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A COMPETENCY FRAMEWORK IN LEAN CONTEXT

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Abstract

The management of competencies and lean management are levers for the sustained growth of companies. Recognizing the organizational challenges and the intense competitiveness of the industrial domain, companies are focusing on their managerial strategies by developing their employees' skills and behaviours. Thus, competency frameworks turn out to be valuable tools for the success of the competency management project. In industrial and academic fields, the focus on competence management in the lean approach is highly emphasized. Several works and studies were performed in these disciplines separately. However, from our perspective, there's a noticeable lack of a competency framework within the lean context, which previous research might have overlooked. This gap in the existing literature provides an opportunity to further investigate the relationship between competence management and the lean approach. This exploration could significantly contribute to the development of a competency framework in the field of lean methodologies. This paper aims to introduce a competency framework within the lean context, founded on an original competency model. The methodology adopted for the elaboration of the framework involved interviewing lean experts and extensively analysing tasks and job descriptions of lean professionals' tasks from diverse organizations. These interviews and analyses were instrumental in identifying job-level activities within lean organizations. Subsequently, these activities were translated into competencies, forming the basis for the development of the competency framework applied to the automotive industry. The developed competency framework provides a valuable tool and practical insight for lean professionals, talent development specialists, and organizational leaders seeking to recruit, assess, and develop lean talents. By adopting this lean competency framework, organizations would have a clear roadmap for lean career evolution and serve as a foundation for the succession of lean training plans within industries.

Keywords: Competency, Competency framework, Competency model, Lean expert, Lean leader, Lean practitioner.

1. Introduction

Manufacturing industries witness rapid technological advancements and fierce competition, shifting market dynamics, particularly towards digitalization, technological advancements, and globalization. This complexity is further compounded by the connection between global markets and the emergence of new skill demands (digital literacy, technological skills, critical thinking, and analytical thinking), making it essential for companies to navigate a constantly evolving landscape to remain competitive.

In addressing these complexities, enterprises are confronted with organizational management practices and cultural frameworks that might lack the agility to promptly accommodate swift changes. Consequently, there's a growing emphasis on formulating novel managerial methodologies and structures that recognize competencies as fundamental drivers for the effective development of strategies [1]. Therefore, the growing attention toward establishing these structures highlights the rising significance of employing competency frameworks. These frameworks serve as key tools for assessing and developing employee skills and managing their performance. They represent a detailed description of the skills and behaviors of an employee during his or her functions [2]. These frameworks are based on the mapping of the company's competencies to ensure better management.

On the other hand, lean management aims to change the company's organizational management styles; it focuses on determining and refining employee skills and attitudes. This concept concentrates basically on all the general aspects of human resources management within the company. Numerous renowned scientists and practitioners have repeatedly demonstrated and characterized its effectiveness [3]. Therefore, competency frameworks emerge as crucial instruments for the efficient evaluation of workers' competencies, thereby enhancing overall performance within lean management systems [4].

Competency frameworks have been the subject of some research in the literature; the IEEE Reusable Competency Definitions, for example, suggest a model for representing competencies. Its main goal is to reference competencies without classifying them [5]. Moreover, the HR-XML competencies schema is useful in the evaluation, comparison, or matching of required competencies with available ones [6]. Furthermore, studies are conducted to develop taxonomies of skills and competencies, such as the Occupational Information Network (ONET-SOC), which provides a comprehensive database with detailed worker and occupational information, including definitions and assessments [7]. Competency frameworks are associated with diverse fields. For instance, Aidan [8] contributed to developing competencies, specifically for managing lean improvement projects in healthcare, highlighting their practical implications for both individual and organizational applications. Kregel et al. [9] conducted a study on the lean competency taxonomy. Ali et al. [10] presented a selection of competency frameworks from diverse organizations. Despite the existence of these frameworks in different fields, there is a notable absence of competency frameworks specifically designed for lean manufacturing. This need was reinforced through interviews with lean professionals who acknowledged the existence of lean practices but emphasised the absence of a competency framework developed in this domain. Thus, this gap grants substantial significance to current research topics.

Our work contributes to the field of human resource management by developing a competency framework in a lean management context. It aims to integrate human competencies into the process of continuous improvement and contribute valuable insights to the broader field of lean management.

The specific objectives of this study include identifying the competencies required at each hierarchical level according to the lean organizational structure. Then, create a competency framework that integrates these identified competencies, finally acknowledging the framework's role and effectiveness in promoting employee performance and development.

The resulting competency framework has applications across various organizational functions, including recruitment, training, and performance evaluation. The framework can serve as a valuable tool for HR professionals and managers, enhancing talent management practices and fostering a culture of continuous improvement.

Through an extensive literature review, our research began with a definition and an identification of the competency concept. It was followed by a discussion of the existing competency models and then an introduction of our competency model. It's generic in nature, as it is not specific to any field, and it is operational in that it can be applied by professionals across various industrial sectors. Afterward, we presented the lean organization and determined the key activities of each of the lean positions. In practice, these activities' identification was elaborated via in-depth interviews with lean industrial experts, a broad analysis of the required tasks of lean professionals from diverse organizations, and a review of their job descriptions. The identified activities were translated into competencies to serve the elaboration of the competency framework. Subsequently, we developed the lean competency framework and presented its application through a case study in the lean context of the automotive industry.

2. Theoretical Framework

2.1. The competence concept

Competence is a polysemantic concept associated with many definitions. Several studies have been carried out to identify this concept [6, 11], and even if competence has often been defined, there is no agreement on its definition.

The competency approach was developed in psychology, first denoting the individual's capability to successfully perform their occupational functions. Lévy-Leboyer [12] indicated that competencies concern the integrated implementation of aptitudes, personality traits, and knowledge acquired to carry out a complex task within the company's framework that has been assigned to the individual and in the spirit of its strategies and culture. Furthermore, research, in addition to this perspective, defined competencies as a combination of the knowledge, abilities, and skills required to fulfil a specific role [13]. This concept emphasizes that competencies are multifaceted and encompass a synthesis of various attributes, offering a comprehensive view of the requisite abilities for optimal performance.

In literature, competence was defined by its nature, detailing its defining attributes or characteristics [14]. Indeed, many studies have focused on competency

characteristics, which are structured according to two concepts that are slightly different from each other, namely the Anglo-Saxon and French approaches.

The Anglo-Saxon approach tends to focus on defining competencies in terms of observable skills and behaviours. It emphasizes what individuals do in their roles and often favours flexibility in competency models, recognizing that job roles can change rapidly in dynamic environments. Competencies are seen as adaptable and evolving and are used to evaluate and assess employees' performance, with a focus on setting clear expectations and providing feedback [15].

In the upcoming paragraph, we will present some competency definitions derived from this approach. According to Foveau [16], the Anglo-Saxon approach focuses on threshold competencies as basic knowledge and skills that represent the minimum of differential abilities, which are behavioural competencies and advanced skills. According to Vikram, Tucker and Cofsky suggested a generic classification into five major components of competencies [11]. These are grouped as shown in Fig. 1.

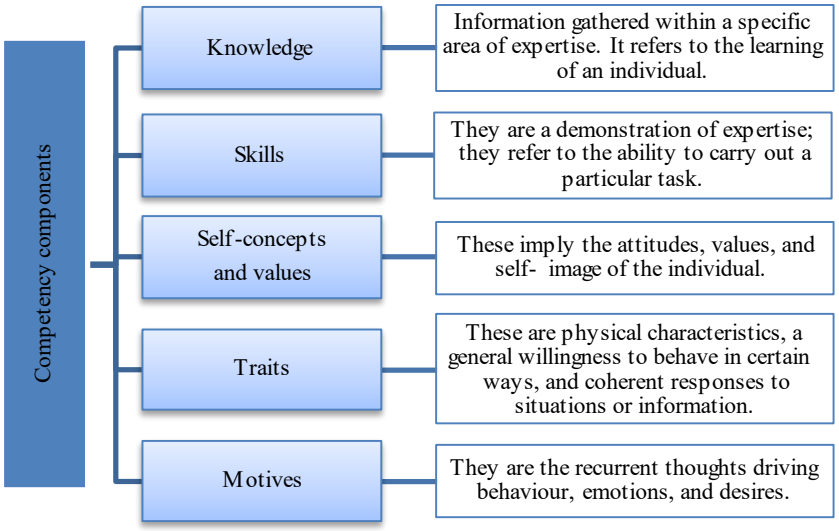

Fig. 1. Competency components [11].

The French approach, on the other hand, often conceptualizes competence as expertise or knowledge. It places a strong emphasis on individuals possessing specific knowledge and expertise relevant to their roles. The French approach values precision and depth of knowledge, seeking to ensure that individuals have a comprehensive understanding of their field [15]. In some cases, the French approach to competencies could result in certification or licensing requirements, emphasizing formal qualifications and expertise.

The French approach generally emphasizes three competency components: know-how, knowledge, and know-how-to-be. Researchers such as Le Boterf [17] asserted the dynamic nature of competency and suggest that competence may be viewed as either a decision to act or a process. Levy-Leboyer [12] shared Le Boterf's perspective regarding the competency definition and its context-specific nature, emphasizing that competency depends on the organization where it is implemented. They confirm that

the skills are tailored for specific situations or even specific organizational contexts. Bonjour and Dulmet [18] defined competence as the utilization of diverse knowledge to achieve recognized performance. This performance is achieved within a specific environment and is contextualized within a finalized activity.

In other fields, competencies are defined diversely; for instance, in sociology, competence is the practical understanding of situations rooted in acquired knowledge, which becomes more robust with exposure to diverse situations [19]. Therefore, companies operating within an evolving market, such as aerospace and automotive, must enhance their competencies to adapt to this competitive context. Indeed, the competitiveness of these companies in the market and their achievement vary through the competencies of their collaborators; enterprises' evolution and success are subject to the human resources competencies and the collaboration they can create.

In the past, manufacturing companies were concerned about the technical characteristics of their production; thus, they selected employees who were technically able to perform the tasks they were hired for. Now, employees are considered not only for their capacity to perform a particular job or activity, but also especially for their transversal competencies, corresponding to soft skills [20].

The concept of soft skills is related to the fundamental abilities associated with an individual's interaction with others. Complementing hard skills, these skills are essential for achieving task objectives [21]. In our work, competency is defined as including both soft and hard skills. Hard skills refer to the capabilities to accomplish a job [21], encompassing general knowledge, knowledge specific to the professional environment, and procedural knowledge. The characteristics selected to form the hard skills are defined as shown in Fig. 2.

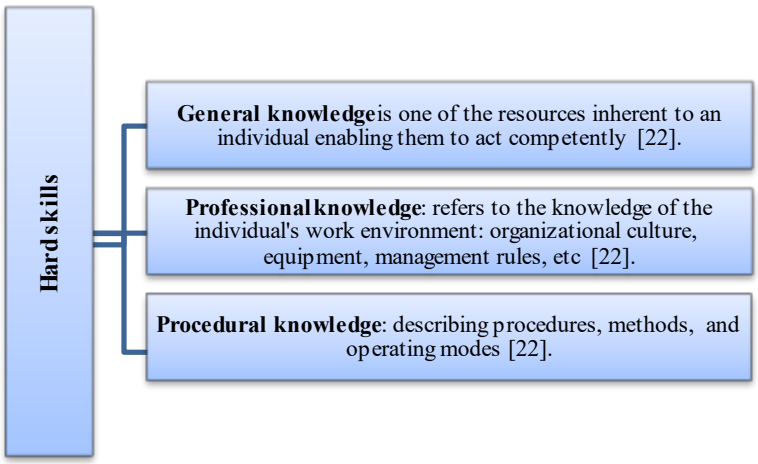

Fig. 2. Hard skills characteristics.

On the other hand, soft skills are competencies related to behavioural characteristics. They give hard skills the needed flexibility to grow and adapt to changing circumstances [20]. Five categories of behavioural competencies are considered in our definition of soft skills; they are defined in Fig. 3.

Drawing from the data presented in Figs. 2 and 3, we can deduce that competence characteristics are listed and recognized, but the definition may not reveal the relationship between these characteristics. Thus, a competency model that formulates the mixture as well as the connection of competencies is necessary.

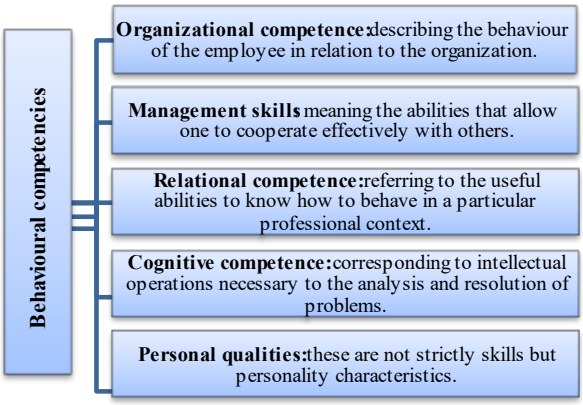

Fig. 3. Behavioural competency categories.

2.2. Competency models

Competency models have been the subject of research in industrial engineering [8, 22]. An in-depth study of competency models was conducted in our previous study [23]. In the following section, some existing models in the literature are summarized:

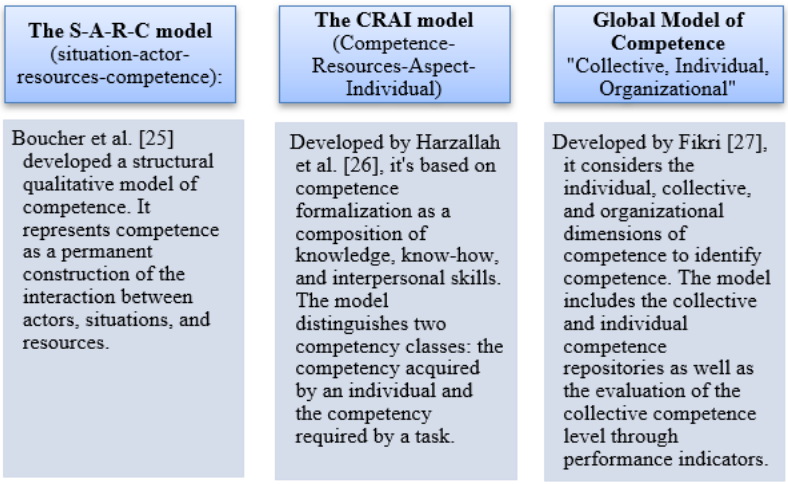

Fig. 4. Competency models in literature.

Each model offers its unique perspective on the attributes defining individual competencies. Below, we provide a more detailed explanation of each of these models separately: The S-A-R-C model places significant emphasis on the situation

or context in which actions and interactions unfold. It considers how the situation influences the actions of actors and how resources and competencies are utilized within that context [24].

Conversely, the CRAI model places competence at the centre of its framework. It underscores the importance of considering unique aspects or contexts in which competence and resources are applied. These aspects may vary, leading to different competency requirements [25].

The Global Competence Model "Collective, Individual, Organizational" built upon the Entity-Relation CRAI Model, introduces an additional element, namely: knowing how to appear defined as a presentation of one's personal and professional image (adhering to work standards such as safety, hygiene, and environmental practices). Furthermore, it includes the role of the evaluator as an expert specialized in a particular domain entrusted with the responsibility of evaluating individual's competencies [26].

From the existing models, we conclude that each model identifies the competence concept and characteristics corresponding to its theory, established based on the objectives targeted by the subsequent use of the model. Therefore, while certain aspects are shared among various models, each model prioritizes competency aspects over others. Moreover, competency modelling is a challenging task because competence is an abstract notion that can be defined differently depending on the purpose of the application. In conclusion, the models described above presume that competency representation is based on the interaction between individuals and the situation or mission without promoting any explicit relationship between the concepts. Based on this limitation, we emphasize the importance of a competency model with ontologies.

2.3. Competency models using ontologies

The competency model and the described skills must all be understood in the same way by all parties involved. As a result, a common exchange format and taxonomies, or ontologies, are applied.

An ontology is a formal representation of a standard and explicit way of conceptualizing a particular area of interest. It consists of a collection of domain-related concepts (entities, attributes, and properties) along with their definitions and connections [27]. An ontology enables [28]:

- Individuals or software agents to communicate a common understanding of the structure of information.
- Making explicit domain notions.
- Allowing domain knowledge to be reused.
- Assessing domain expertise.
- Distinguishing operational knowledge from domain knowledge.

In literature, taxonomies and ontologies are considered for describing competencies [9]. On the one hand, taxonomies for job descriptions exist, like the "Standard Occupational Classification (SOC)" from the United States Department of Labor, which divides workers into 820 different occupations, and the e-Competence Framework for ICT Professionals in diverse industry sectors, which

was developed by the European Committee for Standardization [9]. On the other hand, ontologies are also used to structure the skills, enabling a further comprehensive understanding of how they correlate and promoting any explicit relationship between the concepts.

By leveraging ontologies, comprehensions of the hierarchies and semantic connections between different skills and their properties can be established, compared to taxonomies that simply list and organize skills in a hierarchy [29]. The connections revealed by ontologies are dynamic compared to taxonomies that are defined and static [29]. Hence, ontologies are a more formal and detailed way of representing skills.

Several studies with a generic classification exist in the literature; Table 1 provides a summary of the existing competency models based on ontologies in chronological order of their development.

Table 1. Competency models based on ontologies.

Authors/ year	Competency model
Sure et al. (2000) [30]	Offer solutions to two common issues with skill management: matching profiles and keeping skill data up to date. They apply an algorithm for estimated matching profiles and represent the ontology based on F-Logic to represent the relation between concepts and rules.
Colucci et al. (2003) [31]	Elaborate a logic-based approach to combine teams for specific tasks and propose a semantic matching method for skills and competencies necessary in the job market. The objective of this study was to create a virtual knowledge marketplace aligning skill demand and supply
Petrican et al. (2003)[32]	Suggest competence modelling and matching using semantic web methods to match profiles of job seekers and offers of employment. Taxonomy was enriched through the incorporation of a similarity function. This function operates in a manner inversely proportional to the distance between two concepts within the taxonomy.
Dorn (2006) [33]	Suggests a skill-based human performance assessment ontology. The ontology is designed to represent skills and competencies in a fine-grained manner and can be used for human resource management and competence management systems.

3. Development of a Competency Model

In reviewing the existing literature on competency models, we identified some limitations. These include an excessive generalization of competencies, limitations in addressing behavioural aspects, and complexities that make them difficult for professionals to implement. Understanding these limitations is critical as we aim to propose a novel competency model. A well-structured competency model comprises various components that collectively form a comprehensive framework. In our study, drawing from both the Anglo-Saxon and French approaches, we suggest a holistic

and effective competency model encompassing several key components. It branches into several components, unfolded as follows:

a. Competency: Identified as the combination of hard and soft skills. They serve as the foundation of the model and entail specific competencies.
b. Specific competencies: These reflect the skill sets required for various functions or job families and serve as a bridge between the organization's strategic objectives and the responsibilities of employees. They are known as hard skills. Moreover, in addition to the technical skills and domain knowledge that were introduced previously, these specific competencies include specialized behavioural traits relevant to each specific area, known as soft skills.
   - Hard skills: these encompass general knowledge, knowledge specific to the professional environment, and procedural knowledge.
   - Soft skills: these entail organizational competence, management skills, relational competence, cognitive competence, and personal qualities.
c. Competency type: The introduced competency model discerns two classes of competencies, namely the competency acquired by an individual and the competency required by a mission.
d. Proficiency levels: They are defined to assess and categorize an individual's competency in each sub-competency, and, in practice, the competency is assessed by a level and justified by recorded and documented evidence. The incorporation of proficiency levels is important because it helps define the expected skill or behavioural proficiency at different career stages.
e. Competency evidence: Information pertaining to a competency's existence, sufficiency, or mastery level can be concluded using competency evidence. Test results, reports, evaluations, certificates, licenses, or a report from a former supervisor or another employment reference are all examples of evidence.

The following Fig. 5 shows the structured representation of our competency model above:

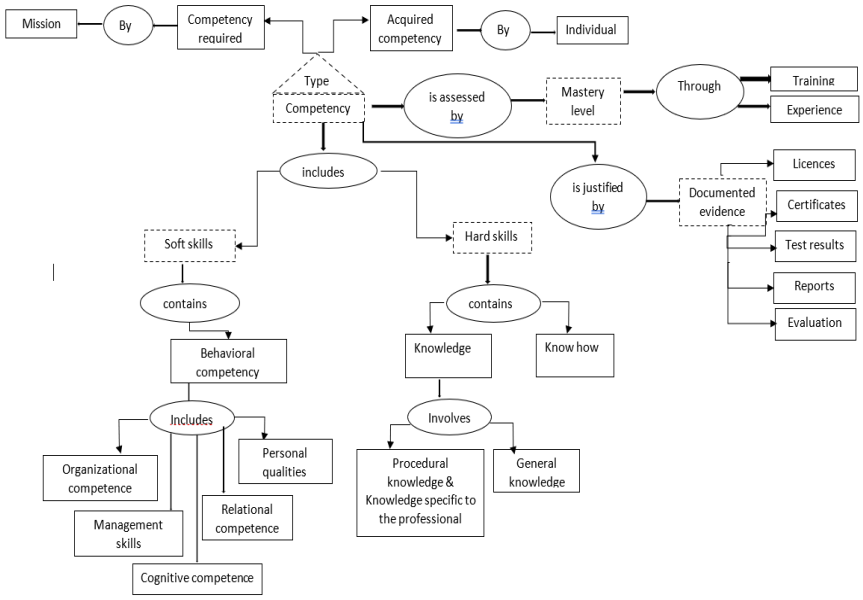

Fig. 5. Hard and soft skills competency model.

Although the suggested competency model builds on previous models for categorizing competencies referenced in Section 2.2, it is simple to avoid excessive complexity in dealing with specificities. It takes on a global dimension, as its application is not limited to a specific field, and it is operational, meaning that it can be easily implemented by industry professionals. This serves as the foundation for the creation of a competency framework.

4. Development of a Competency Framework

The competency framework describes the set of competencies needed to accomplish a particular job. It allows the company to identify its current and future needs in terms of skills. A tool for dialogue and consultation, the competency framework is developed in agreement with the interested parties and the people concerned by the job [16].

4.1. Competency framework construction methodology

The classic method for developing a competency framework is based on expert interviews, which is a method commonly observed across diverse systems [16]. Foveau [16] emphasized the significance of constructing a skills framework for the implementation of a skills management policy based on a system and proposed a procedural model for the development process of a framework. This process is delineated into three steps, as illustrated in Fig. 6.

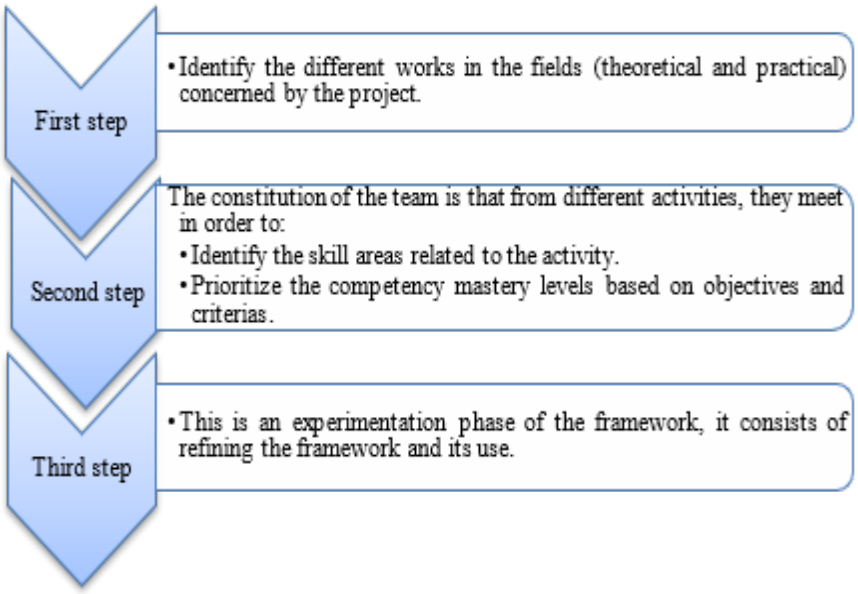

Fig. 6. Competency framework development steps [16].

In literature, the most common methods used by managers to identify the skills required at each job level are direct observation, self-description, and interviews [2]. Some studies presented other methods, such as the approach to identifying skills based on functional analysis of Sefiani [19] and the methodology of Boumane

et al. [34], which consists of situating competence in the context of the real work situation in which the individual is immersed.

4.2. Case study: competency framework in lean context

In the following sections, we present the methodology employed to develop our competency framework in the lean context. We begin by introducing the structure of a lean organization, then identify the key activities at each hierarchical level of the lean organization, and finally, we extract the required competencies from these activities for each hierarchical level and elaborate the competency framework.

The study employed a qualitative approach, conducting interviews with experienced professionals and lean experts to determine lean competencies. This method aims to gain profound insight into the perceptions and experiences of industry professionals regarding lean practices. Subsequently, we detail the process and approach adopted to gather comprehensive data on lean competencies, as shown in Fig. 7.

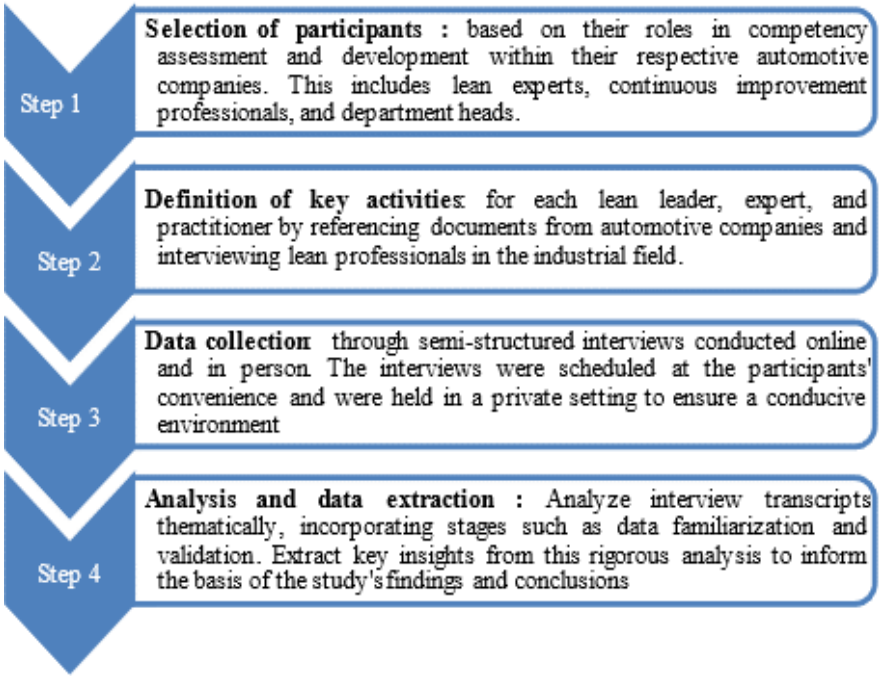

Fig. 7. Interview process.

In Table 2, we present key information on seven experts whose extensive knowledge and experience served as the foundation for the qualitative study in our research. The experts were carefully selected to provide diverse perspectives and insights into lean competencies in various professional contexts. The comprehensive data gathered from these individuals forms a crucial aspect of our study, contributing to a deeper understanding of lean management practices and competencies.

Table 2. Overview of expert profiles in qualitative study.

Expert number	Experience (in years)	Function	Sector	Certification
1	15	Lean Specialist	Automotive Manufacturing	Lean Black Belt
2	12	Continuous Improvement manager	Automotive Manufacturing	
3	18	Operations Manager	Automotive Manufacturing	Lean Black Belt
4	20	Head of engineering department	Automotive Manufacturing	Lean Master Black Belt
5	11	Lean Manufacturing Engineer	Automotive Manufacturing	
6	25	Operations Manager	Automotive Manufacturing	Lean Green Belt
7	16	Lean Manufacturing Engineer	Automotive Manufacturing	

4.2.1. Lean organization

Lean management offers essential interest to the human resources management aspects within the company. Indeed, investing in human resources is part of the company's investment and will implicitly become beneficial to the company. Lean management aims to have highly qualified management that can provide employees with self-development opportunities. Thus, to become lean leaders, managers must enhance their soft skills and encourage respect among workers [3]. From this perspective, human resources competencies in a lean management context need to be identified, evaluated, and managed to contribute to the firm's progress.

In this study, a lean organization composed of a lean leader, a lean practitioner, and a lean expert is considered. The details of the lean organization are found in our previous work [23].

4.2.2. Identification of lean leader, lean practitioner, and lean expert activities

In this part, there is an emphasis on key activities for each lean leader, lean practitioner, and lean expert. They are the main activities for the success of lean development; then, we highlight the tasks in relation to each activity. At this level, the aim is to identify, through the methodology detailed before, the skills required for each position.

It is noteworthy that the chosen methodology is, in our opinion, the most practical and relevant because it is based on the insights of experts who have

extensive knowledge in the lean field and on concrete data extracted from internal documents of companies operating in the automotive sector, such as job descriptions and other references. Below is shown in Table 3 the representation of the main activities and tasks for each of the lean leaders, practitioners, and experts:

Table 3. Lean leader, lean practitioner and lean expert main activities and tasks.

	Competency	*Activities*
Hierarchical level	**Lean leader**	Ensures the deployment of the projects determined by the lean expert.	• Trains the employees to deploy the Kaizen philosophy (improvement) within their entity, both in theory and in practice. • Supports the autonomy in the deployment of the lean spirit within the company. • Defines the necessary operational means and required resources for the implementation. • Ensures that results are achieved through field audits. • Converts the strategic objectives into operational goals. • Defines the processes to be optimized and prioritizes the projects. • Checks the project follow-up. • Challenges lean practitioners and project teams on the achievement of objectives • Guides the teams in terms of priorities. • Informs teams about schedule changes. • Monitors progress report
	Lean practitioner	Ensures implementation in the field.	• Leads a lean project in a specific entity. • Trains the operators to deploy the Kaizen philosophy (improvement) in the field. • Solves the daily problems in the field. • Identifies and determines improvement opportunities. • Implements a Kaizen continuous improvement approach. • Ensures the operational implementation of the projects in the field. • Reports the progress of actions in the field and informs the lean leader of the encountered obstacles.
	Lean expert	Ensures the deployment of the lean approach on a long-term strategy.	• Defines the projects and selects the strategic projects for the company in the long term. • Defines the necessary resources for the deployment of the projects and guarantees their financing. • Insures the training of the management on the lean tools. • Implements macro-projects at a strategic level. • Supports the company in its strategy. • Determines the levers on which the plants must act. • Supports the lean leader and practitioner in the implementation of the projects. • Ensures the achievement of the strategic objectives. • Helps the lean leader to overcome the blockages. • Trains lean practitioners, lean leaders, and plant managers in multi-site environments.

After collecting detailed information about the activities, we defined at the beginning for each activity the required competencies to perform it effectively. The defined competencies included soft and hard skills. Next, we organized the identified competencies into categories and subcategories. This process considered the components of the competency model detailed in Fig. 5. Additionally, we applied the following taxonomy to structure the competencies

further. At the largest level, we have the general area of competency, which is the general category of grouping in the framework (according to Table 4). Within these general categories, we delve deeper into the specific areas of competency (as per Table 4). Here, each general area of competency is further divided into more specific domains of expertise [35].

In large frameworks, more detailed levels may exist; they represent more specific areas of competency. Finally at the most specific level, we have the competencies themselves. Each specific area of competency (as per Table 4) or more specific area of competency has several competencies. Each competency contains both a competency statement (as per Table 4) and a performance criterion (as per Table 4) [35]. For example, some of the subsequent subcategories we had were knowledge specific to the professional environment and procedural knowledge; organizational competence; management skills; and relational competence. Afterward, we validated the resulting competencies through the analysis of job descriptions from well-known companies with expertise in lean implementation and reviewing job's requirements presentations delivered by lean professionals in the industrial sector. The validation process was further fine-tuned through feedback sessions with lean experts and professionals.

In conclusion, we documented the list of competencies, explaining what each competency requires. The outcome of the documentation phase is the creation of the competency framework. Table 4 serves as an extract from the competency framework. It pertains specifically to the competency statement: Use and implement approaches and tools to optimize the performance of industrial processes (Lean manufacturing, DMAIC, Six Sigma, Kanban, 5S, Kaizen, workstation ergonomics, etc.), which falls under the subcategory know-how within the general category of hard skills. This table also outlines the performance criteria for this competency at each job level within the lean organization, encompassing lean practitioners, lean leaders, and lean experts, respectively. Refer to the detailed extract in Appendix A for additional insights; while more detailed, it remains a selective representation of the full framework, encompassing one characteristic each of hard and soft skills.

Our developed lean competency framework is based on a specific competency model, setting it apart from the existing literature frameworks, where the underlying competency models lack a clear definition. It can be implemented within industrial companies that are encouraged to bolster their lean or continuous improvement departments. After considering the initial goals and insights shared by lean experts contributing to the framework's development, our aim is to develop a framework to identify and bridge competency gaps. The Human Resources department could incorporate this framework into their recruitment process, aiding in in the selection of candidates with essential hard and soft skills required for their job levels. Subsequently, the framework application will support organizations in identifying the crucial competencies necessary for successful lean management practices, guiding targeted training and recruitment. It also ensures standardized competencies across the organization, promoting consistent implementation of lean principles. Moreover, by clearly defining these competencies, organizations encourage employees to align their skills and behaviours with lean management principles.

Table 4. Competency framework extract.

Performance criteria for lean expert (8)	Performance criteria for lean leader (7)	Performance criteria for lean practitioner (6)	Competency statement (5)	Specific area of competence (4)	General area of competence (3)	Sub-category (specific) (2)	Category (general) (1)
Determine the tools and approaches to be applied at each plant level according to the group's strategic objectives.	Monitor the proper implementation of lean tools and the adequacy of the approaches to the desired optimization objectives in different projects.	Deploy and implement lean tools and approaches to optimize process performance in workshops.	Use and implement approaches and tools to optimize the performance of industrial processes (Lean manufacturing, DMAIC, Six Sigma, Kanban, 5S, Kaizen, workstation ergonomics, etc.).	Approaches and tools for optimizing the performance of industrial processes (Lean manufacturing, DMAIC approach, Six Sigma, Kanban, 5S, Kaizen, workstation ergonomics, etc.).	Lean tools	Know how	**Hard skills**
Analyse monthly the status of the achievements of each plant.	Analyse and follow up weekly on the progress of technical studies done at the operational level.	Support the teams in the realization of technical studies at field level.					
Determine and secure funding for projects to improve the performance of existing equipment and for investments in new equipment.	Carry out financial studies of projects to improve the performance of existing equipment and to invest in new equipment.	Assist the teams technically during the start-up of new installations and solve problems.					

Additionally, some organizations could use competency frameworks for accrediting their staff in lean, providing external recognition of employee's skills, and setting benchmarks for achievements and continuous improvement. The benefit of our lean competency framework was supported by lean professionals involved in the elaboration process. Through in-depth interviews, these professionals validated the framework's applicability and effectiveness in lean environments. Their direct involvement added practicality to the framework and ensured that it resonated with industry experts who are well-versed in lean methodologies and continuous improvement practices. This collaborative approach supported the framework's credibility and confirmed its capacity to drive meaningful improvements within lean organizations.

While this value was confirmed by lean experts and professionals, we also recognised the need for fine-tuning and refinement of this foundational framework to ensure its continued relevance in a rapidly evolving world. Overall, this study illustrates the practical benefits of our competency framework in enhancing recruitment and training processes within organizations, underscoring its utility in enhancing talent management strategies.

5. Conclusion

Competency management in the context of lean is necessary for organizations wishing to enhance performance and maintain market competitiveness. Indeed, it is a key factor in success, particularly in a lean management context, aiming to improve a company's achievements permanently and continuously.

Our research led to the development of a new competency model that offers a holistic view of competencies. This approach allows for a more precise assessment of competencies and better decision making in terms of professional development. Furthermore, our model was designed to be adaptable to various industrial sectors and fields, making it a versatile tool that can be applied in diverse contexts.

Second, our study introduced an innovative competency framework, based on the developed competency model, and applied it through a case study in the automotive industry. It is an incorporation of a new tool that addresses the competencies within lean organizations, emphasising that this issue has not received adequate attention in prior research, and no study has specifically focused on lean framework elaboration.

By implementing this framework, we aim to enhance talent management practices, improve lean employees' performance and satisfaction, and ultimately contribute to the long-term success and competitiveness of companies. Through the effective use of the framework, the HR department will design targeted training programs and allocate resources strategically to align employee skills more closely with job requirements. The application of this framework will enable HR to improve the quality and efficiency of the hiring process for high-potential talent. Additionally, the competency framework can be used in performance management to provide feedback about performance evaluations and set clear expectations for employees.

To conclude, we strongly advocate that industries proactively adopt and implement the competency framework as a dynamic tool to enhance their employees' skills, use it as a benchmark for evaluating operative performance, provide targeted feedback, and identify areas for improvement in a lean context.

Overall, from a developmental perspective, we suggest that ongoing research and feedback loops refine and enhance the developed framework, ensuring its continued relevance. This is particularly because it is the result of inputs gathered from the sample of experts consulted during our study, as well as evaluations from professionals in the automotive sector. Subsequently, to further enhance the framework, we recommend involving experts from diverse industrial sectors and implementing it software applications.

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Appendix A: Competency Framework

Performance criteria for lean expert	Performance criteria for lean leader	Performance criteria for lean practitioner	Competency statement	Specific area of competence	General area of competence	Sub-category (specific)	Category (general)
Determine the tools and approaches to be applied at each plant level according to the organization's strategic objectives.	Monitor the proper implementation of lean tools and assess the appropriateness of approaches in achieving optimization objectives across various projects.	Deploy and implement lean tools and approaches to optimize process performance in workshops.	Use and implement approaches and tools to optimize the performance of industrial processes (Lean manufacturing, DMAIC, Six Sigma, Kanban, 5S, Kaizen, workstation ergonomics, etc.).	Approaches and tools for optimizing the performance of industrial processes (Lean manufacturing, DMAIC approach, Six Sigma, Kanban, 5S, Kaizen, workstation ergonomics, etc.).	Lean tools	Know how	**Hard skills**
Analyse monthly the status of the achievements of each plant.	Analyse and provide weekly updates on the progress of technical studies at the operational level.	Support teams in conducting technical studies at the field level.					
Develop and implement innovative solutions for optimizing industrial processes, enhancing efficiency and effectiveness using innovative and advanced methods.	Oversee the monitoring of industrial process performance, making strategic adjustments based on optimization tools and approaches.	Engage in continuous improvement efforts by leveraging optimization tools for ongoing enhancements.					
Demonstrate mastery in statistical tools, applying advanced statistical techniques to guide decision-making for complex organizational challenges.	Integrate statistical tools strategically at a broader organizational level, aligning with lean strategies and goals.	Apply statistical tools and Six Sigma principles to analyse data and identify areas for improvement within the lean processes.	Master the statistical tools and Six Sigma.	Techniques used to collect, analyse, interpret, and present data. And statistical tools to achieve process improvements.	Statistical tools and Six Sigma		
Apply advanced problem-solving techniques to address complex organizational challenges and drive innovation.	Develop and implement strategic approaches for problem-solving across various teams, aligning with lean strategies.	Utilize fundamental problem-solving methods and tools within the context of lean projects.	Demonstrate ability to employ a variety of problem-solving methods and approaches to analyse and resolve issues effectively within the lean context.	Techniques, frameworks, or systematic approaches used to identify, analyse, and resolve problems within a given context. aiming to find viable solutions or improvement.	Methods and approach for problem-solving		

Take a leadership role in driving comprehensive problem resolution initiatives, influencing organizational problem-solving strategies.	Promote collaborative problem-solving within teams, fostering an environment where individuals collectively contribute to solutions.	Apply root cause analysis techniques to identify and address issues affecting operational efficiency at a practical level.					
Develop and implement innovative solutions for complex problems, contributing to the evolution of lean methodologies.	Integrate problem-solving approaches into performance optimization strategies, ensuring sustained efficiency gains.	Support a continuous improvement mindset by employing problem-solving approaches to enhance day-to-day processes.					
Design and implement advanced change management plans that drive lean transformations across the organization.	Demonstrate strategic leadership in change management, aligning organizational changes with lean objectives.	Integrate change management techniques into lean initiatives, ensuring smooth transitions and effective adoption of lean practices.	Master of change management techniques.	Methodologies and practices of defining project goals, outlining tasks, setting timelines, allocating resources, managing risks, coordinating teams, monitoring progress, and ensuring successful project completion within the defined scope, budget, and timeline.	Project management approach		
Apply advanced project portfolio management techniques, optimizing the portfolio of lean initiatives for maximum impact.	Take a leadership role in project management, applying advanced techniques to oversee complex lean projects effectively.	Apply technical project management techniques to align project objectives with lean principles, ensuring efficient project execution.	Master of technical project management techniques.				
Set up a monthly monitoring schedule achievement.	Monitor achievements on a weekly basis.	Support teams in gathering data at the field level.	Monitor the completion of technical and financial studies for performance improvement projects (existing equipment) and investments (new equipment).				
Develop and execute financial strategies that align with and drive lean transformations	Take a leadership role in overseeing budgets related to lean projects, ensuring financial goals align with organizational objectives.	Apply financial analysis skills to assess the costs and benefits of lean practices, contributing to informed	Master of financial management tools				

across the organization.		decision-making.					
Promote a culture of cooperation and facilitate collaboration among team members.	Foster a collaborative environment and encourage teamwork.	Collaborate actively with team members.	Engage with cross-functional teams.	Collaboration within cross-functional teams	Cooperation	Relational competence	**Soft Skills**
Ensure a harmonious working environment.	Ensure that team members work together efficiently toward Lean objectives.	Share insights and works collectively on Lean projects	Share insights and contribute to a collaborative atmosphere.				
Nurture a sociable atmosphere, encouraging open communication among team members.	Demonstrate interpersonal skills, making team members feel comfortable and valued.	Build positive relationships within the team, contributing to a sociable and supportive Lean culture.	Demonstrate strong interpersonal skills that enhance team cohesion.	Ability to build positive relationships, foster a sociable environment, and demonstrate interpersonal skills in various work-related interactions.	Sociability		
Facilitate and enhance group work effectiveness.	Manage effectively group dynamics.	Contribute actively to group efforts.	Demonstrate active participation and collaboration on cross-functional projects to achieve project goals.	Collaboration on cross-functional projects to achieve project objectives collectively.	Teamwork		
Leverage collective strengths to achieve Lean goals.	Ensure cohesive teamwork in alignment with Lean principles.	Demonstrate flexibility and adaptability in teamwork settings.					
Articulate complex Lean concepts clearly.	Communicate vision and objectives clearly.	Express ideas effectively.	Demonstrate communication skills, particularly in presenting ideas and proposals, ensuring clarity and fostering engagement in discussions.	Conveying ideas clearly, fostering open communication, articulating ideas persuasively, tailoring communication to different audiences, and ensuring clarity in presentations.	Effective Communication Skills		
Influence and gain acceptance through effective communication.	Ensure team members understand and align with Lean strategies.	Facilitate a clear and concise communication of Lean initiatives within the team.					
Demonstrate strong skills in negotiation, persuading stakeholders and team members to embrace Lean methodologies and initiatives.	Demonstrate strong negotiation skills, advocating for Lean principles and securing necessary resources for implementation.	Demonstrate effective argumentation skills in proposing Lean improvements and negotiating support from team members.	Demonstrate the ability to present compelling arguments, securing favourable terms, and fostering positive outcomes for the organization.	Ability to articulate arguments effectively, negotiating, and reaching agreements that align with organizational objectives.	Argumentation Skills/ Negotiation Skills		