.

3. Methodology

3.1 Investigating organizational operations and identifying challenges

The initial step involves investigating organizational operations by examining existing documents and focusing on two specific processes: monitoring critical issues and recording individual achievements. This comprehensive examination delves deeply into various elements such as activities, workflows, operation time, associated documentation, and responsible individuals. Following this, workflows are created to visualize the organization, identify gaps, align understanding among employees and managers, and establish a foundation for further improvements. Subsequently, interviews with project and department coordinators are conducted to identify challenges within the operations.

3.2 Analyzing the operations using Lean concept

The following step focuses on implementing the Lean concept by utilizing the workflow generated from previous steps. This involves categorizing activities and their respective flows into three classifications as follows.

VA refers to value-added activities that directly contribute to meeting the customer's requirements or significantly enhance a product or service. Strategies for managing this activity involve focusing on optimization and improvement to maximize its impact on customer satisfaction. NVA refers to non-value-added activities that do not contribute to the product or service from the customer's perspective. These activities should be minimized or eliminated by redesigning processes and removing these non-value-added elements. NNVA refers to non-value-added but necessary activities. While they should not be eliminated, these activities can be optimized by minimizing resources and making them more efficient.

3.3 Applying ECRS technique to define solutions for improvement

After classifying processes, ECRS (Eliminate-Combine-Rearrange-Simplify) is applied. IT is a problem-solving tool that aligns with Lean principles by striving to minimize waste and enhance value-adding activities within a process or system. The explanation of the ECRS technique and how it is linked to Lean concept is presented as follows.

Eliminate (E): This solution involves identifying and removing non-value-added activities, reducing or eliminating them to streamline processes and enhance efficiency.

Combine (C): This solution aims to merge and optimize processes to reduce redundancy and minimize non-value-added efforts.

Rearrange (R): This solution involves rearranging the sequence of tasks or steps for better flow. It aims to ensure activities are well-organized and flow smoothly, thus increasing value-adding efficiency.

Simplify (S): This solution involves making processes easier and more standardized, reducing complexity and errors to improve overall efficiency.

3.4 Designing the solutions and validating the results

After identifying the enhancements through ECRS techniques in the previous phase, the solutions are designed modified from Wong et al. [20]. In the design phase, this stage entails creating and crafting solutions utilizing Microsoft Office 365 tools, specifically Microsoft Planner and Microsoft Power Apps. The company has opted for Office 365 due to its longstanding usage within the organization, leading to a high level of familiarity among employees. Additionally, it provides a closed system environment, effectively preventing information leakage.

In the end, after the proposed solutions are created, in the implementation phase, users test them to confirm their effectiveness in an actual operational setting helping validate the solutions. Users are asked to utilize the manual and perform the assigned tasks. Following that, user feedback is gathered and integrated into the ultimate versions of the solutions. Performance metrics, such as processing time and the quantity of activities related to the chosen processes, are established and subsequently compared to previous scenarios.

4. Results

The chosen company aimed to implement digital transformation principles within its administrative operations to increase its operational efficiency. In the HR department, they selected two pilot processes for digitization: (1) tracking critical project-related issues and (2) documenting individual accomplishments. Currently, the company has embraced Microsoft Office 365 as its primary tool to facilitate these changes.

4.1 Current situation of a case study company

4.1.1 Monitoring critical issues

Critical issues are typically documented by filling out the forms in Microsoft Excel to assess their importance for subsequent weekly monitoring. There are three types of critical issues: (1) urgent and important, (2) urgent but not important or important but not urgent, and (3) unimportant and nonurgent. As depicted in Figure 1, this procedure commences with the project coordinator completing the form. Subsequently, the department coordinator gathers and reviews the forms before transmitting all documents to the PDCA committee for validation. If all documents are accurate, they are then forwarded to the central coordinator for compilation and resubmission to the PDCA committee. During the weekly meeting, the PDCA committee provides reports to the managerial personnel, following which, the solutions are discussed and communicated back to the project coordinator via email. The entirety of these processes is concluded within five working days.

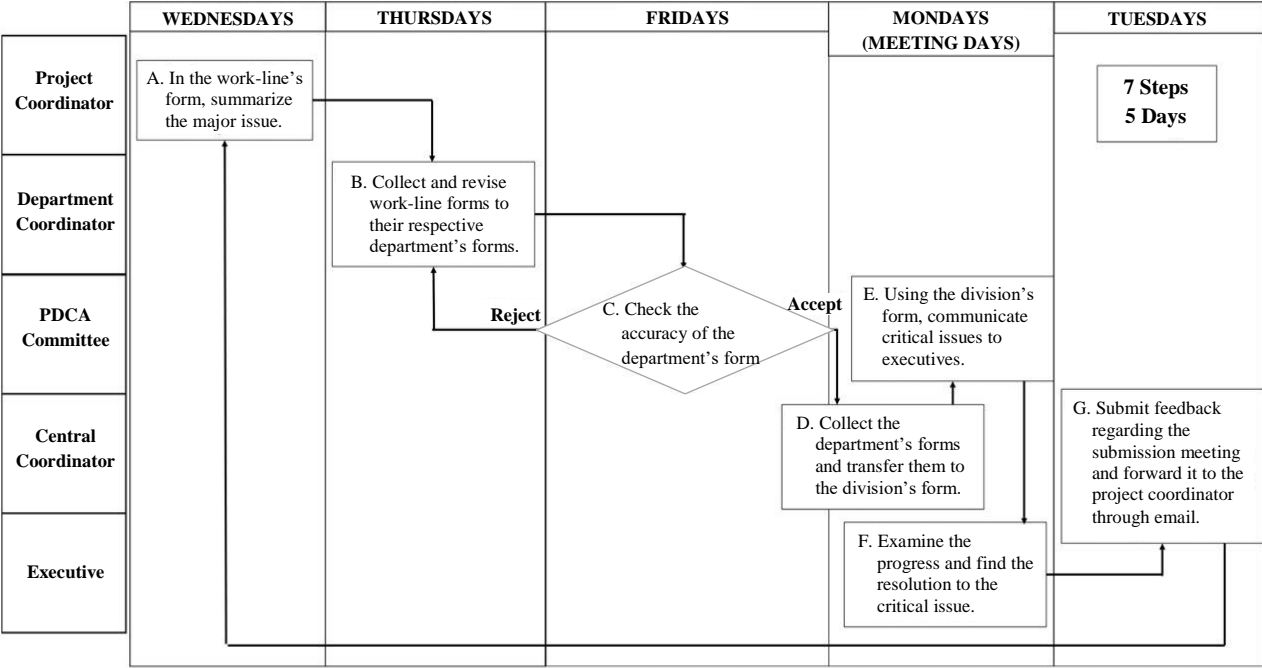


Figure 1 Process of monitoring critical issues

Based on interviews with the project and department coordinators, several challenges have emerged, encompassing the following issues. Initially, the coordinator is obligated to consistently create a manual form. Secondly, when there are updates, the form is reconstructed since the data cannot get updated automatically. Thirdly, employees don't promptly get updates or modifications if they do not participate in the weekly meeting. Lastly, suggestions arising during the meeting aren't automatically connected to the subsequent week's critical follow-up form.

4.1.2 Recording individual achievement

As shown in Figure 2, in the preceding week, employees record and assess their work results using the MS Forms application. At the start of the subsequent week, division management personnel and the coordinator choose the accomplished tasks. Following this, the coordinator creates a presentation for the weekly meeting and delivers it during the meeting.

As per the interview, challenges linked to this process were identified. First, the existing working process is predominantly reliant on manual tasks. Also, access to information pertaining to employees' performance is limited solely to the coordinator.

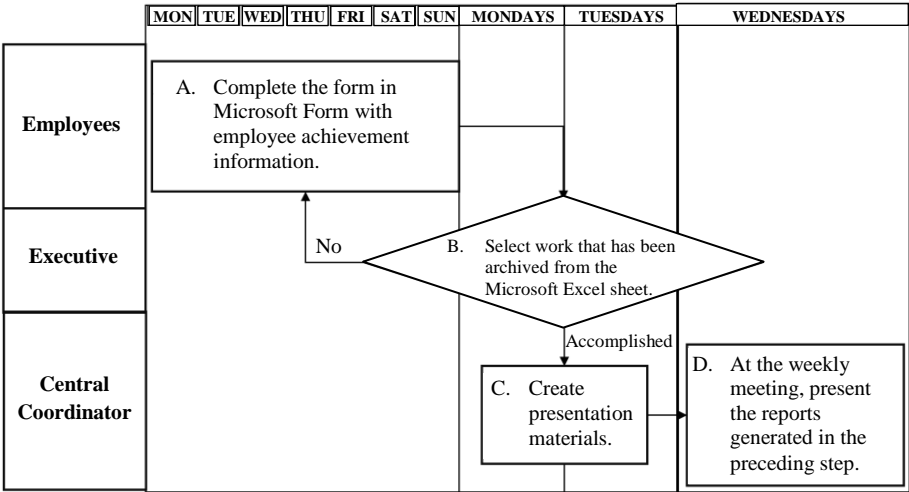


Figure 2 Process of recording individual achievement

4.2 Improvements with the Lean approach

4.2.1 The improvement in the critical issue monitoring process

In the context of this study, VA refers to work that involves importing new data, making decisions, or communicating to proceed with the next step of work. NVA refers to a step that does not involve importing new data and, upon consideration, can be eliminated without reducing value of the data to be used in the next step. Last, NNVA refers to a step that does not involve importing new data or modifying existing data in the process but is necessary to make the work more convenient or organized for the next step.

Based on the operational sequence in Figure 1, Table 1 provides an overview of activity classification in accordance with Lean principles. Five steps were categorized as VA activities, while steps B and D fell into the category of NNVA activities. To enhance the operational flow, the ECRS technique was employed. To streamline the process, steps A, B, and D were simplified. This was facilitated by utilizing Microsoft Planner, enabling workers to input data into the form more efficiently, while the software automatically combines the forms. Following this consolidation, step C is executed. For the remaining steps, operations were streamlined through implementing a digitization solution, and thus summarizing data after the meeting's conclusion.

Table 1 Process analysis of the critical issue monitoring process

Step	Activity	Process analysis	Waste	Time
A	VA	This is a value-added activity because it involves importing important data for the critical task tracking process.	No waste	-
B	NNVA	It is not a value-added activity but it is necessary because it involves collecting forms from project coordinators and standardizing them (which does not involve importing new data)	Waiting and processing (This is a manual task that requires 3 days to wait for the critical issue to be resolved, and it takes about 1 hour to collect forms from the previous step on Thursday. There is also a waste of human resources in that a department coordinator is required to collect the forms.)	3 days 1 hour
C	VA	It is important to verify the accuracy before accepting or rejecting	Processing (Waste occurs from the manual transfer of data between stakeholders)	1 day
D	NNVA	It is not a value-added activity but it is necessary because it involves collecting forms to be passed on to the next step (which does not involve importing new data)	Processing (This is a manual task that takes about 1 hour to collect forms from the previous step on Monday)	1 hour
E	VA	This is a value-added activity because it communicates important work to management	No waste	-
F	VA	This is a value-added activity because it involves considering and providing recommendations, which is a process of importing new information	No waste	-
G	VA	This is a value-added activity because it communicates the conclusion of the feedback to the project coordinator	Processing (There is waste from the fact that feedback must go through a central coordinator, who takes notes and sends the feedback received from the management via email to the department coordinator again, which can lead to communication errors)	1 hour

Table 2 Improvement of the critical issue monitoring process using Lean principles

Step	LEAN			ECRS	Results
	VA	NVA	NNVA		
A	✓			S	Introducing a digital tool helping to input data more easily and efficiently.
B			✓	S	Developing a tool to simplify and streamline data input, making it more efficient than manual entry
C	✓			R	Shifting this phase to occur following the consolidated steps (A, B, and D).
D			✓	S	Introducing a digital tool helping to input data more easily and efficiently.
E	✓			S	Utilizing tools to facilitate the sharing and presentation of data, as well as the recording of feedback from the meeting.
F	✓			S	
G	✓			S	

Based on the analysis in Table 2, it was evident that the company required tools not only for data consolidation but also for staff examination and revision. These tools are needed to facilitate effective communication. Following a comparison of various Microsoft applications, Microsoft Planner was selected due to its capability to grant staff complete ownership, enabling real-time data input and modification. The process initiated with the study of data requirements within Microsoft Planner and comparison of the consistency with the provided forms. Subsequently, a communication manual was created and distributed to the staff.

4.2.2 The improvement of the individual achievement recording process

Table 3 and Table 4 show how each step was classified into activities in Lean concept. In response to the challenges identified during the interview, for steps B and C, the process was enhanced by eliminating manual operations. In addition, a proposed solution to streamline the activities in steps A and D was introduced.

According to the findings from Table 4, the company required tools that were user-friendly and easily accessible on mobile devices. These tools are needed to enable staff to input data from Microsoft Form, search or filter data as necessary, and display search results. To ensure universal access for all staff, the chosen tools had to be available in mobile device format for convenient and real-time usage. Microsoft Power App was chosen to fulfill these requirements.

Table 3 Process analysis of the individual achievement recording process

Step	Activity	Process analysis	Waste	Time
A	VA	It adds value because it imports job completion data through Microsoft forms by having the job owner fill out and evaluate their own work on the form	No waste	-
B	NNVA	This activity does not add value without importing new data. However, it is necessary because the central coordinator must select the work that received an A grade as filled out by the employees in the form. Or, in cases where there are many works that received an A grade, the central coordinator and the management will select the outstanding work through a meeting.	Processing waste (The coordinator needs to spend time selecting the work)	1 hour
C	NNVA	This activity does not add value without importing new data. However, it is necessary because the central coordinator needs to create presentation materials for the weekly meeting	Processing waste (The coordinator needs to spend time preparing the presentation)	1 hour
D	VA	This activity adds value because it communicates the results of the work that was evaluated as A grade in the weekly meeting	No waste	-

Table 4 Improvement of the individual achievement recording process using Lean principles

Step	LEAN			ECRS	Results
	VA	NVA	NNVA		
A	✓			S	Create a system to access data and acknowledge individual achievements.
B			✓	E	Eliminate it since it's a redundant task.
C			✓	E	Replacing the manual task by a data-access tool for relevant individuals.
D	✓			S	Identify accessible tech tools for all employees regarding individual achievements.

4.3 Solution for improvements

4.3.1 Solution development for the monitoring critical issue process

As shown in Figure 3, the previous workflow, which had seven steps, has been streamlined to five steps, resulting in a decrease in the overall processing time from five days to two days. Nevertheless, the timeframe was shortened to 2 days as certain processes proved inflexible. For instance, given the inter-departmental nature of the work, allowing time for responses in the communication process, as observed in step B, became essential. Delays stemmed from awaiting corrections from various project coordinators, compounded by the weekly Monday meeting, ultimately impeding the transition of the entire process to Monday due to time constraints.

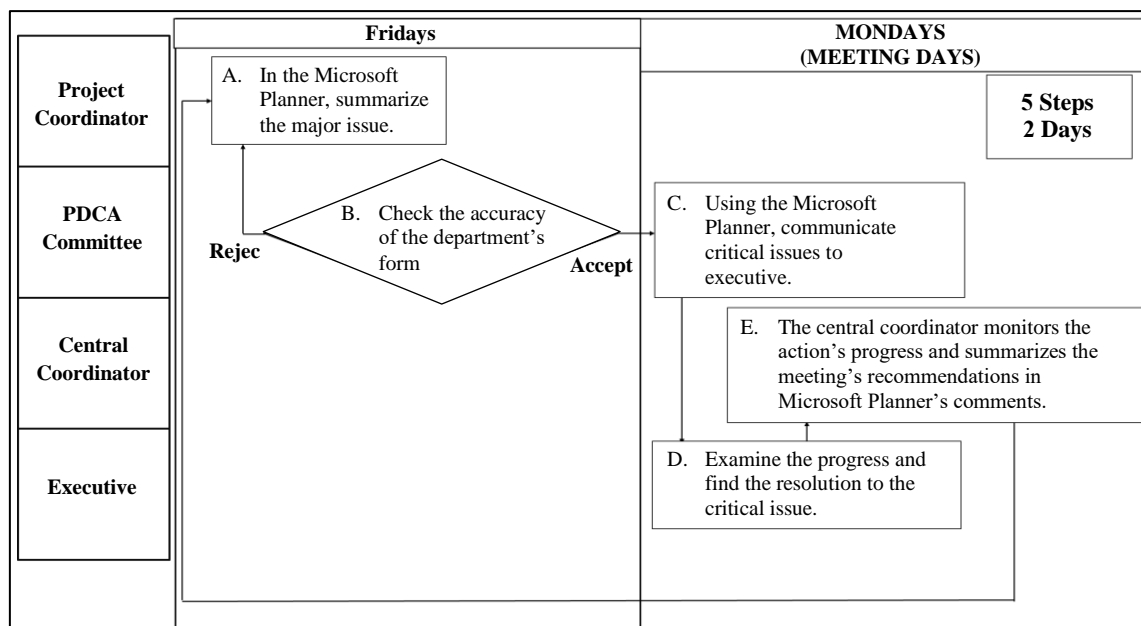


Figure 3 The workflow of the monitoring critical issues (before improvement)

To put the suggested workflow into action, the process solution was created using Microsoft Planner, following the six phases of the system development life cycle. The information prerequisites for this process were evaluated, making use of Microsoft Excel (MS Excel) as the previous tool (Figure 4).

It's worth noting that the issues could be categorized into hard, soft, and quality sides, respectively. The hard side focused on the tangible results achieved by the organization's work, such as receiving international recognition. The soft side emphasized the development of the organization's human resources, including employee training and knowledge sharing. The quality side prioritized continuously improving work processes by implementing principles like TQA, TQM, or fostering innovation. Subsequently, this information was translated into the requisites for constructing the solution through the utilization of Microsoft Planner (MS Planner), as depicted in Figure 5.

<i>Critical Issue Form</i>							
Organizations addressing critical issues	Name of critical issue	Level of critical issues	Hard Side, Soft Side, or Quality	Weekly update on progress	Continuation of events	Owners	Deadline
xxx	xxx		Hard Side	xxx	xxx	xxx	xxx

Figure 4 Critical issue form.

The screenshot shows the Microsoft Planner task form with the following sections:

- 1. Task:** Includes a title field and a timestamp "Last changed moments ago by you".
- 2. Assign E-mail:** Includes an "Add label" button.
- 3. Bucket:** A dropdown menu currently showing "EN".
- 4. Progress:** A dropdown menu currently showing "Not started".
- 5. Priority:** A dropdown menu currently showing "Medium".
- 6. Start date-Due date:** Two date pickers. The first is set to "Start anytime" and the second is set to "07/23/2021".
- 7. Notes:** A text area with the placeholder "Type a description or add notes here".
- 8. Checklist:** A section with a placeholder "Add an item".
- 9. Attachment:** A button labeled "Add attachment".
- 10. Comment:** A text area with the placeholder "Type your message here".

Figure 5 The information required within MS Planner

To confirm the effectiveness of the suggested solution, a comparison was conducted between the requirements information extracted from Microsoft Excel and the corresponding data fields within Microsoft Planner. This comparison is outlined in Table 5.

Table 5 Requirements in MS excel and MS planner

Requirements from MS Excel	Input fields in MS Planner	Noted
1. Organizations addressing critical issues	Bucket	
2. Name of critical issues	Task	
3. Level of critical issues	Priority	
4. Hard Side, Soft Side, or Quality Side	Note	Should be included but is not necessary.
5. Weekly update on progress	Comment	After the status is reported, no modifications can be made to the data.
6. Continuation of events	Checklist	
7. Owners	Assign E-mail	Individuals participating in the reported task receive automatic email notifications when updates are applied.
8. Deadline	Due Date	Notifications are triggered as the deadline approaches.

4.3.2 Solution development for the individual achievement recording process

Based on Figure 6, the earlier critical issue monitoring workflow utilized various tools including MS Form, MS Excel, and MS PowerPoint. To enhance this process, a prototype was developed using MS Power Apps. Following the improvement, the operational steps were streamlined, as shown in Figure 7.

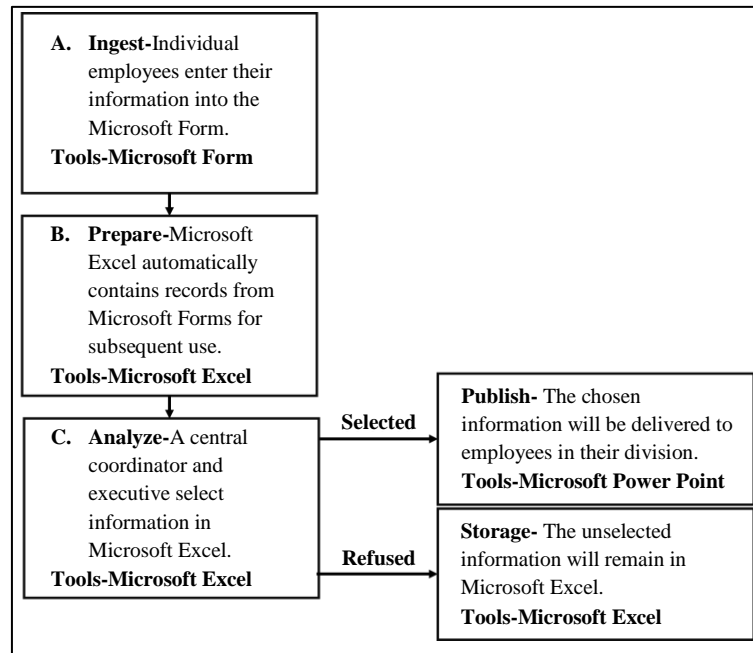


Figure 6 Flow chart depicting the individual achievement recording process (before improvement)

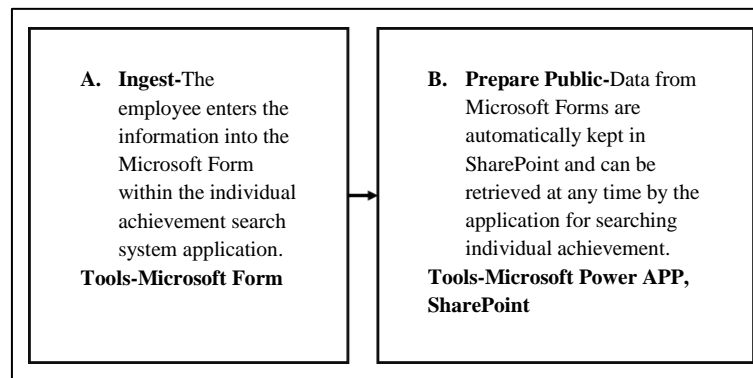


Figure 7 Flow chart depicting the individual achievement recording process (after improvement)

4.4 Validating and evaluation results

Users conducted testing on the developed solutions, and the outcomes of the tests, along with their evaluation, are presented in Tables 6 and 7.

Table 6 Evaluation results for the process of monitoring critical issues

Improved items	Results after improvement
Summarizing critical issue data	<ul style="list-style-type: none"> Reduces the central coordinator's workload time by half. The duration for weekly tracking critical issues is reduced from 5 to 2 days. Time needed to fulfill the coordinators' duties is reduced by 60%
Viewing information	<ul style="list-style-type: none"> When Microsoft Planner is updated, coworkers can view the information in real time. Therefore, workers can instantly update modified data, ensuring that all relevant individuals have access to the information.
Tracking critical issues	<ul style="list-style-type: none"> Project owners can define and track critical issues independently via Microsoft Planner applications. Project owners can independently submit and review issue resolutions.

Table 7 Evaluation results for the process of the individual achievement recording process

Improved items	Results after improvement
Accessing achievement information	The app empowers employees to access and obtain their achievement information independently. Therefore, everybody can access information conveniently.
Coordinator's workload	The app simplifies achievement communication, reducing the central coordinator's workload by eliminating the need for manual selection and presentation.

5. Discussion and conclusions

Within human resource management (HRM), the essential responsibilities of monitoring critical issues and documenting individual achievements hold significant importance. The prompt and meticulous handling of critical issues is essential to prevent any negative consequences for the organization. Simultaneously, it is imperative to effectively disseminate and retrieve information for employee performance evaluations among relevant parties. Nonetheless, the presence of non-value-added activities and manual operations can hinder the efficiency of HRM. Hence, this study aims to improve two pivotal HRM operations—namely, the monitoring of critical issues and the recording of individual achievements—by embracing the Lean concept and digitalization. This integration is facilitated through the implementation of IT solutions.

The methodologies employed in this research can be categorized into two stages. The initial stage involves the accumulation of relevant data, encompassing the challenges identified during interviews. Subsequently, the application of the Lean concept is initiated, involving the classification of activities into VA, NVA, and NNVA activities within the processes. The ECRS technique is employed to enhance each process's workflow. In the next phase, solutions are created to implement the Lean-based improvements. Testing and evaluation confirm that these solutions can streamline the process by reducing the number of steps. According to the interviews with the users, the newly introduced system facilitates quicker task completion, showcasing a substantial 50% reduction in processing time, shrinking it from five days to two days, permitting users to allocate more time towards more important tasks. Additionally, the newly established system promotes seamless data sharing across the organization, resulting in reduced operations, decreased operation time, and less manual work. In addition, with the implementation of the IT solution, communication errors among departments are minimized. Remarkably, all individual NNVA activities have been entirely eradicated. Most of which have been simplified outright, while the remaining have been eliminated and rearranged. Consequently, a substantial reduction in the time needed to monitor critical issues is achieved, reducing it from five to two days per week. Additionally, the suggested application enables real-time data updates and empowers employees to autonomously access their individual achievement records. Implementing Lean management techniques reduced task time, leading to labor cost savings, while IT solutions optimized task management processes efficiently, with potential applicability to other organizational issues and departments.

This research provides two significant contributions. Firstly, it underscores that although the amalgamation of Lean principles and digitalization is primarily linked with manufacturing operations, their collaborative benefits can also be leveraged in the realm of Human Resource Management (HRM). This study serves as an exemplar, showcasing the elimination of redundant tasks and the enhancement of operational flows within the HR division. Secondly, this research adds value to the discourse concerning the reciprocal influence of the Lean and digitalization paradigms. Particularly, this investigation underscores the complementary relationship between the Lean concept and digitalization [21]. Specifically, the Lean concept plays a pivotal role in identifying and curtailing inefficiencies, subsequently delineating the processes ripe for digitalization. By streamlining operations, the Lean concept expedites the integration of digital solutions within HRM. Given the prevailing Industry 4.0 landscape, organizations are enthusiastically pursuing digital transformations. Consequently, from a practical standpoint, this study recommends that organizations contemplating the implementation of IT solutions to enhance their operations consider embracing the Lean concept as a pivotal strategy for effective digital transformation. It emphasizes that the absence of the Lean concept can potentially result in digitalizing inefficiencies, which contradicts the overarching objective of digital transformation [21].

6. Acknowledgements

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7. References

- [1] Farmanesh P, Mostepaniuk A, Khoshkar PG, Alhamdan R. Fostering employees' job performance through sustainable human resources management and trust in leaders—a mediation analysis. *Sustainability*. 2023;15(19):14223.
- [2] Yahya S, Goh WK. Managing human resources toward achieving knowledge management. *J Knowl Manag*. 2002;6(5):457-68.
- [3] Kaur Paposa K, Thakur P, Antony J, McDermott O, Garza-Reyes JA. The integration of lean and human resource management practices as an enabler for lean deployment—a systematic literature review. *TQM J*. 2023;35(8):2598-620.
- [4] Chiappetta Jabbour CJ, Mauricio AL, Jabbour ABL. Critical success factors and green supply chain management proactivity: shedding light on the human aspects of this relationship based on cases from the Brazilian industry. *Prod Plan Control*. 2017;28(6-8):671-83.
- [5] Johari J, Yean TF, Adnan Z, Yahya KK, Ahmad MN. Promoting employee intention to stay: do human resource management practices matter. *Int J Econ Manag*. 2012;6(2):396-416.
- [6] Gardner TM, Wright PM, Moynihan LM. The impact of motivation, empowerment, and skill-enhancing practices on aggregate voluntary turnover: the mediating effect of collective affective commitment. *Pers Psychol*. 2011;64(2):315-50.
- [7] Russell RS, Taylor BW. *Operations and supply chain management*. 10th ed. United States: John Wiley & Sons; 2019.
- [8] Indrawati S, Ridwansyah M. Manufacturing continuous improvement using lean six sigma: an iron ores industry case application. *Procedia Manuf*. 2015;4:528-34.
- [9] Srisuk K, Tippayawong KY. Improvement of raw material picking process in sewing machine factory using lean techniques. *Manag Prod Eng Rev*. 2020;11(1):79-85.

- [10] Garza-Reyes JA, Oraifige I, Soriano-Meier H, Forrester PL, Harmanto D. The development of a lean park homes production process using process flow and simulation methods. *J Manuf Technol Manag*. 2012;23(2):178-97.
- [11] Dinis-Carvalho J, Guimaraes L, Sousa RM, Leao CP. Waste identification diagram and value stream mapping: a comparative analysis. *Int J Lean Six Sigma*. 2019;10(3):767-83.
- [12] Cannas VG, Pero M, Pozzi R, Rossi T. Complexity reduction and kaizen events to balance manual assembly lines: an application in the field. *Int J Prod Res*. 2018;56(11):3914-31.
- [13] Peslak AR, Subramanian GH, Clayton GE. The phases of ERP software implementation and maintenance: a model for predicting preferred ERP use. *J Comput Inform Syst*. 2008;48(2):25-33.
- [14] Leloudas P. *Software development life cycle: a practical guide to testing, design, automation, and execution*. Berkeley: Apress; 2023.
- [15] Kasemset C, Rinkham C. Improvement of shipping process in warehouse operations management: a case study. *Proceedings of the 17th Asia Pacific Decision Sciences Institute Conference 2012 (APDSI 2012)*; 2012 Jul 22-26; Chiang Mai, Thailand. p. 1-9.
- [16] Paiyarom C, Kasemset C, Khwan-Ngern K. Improvement of healthcare service system: the upper Northern hospital network of Thailand. *Zeszyty Naukowe Politechniki Poznańskiej. Organizacja i Zarządzanie*. 2021;84:125-43.
- [17] Thirkell E, Ashman I. Lean towards learning: connecting Lean thinking and human resource management in UK higher education. *Int J Human Resour Manag*. 2014;25(21):2957-77.
- [18] Kurek D. Use of modern IT solutions in the HRM activities: process automation and digital employer branding. *Eur Res Stud J*. 2021;XXIV(S1):152-70.
- [19] Shenshinov Y, Al-Ali A. The tools of increasing efficiency of human resource in the lean production environment: conceptual study. *Int J Core Eng Manag*. 2020;6(7):1-18.
- [20] Wong WY, Yu SW, Too CW. A systematic approach to software quality assurance: the relationship of project activities within project life cycle and system development life cycle. *Proceedings of 2018 IEEE Conference on Systems, Process and Control (ICSPC)*; 2018 Dec 14-15; Melaka, Malaysia. USA: IEEE; 2018. p. 123-9.
- [21] Lorenz R, Buess P, Macuvele J, Friedli T, Netland TH. Lean and digitalization—contradictions or complements?. In: Ameri F, Stecke K, von Cieminski G, Kiritsis D, editors. *Advances in Production Management Systems. Production Management for the Factory of the Future. APMS 2019. IFIP Advances in Information and Communication Technology*, vol. 566. Cham: Springer; 2019. p. 77-84.