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WORKER INVOLVEMENT STRATEGIES IN CONSTRUCTION: INSIGHTS FROM THE LEAN LITERATURE

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ABSTRACT

The Human-centric approach concept establishes that human needs must be at the center of the production process. Human needs models propose a sense of belonging among these necessities since people require appreciation, collaboration, and involvement. In this work, the Employee Involvement (EI) concept relies on developing the workers' sense of belonging to the organization and allowing these workers to change the work environment. Despite the potential contributions, papers systematizing EI strategies in the construction industry were not found in the literature. Therefore, this paper aims to identify worker involvement strategies in construction based on the EI concept in the Lean Construction literature. The research method adopted was a Systematic Literature Review (SLR). A total of 12 papers were considered eligible for this review. 12 EI strategies were identified and analyzed based on three constructs: upskilling workers, communication, and autonomy for decision-making. The results reveal that there are still few empirical studies. Furthermore, the strategies are based on the managers' and researchers' points of view, not considering the workers' points of view. However, the presented strategies and discussion might be considered in elaborating and implementing the HC approach for construction. A set of questions was elaborated to support future research.

KEYWORDS

Employee empowerment, Employee participation, Industry 5.0, Lean construction 4.0.

INTRODUCTION

The human-centric (HC) approach is defined as placing the main human needs and interests at the center of the production process (Breque et al., 2021). Lu et al. (2022) bring a similar understanding, pointing out that manufacturing should be HC by positioning the well-being of the industry workers at the production process center. This concept is referred to as one of the cores of Industry 5.0 (Breque et al., 2021; Lu et al., 2022) and Lean Construction 4.0 (Hamzeh et al., 2021; González et al., 2023).

Lu et al. (2022) summarize the needs of workers in manufacturing based on the hierarchy of basic needs presented by Abraham Maslow in 1943. Wahba and Bridwell (1976) and Ward and Lasen (2009) also present other models that discuss human needs. However, the hierarchy proposed by Maslow (1943, 2017) is widely disseminated and used worldwide (e.g., Zhao et al., 2015). Furthermore, it refers to humans (Maslow, 2017), not specifically those who integrate an industrial sector. Thus, these aspects will also be considered necessities of construction workers.

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The five levels of human needs specified by Maslow (2017) are physiological (bottom), safety, love/belonging, esteem, and self-actualization (up). Based on this and in discussion with specialists, Lu et al. (2022) proposed the "Industrial Human Needs Pyramid", also integrated into five levels, from bottom to up: safety, health, belonging, esteem, and self-actualization. Although this model needs to be analyzed to determine if it can be fully applied to construction workers' context, this paper focuses on the third level, related to the need for belonging, presented in both models (Maslow, 2017; Lu et al., 2022). Lu et al. (2022) define the sense of belonging as human emotional needs for interpersonal relationships, affiliation, connection, and being part of a group. Some aspects of this need rely on appreciation, collaboration, and involvement.

Employee involvement (EI) is an important concept regarding this topic. Traditionally, employee involvement has two goals. The first consists of developing a sense of belonging to the organization through high commitment. The second refers to allowing the worker to change the work environment by giving suggestions that improve the organization's performance (Tortorella et al., 2021; Welikala & Sohal, 2008).

Employee involvement in the pursuit of continuous improvement has been widely discussed in the literature on operations management, industrial relations, work process, and human resource management (Hernandez-Matias et al., 2020). According to the authors, EI is a fundamental feature of continuous improvement programs.

EI has also been described as employee empowerment (EE) for decision-making and problem-solving at his/her organizational level (Tortorella et al., 2021; Welikala & Sohal, 2008). According to Sun et al. (2000), this understanding is based on the premise that the worker directly involved with a set of specific tasks is in the best position to decide and improve the process related to these activities. Another conceptualization proposed by Dimitmades (2001) highlights that empowerment refers to allowing and supporting the organization's human resources to make efficient, effective, and high-quality decisions, leading to continuous improvement. Thus, Vidal (2007) emphasizes the need to increase the responsibility of frontline workers and improve their skills to perform these new demands.

Different terms can be found in the literature to which similar meanings were attributed, which are: involvement (Koskela, 1992; Hasle et al., 2012; Hernandez-Matias et al., 2020; Sun et al., 2000; Tortorella et al., 2021; Welikala & Sohal, 2008), empowerment (Koskela, 1992; Dimitmades, 2001; Vidal, 2007; Welikala & Sohal, 2008), participation (Sun et al., 2000; Tortorella et al., 2021; Welikala & Sohal, 2008), engagement (Liker, 2004; Hernandez-Matias et al., 2020; Tortorella et al., 2021) and commitment (Hernandez-Matias et al., 2020; Welikala & Sohal, 2008). This paper focuses on the first three terms presented since the last two terms also incorporate other meanings. Furthermore, employee, worker, and frontline worker are considered synonyms in this research.

The workers' involvement has been a study subject by researchers in Lean Production/Lean Management (Beraldin et al., 2022; Hasle et al., 2012; Hernandez-Matias et al., 2020). Hernandez-Matias et al. (2020) named 'soft-lean practices' the ones aimed at workers' and managers' involvement and commitment to promoting the system's human aspects. The authors also emphasized that EI/EE are lean practices related to workers, using the terms employee's HRLP (human-related lean practices) to designate these practices. In the context of the Toyota Production System (TPS), Liker (2004) points out that the non-use of workers' creativity is a type of waste (a practice that does not add value). According to this author, this waste occurs when there is no use of time, ideas, skills, or opportunities for learning and improvement by not engaging or listening to workers. Among the 14 principles of the "Toyota Way" presented by Liker (2004), the sixth principle associates the empowerment of workers with continuous improvement.

Aligned with the lean literature, Hernandez-Matias et al. (2020) highlight that the involvement of workers for continuous improvement refers to organizational practices that, when implemented consistently, promote a constant increase in worker motivation and opportunities for improving products and processes.

Within the scope of Lean Construction, Koskela (1992) points out that the concept of employee involvement emerged from efforts aimed at Just-in-Time (JIT) and Total Quality Control (TQC). According to the author, there are several reasons for the empowerment of construction workers, including the need for quick responses to problems. Koskela (1992) also points out that continuous improvement depends on workers' daily observation and motivation.

Despite the potential contributions, papers systematizing strategies for employee involvement in the construction industry were not found in the literature. Besides, Noueihed and Hamzeh (2022) and González et al. (2023) raised important questions to be addressed by future research related to the social impacts of Construction 4.0, which are strongly related to the HC approach concept. One question regarding this review's topic is how to include/involve workers in the design and implementation of new construction processes.

Therefore, this paper aims to identify worker involvement strategies in construction based on the EI concept in the Lean Construction literature. Understanding the existing employee involvement strategies in the LC approach is essential for pondering possible paths to implement the HC approach in construction processes.

LITERATURE REVIEW

Involvement is not a technique but a philosophy that demands a transformation in how organizations are designed and managed (Dimitmades, 2001). As argued by Sun et al. (2000) and Welikala and Sohal (2008), for effective worker participation, it is necessary that responsibility in decision-making and the power and autonomy to act at their organizational level be delegated to these workers. Participation without attribution of power will result in unaccepted suggestions, leading to frustration and potential demobilization of workers in contributing to the organization's performance (Sun et al., 2000).

Welikala and Sohal (2008) and Dimitmades (2001) highlight two workers' empowerment tools available for application by managers: participatory management and self-management. In participatory management, workers receive partial authority and responsibility in decision-making and are encouraged to present their ideas for the organization's continuous improvement in all its aspects. In the case mentioned, implementing the ideas is up to the managers. In self-management, workers are given full authority and responsibility and held accountable for their actions. This autonomy and responsibility refer to presenting new ideas and implementing these proposals. The authors point out that the choice between these two tools will depend on the scope of responsibility and authority to be attributed to workers. Dimitmades (2001) highlights that total empowerment may not be appropriate for all organizations or workers. Thus, it recommends that managers conduct a comprehensive assessment to determine the empowerment strategy that best fulfills the organization's demands.

Despite the implementation of EI strategies being significantly frequent in manufacturing (Hernandez-Matias et al., 2020; Tortorella et al., 2021), the literature indicates a gap regarding applying EI strategies in construction and the systematization of the existing strategies (Lehtovaara et al., 2022).

RESEARCH METHOD

The research strategy adopted is the Systematic Literature Review (SLR). According to Dresh et al. (2016), SLRs are studies to map, find, critically evaluate, consolidate, and aggregate the results of relevant primary studies on a specific research topic. The gap found in the literature

related to the systematization of EI strategies in construction was divided into the following question: 1) What are the strategies for upskilling workers to contribute to their participation in the design/implementation of lean processes in construction?; 2) How can communication between workers and managers be performed?; 3) How to assign responsibility and autonomy for decision-making to workers in the context of Lean construction? The research process is illustrated in Figure 1.

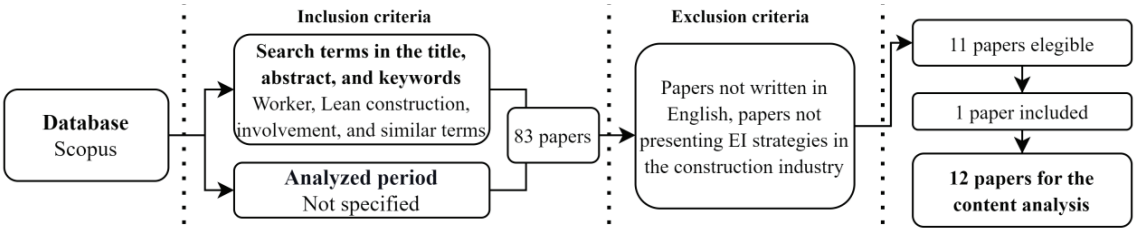

Figure 1: SLR research process adopted

The research process was composed of the definitions of the database, the inclusion criteria, the exclusion criteria, and the content analysis. The database adopted was Scopus since this search engine covers many journals and some proceedings related to construction management.

The following string was used as inclusion criteria: "TITLE-ABS-KEY ((employee* OR worker* OR workforce) AND ("lean construction" OR "lean production" OR "World Class Manufacturing") AND construction AND (involv* OR empower* OR participat* OR engag* OR commit*))". Papers on the subject were read to determine the most appropriate terms for the search string. Tests were made to select relevant terms and discard those that did not increase the number of publications during the search. No search period was specified. Eighty-one papers were identified at this stage.

Two exclusion criteria were adopted: discarding papers not written in English (due to the universality of the language) and not presenting EI strategies in the construction. From this stage, 11 papers were selected. If the paper presented only a part of the study addressed worker involvement strategies, the study was considered eligible for this SLR. A short paper that fulfills the criteria was also added, which was not located by the Scopus search.

The papers considered eligible for this review were analyzed and discussed based on three constructs highlighted by the scientific literature as important processes for EI: upskilling workers, communication, and autonomy for decision-making. **Upskilling workers** means improving their abilities to face new responsibilities (Vidal, 2007). **Communication** refers to improving the communication between managers and workers (Sun et al., 2000; Welikala & Sohal, 2008). **Autonomy for decision-making** refers to the attribution of responsibility to the workers for decision-making and autonomy for action at their level in the organization (Sun et al., 2000; Dimitmades, 2001; Welikala&Sohal, 2008; Tortorella et al., 2021).

RESULTS

The sample included two journal papers (16,7%) and ten conference papers (83,3%). Regarding journal papers, one was from the International Journal of Occupational Safety and Ergonomics (2021) and one from Frontiers in Built Environment (2022). Of the conference papers, eight were from the Annual Conference of the International Group for Lean Construction (IGLC) proceedings (2011, 2014, 2015, 2019, two in 2020, and two in 2021), one from European Modeling and Simulation Symposium proceeding (2017) and one from the International Workshop 'When Social Science meets Lean and BIM Towards Industry 5.0' proceeding (short paper) (2022). This section presents the content analysis.

The strategies identified in the lean literature for involving construction workers are presented in Table 1, divided into three groups: ‘upskilling workers’, ‘communication’, and ‘autonomy for decision-making’.

Table 1: Systematization of The Strategies Identified in the Analyzed Papers

Authors	Workers’ involvement strategies
Group 1: **Upskilling workers**	
von Heyl (2015)	Simulation game
Santana et al. (2017)	Educational animation
Hamzeh and Albanna (2019)	Training using non-digital games
Pütz et al. (2021)	Gamification components in LC training
Jacobsen et al. (2021)	Gaming environment involving multiple players simultaneously in virtual reality for LC training
Group 2: **Communication**	
Valente and Costa (2014)	Transparency practices at the construction site
Reinbold et al. (2020)	Digital visual management (VM) devices to increase workers' situational awareness (SA)
Abu Aisheh et al. (2021)	Constant and direct communication between managers and workers
Stevens (2022)	Worker anonymous Hazard Reporting app
Group 3: **Autonomy for decision-making**	
Antillón et al. (2011)	Autonomation in the context of safety
Reinbold et al. (2020) and Görsch et al. (2020)	Workers' situational awareness (SA) increased by digital visual management (VM) devices or other methods
Lehtovaara et al. (2022)	Decentralizing decision-making in production planning and control

UPSKILLING WORKERS

According to Hamzeh and Albanna (2019), all human resources involved with the process must be integrated, empowered, and trained to achieve all the benefits of lean construction. Thus, construction workers assume new roles and responsibilities and must be qualified regarding lean tools, principles, and concepts. von Heyl (2015) emphasizes the need for a systematic approach to teaching the basic lean principles and tools for the application of this philosophy to be accepted. Based on this understanding, the upskilling workers' strategies (group 1) identified in the literature are presented.

In order to teach basic Lean principles and tools to workers and site managers, von Heyl (2015) developed a systematic approach using a simulation game. A simulation of a road construction site was developed traditionally and also with the implementation of lean principles, followed by the participants' analysis. The results revealed that the simulation enabled the involvement of participants in the learning process. From the feedback provided by the workers, they felt motivated throughout the game, in which they were encouraged to experience the lean principles and reflect on possible improvements in existing processes. The

author recommends that new tests be done to refine and use the proposed simulation game professionally.

Santana et al. (2017) worked on developing educational animation to transfer knowledge to workers regarding good practices related to lean construction. The material is structured for workers to have a vision of adopting lean practices in their work routine. As the authors point out, educational animation is a complementary action to training, as it illustrates how work should be carried out based on lean principles. The authors did not implement the proposed method on a construction site to collect feedback and improve the strategy. However, they encourage the development of new materials and the implementation of educational animation in future construction applications.

Hamzeh and Albanna (2019) developed a tool to assess construction workers' understanding of lean principles and concepts. A survey was conducted with workers from different construction sites to validate the tool and identify workers' weaknesses in understanding lean concepts. Based on the results, the authors proposed training for construction workers using non-digital games (House of cards, 5S number, and airplane game, among several others). The authors also present a correlation between the games with the lean categories explored in these games. According to the authors, training with games facilitates seeing lean concepts and principles applied, allowing workers to get involved with the learning process. Despite the suggestion of using games, the authors do not explore the application of these games in this paper to improve workers' knowledge.

Putz et al. (2021) also highlighted the need for efficient and targeted training to enable and motivate workers in applying lean construction methods (Last Planner System, Takt planning and takt control, 5S and A3). The authors conducted an exploratory study using gamification to improve training about lean construction principles and practices. The concept of gamification involves developing a game-like experience in a non-game context. Thus, gamification is applied by bringing game elements, such as scores, levels, and narratives, into the daily work context, creating a learning environment. The authors developed a framework for the application of gamification in LC training with several elements, such as challenges, cooperation, competition, feedback rounds, levels, points, rewards, and playing different roles, among others. They also highlight the importance of working with different elements, considering that different approaches in the game stimulate workers. The authors recommend that future studies be conducted using gamification in Lean Construction training to evaluate this strategy's contributions.

Jacobsen et al. (2021) proposed the development of a digital learning platform for teaching LC concepts using virtual reality (VR) with multiple players. As a result, VR can be used to teach lean principles and concepts in a more realistic environment when compared to using a board or other non-digital lean simulation game. In addition, the authors point out that the data collected automatically during the game can help in decision-making processes since it is possible to analyze this data. For future studies, the authors highlight the possibility that users can interact with each other within the game and also the need to implement new lean principles in the VR environment.

COMMUNICATION

Practices related to communication between managers and workers and the availability of readily accessible information for workers are part of the communication construct.

Valente and Costa (2014) developed a set of recommendations for applying transparency practices in construction based on a literature review and case studies. Among the 20 transparency practices applied, the authors concluded that 15 have an impact on the involvement of workers, such as exposure to long and medium-term planning, dissemination of short-term planning, Kanban systems, visual management boards, and quality indicators,

among others. Increasing process transparency can be used for workers' motivation and participation, among other contributions. Some identified best practices were not implemented in the study but were suggested for future applications.

Reinbold et al. (2020) performed a literature review on the role of digitization in visual management (VM) to increase workers' and teams' situational awareness (SA). They highlighted using position sensors in tools, materials, and workers to collect geographic coordinates and present this information on displays in strategic places (e.g., floor entrances) in real-time. Thus, workers acquire situational awareness and can make decisions based on up-to-date information. The authors point out that future studies should be carried out to identify which VM devices could be used to display the information required in construction sites.

Abu Aisheh et al. (2021) studied the impact of lean construction principles on health and safety at work in construction projects. The authors point out that constant and direct communication between managers and workers seeking to avoid poor safety was the lean technique considered most important among respondents (in the subset related to communication). This communication can occur in daily joint meetings to improve the safety awareness of those involved. The authors indicated the limitation that the results refer only to the studied context, which may be different in other locations.

Stevens (2022) proposed a mobile computing technology for construction safety. The authors point out that workers feel uncomfortable reporting safety issues to supervisors in person. Therefore, a smartphone safety app was created, allowing the report to be done accurately and maintaining the worker's confidentiality. Although the beta version has been developed, it has not yet been tested on a construction site.

AUTONOMY FOR DECISION-MAKING

Strategies related to workers' or teams' autonomous decision-making are part of the autonomy for decision-making construct.

Antillón et al. (2011) proposed a matrix between LC and safety management practices to understand how lean practices interfere with safety. One of the results presented by the authors is the association between the concept of autonomation and the involvement of workers in the context of safety management at construction sites. According to Liker (2004), autonomation consists of not permitting a problem to pass to the next station by allowing machines or workers to interrupt production when something unusual is detected. Thus, Antillón et al. (2011) pointed out that autonomation can be directly extended to workers' involvement, indicating they can stop production whenever they feel at risk. Other Lean practices workers must participate in include root cause analysis, standardization, and continuous improvement. The authors reinforce the need for continuity of these studies to integrate safety as a target for production management.

The paper by Reinbold et al. (2020) is also included in this group since the authors discuss self-managed teams. The increased situational awareness using digital visual devices provides more appropriate decision-making for the context in which these teams are inserted. SA implies that teams have adequate levels of information to understand the project's status, which activities are in progress and where they are taking place, and the availability of materials and tools, among other information. These self-managed teams are formed of proactive workers capable of managing their activities and empowered to make decisions and introduce improvements in the process. The authors pointed out that the availability of data collected in real-time through digital visual management devices can be the link for construction workers to have greater autonomy in the decision-making process. They also highlighted that future studies should be conducted to understand which SA information should be available for different contexts. Görsch et al. (2020) conducted a literature review addressing SA for better decision-making for workers. The author investigated information capture methods and

discussed how the outcomes would boost on-site productivity. However, as the authors point out, it is necessary to continue research to develop methods that explore the potential of SA.

Lehtovaara et al. (2022) proposed a framework combining decentralized decision-making with takt production involving frontline workers in construction. The main aim was to investigate how this combination could affect production planning and control (PPC) practices. In PPC construction, decentralization refers to distributing responsibilities related to production planning and control (initially centralized on project and site managers) to site teams (involving crew leaders and workers). The authors mentioned that intense involvement of the teams from the early stages of planning to the control phase is necessary for the decentralization of planning and production control to be successful. In the performed study, decentralized decision-making related to planning was partially dominated by crew leaders, with little involvement of workers. However, the authors report that decentralization in planning contributed to the commitment and motivation of the teams. In the control stage, there was a lack of worker involvement in decision-making. According to the results presented, the inadequate implementation of decentralization for decision-making in the control stage compromised the involvement of workers, causing them stress. The authors report the need for further studies, given that the present paper was limited to a single-case study.

DISCUSSION AND FUTURE DIRECTIONS

Although no time limit was established for the search, a few published papers discuss worker involvement strategies in the context of Lean Construction.

The group that refers to upskilling workers presents strategies exclusively to train construction workers to learn concepts, principles, and practices. Strategies involve simulation games, educational animation, non-digital games, gamification elements in training, and the application of VR reality for training. Based on the EI concept, new responsibilities are assigned to these workers, resulting in new demands regarding skills (Vidal, 2007). Thus, training has the potential to contribute to the improvement of workers' knowledge on the subject to fulfill these new demands.

Training using primarily non-digital games, educational animation, and gamification elements may have significant potential to be adopted to keep workers up-to-date with lean concepts, principles, and practices, improving their everyday work practices. Unlike the simulation or use of VR, implementing the first three strategies may be low-cost. However, generalizing what was pointed out by Pütz et al. (2021), it is necessary to analyze the effect of training using the mentioned resources in a structured manner to identify the actual contributions of these techniques in the learning and involvement of workers. As an example, the proposal by Hamzeh and Albanna (2019) involves the use of non-digital games for training workers. The authors did not evaluate which games are best suited to the workers' context, considering aspects such as the function performed by each of them, education, and familiarity with digital and non-digital games, for example.

None of the papers that integrate this group discusses what skills should be developed in workers to enable decision-making. The articles focus exclusively on understanding concepts, principles, and lean practices.

Regarding the communication group, strategies with different approaches were identified: using visual devices (non-digital or digital) to provide information to workers; bidirectional communication between managers and workers within the scope of safety management; and implementing a smartphone app for workers to report safety-related issues. Communication plays a crucial role in EI (Sun et al., 2000; Welikala & Sohal, 2008) since workers should propose improvements in the process. Thus, some discussions are provided as follows.

Communication is unidirectional in visual devices since workers only receive the information presented in the device (usually elaborated by managers). However, there is no

communication from the worker towards the manager about improvements to be incorporated in the process, in the information representation of these visual devices, among others. Workers' participation in developing these devices can configure an interesting strategy. The worker will already be familiar with the interface and available information when using them daily.

Another aspect to highlight is that Abu Aisheh et al. (2021) do not present a systematized bidirectional communication strategy involving: the collection of workers' proposals and perceptions by managers in the field of safety; description of how these proposals are evaluated and incorporated into construction processes; how feedback is transmitted to the worker about the implementation or not of their proposals. The same occurs with the app's proposal to report safety-related issues, as it is not explicit how managers will use this collected information and how the general feedback process will be given to workers (considering that the reports are anonymous). The lack of a systematized strategy for integrating proposals and giving feedback will culminate in workers' demotivation and frustration, leading to a potential decrease in the presentation of their contributions to the organization (Sun et al., 2020).

Concerning the decision-making autonomy group, the following strategies were observed: application of autonomation in the context of safety at work; increasing situational awareness to improve the teams' decision-making; and decentralizing the decision-making process. Strategies for autonomy in decision-making represent, in the view of Sun et al. (2000) and Welikala and Sohal (2008), the effective participation of workers.

All the strategies presented involve decentralizing decision-making since this responsibility will not only be up to the project/site manager. Lehtovaara et al. (2022) mentioned that the benefits of decentralization and autonomy in the decision-making process had been the focus of interest in several production sectors, considering that this strategy contributes to increased efficiency, creativity, and well-being of workers. Despite the potential contributions observed in the literature, only Lehtovaara et al. (2022) conducted an empirical test of workers' involvement in decision-making. However, the strategies adopted in the study compromised the workers' effective participation in the production planning and control process. Thus, the latent need for developing effective strategies to ensure the involvement of workers in the decision-making process in different construction activities remains for future research.

In general, for workers to be involved in construction, there is a significant need to address efforts towards upskilling workers, communication, and adopting strategies that enable workers' autonomy for decision-making. These actions complement each other since adequate decision-making is only possible by increasing workers' skills and improving communication between managers and workers. Table 2 presents a set of questions that may help researchers advance studies on employee involvement based on the three constructs mentioned.

Table 2: Research Directions Based on the Three Constructs Related to EI

Construct	Questions to be addressed in future research
Upskilling workers	- What skills should be developed to enable construction workers to make decisions at their activity level? - How to develop the skills required for workers' participation in construction? - Which training strategies have the most significant potential to train workers in lean concepts, principles, and practices considering the characteristics of construction workers?
Communication	- How to systematically establish bidirectional communication between workers and managers to ensure workers' proposals for process improvements are collected, analyzed, and possibly incorporated into the organization's practices? - How to organize the feedback process to give feedback to workers on the implementation or not of their proposals? - How can workers contribute to elaborating visual devices (related to the principle of transparency) since they will use the available information on these devices? - How to establish interaction between managers and workers based on the information in the visual devices?
Autonomy for decision-making	- In which project production and safety activities can managers assign workers autonomy for decision-making? - What new responsibilities could managers assign to workers within the functions performed at the construction site? - What strategies should be implemented to guarantee the real participation of workers in the decision-making process without this participation being restricted to crew leaders? - How could workers be involved in decision-making at their organizational levels based on the knowledge and skills they developed and the communication strategies adopted?

Regarding the HC approach, Lu et al. (2022) point out that it is an early and unclear concept that needs urgent discussions to clarify its research agenda. Despite the concept positioning presented by the mentioned authors in the manufacturing industry, this concept still needs to be determined in the construction industry, demanding research to guide the comprehension and implementation of the HC approach in construction. Therefore, EI strategies in the context of LC have the potential to contribute to the elaboration and implementation of the HC approach in construction since placing the main human needs and interests at the center of the production process is a focus of both concepts/approaches.

CONCLUSIONS

This paper contributes to the body of knowledge by systematizing worker involvement strategies in LC based on three constructs: upskilling workers, communication, and autonomy for decision-making. In total, 12 EI strategies were identified and analyzed. Despite advances in discussions on the involvement of workers in construction in light of LC, there are still few empirical studies, mainly directed to autonomy for decision-making. In addition, the strategies identified in the literature are based on the managers' and researchers' points of view that workers must develop more knowledge and skills to participate and make decisions at their organizational levels. Further research should assess the workers' perception of how they can contribute to the organization based on their previously acquired knowledge, skills, and experience.

Based on the analyzed studies and the concept of EI, a set of questions was elaborated that can be considered for the continuity of reflections and strategy elaboration. The presented strategies and discussion might support elaborating on and implementing the HC approach. Regarding the use of digital technologies related to the Construction 4.0 paradigm in some of the identified strategies (e.g., VR and sensors), future research should also investigate how other technologies associated with this paradigm can contribute to workers upskilling, communication, and autonomy for decision-making.

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