Journal of Optimization in Industrial Engineering,
Vol.17, Issue 1, Winter & Spring 2024, 111-128
DOI: 10.22094/QJIE.2024.1117575

Research Article

Conceptual Framework for Implementing Bottom-Up Kaizen in the Malaysian Automotive Sector

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Received: 04 April 2024; Revised: 06 June 2024; Accepted: 06 June 2024

Abstract
This research aimed to discern the determinants shaping the implementation of bottom-up Kaizen models in the Malaysian automotive industry, conducted in three distinct phases: needs analysis, design and development, and evaluation. The identification of model prerequisites involved utilizing two instruments. In the initial phase, a panel of 11 experts employed the Fuzzy Delphi Method (FDM) to formulate the model, relying on a 5-point Likert scale survey questionnaire for expert feedback. The second phase employed a Partial Least Square Structural Equation Model (PLS-SEM) approach to appraising the model, involving 300 employees in the automotive manufacturing sector. The outcomes from the first phase led to the creation of a model featuring eight constructs encompassing 41 items, specifically tailored for bottom-up Kaizen activities in the Malaysian automotive industry. Subsequently, the results from the second phase underscored that the bottom-up Kaizen activity model comprises seven constructs, wherein only statistically significant and positively influential factors for both direct and mediated paths were considered. This study has culminated in the formulation of a structural relationship model for Bottom-up Kaizen criteria, offering significant potential benefits and serving as a valuable reference for the Malaysian automotive industry.

***Keywords*:** Bottom-up; Kaizen; Development Design Research; Fuzzy Delphi Method; Partial Least Squares

1. Introduction

The amalgamation of Industry 4.0 (IR4.0) technologies with Kaizen methodologies represents a transformative strategy for organizational advancement. Through implementing incremental changes, organizations aspire to enhance efficiency, elevate quality, and improve overall productivity. The contemporary industrial scenario underscores the paramount synergy between Kaizen and IR4.0 technologies, as emphasized (Latif & Saari, 2023). These technologies, spanning data collection and analysis, process automation, and advanced collaboration tools, act as catalysts, amplifying the impact of Kaizen initiatives on a broader scale, and fostering efficiency gains. However, the successful integration of IR4.0 and Kaizen relies on nurturing a supportive organizational culture that values employee empowerment and continuous learning. In this dynamic paradigm, it is crucial to acknowledge that while IR4.0 technologies introduce new possibilities, it is the seamless integration of technological advancements with the intrinsic Kaizen mindset that propels sustainable improvements, ensuring competitiveness in the evolving industrial landscape. This comprehensive approach underscores the importance of not just embracing technology but also instilling a culture of continuous improvement to truly excel in the era of Industry 4.0 (Takakuwa et al., 2018).

1.1 *National automotive policy (NAP) issues related to malaysian automotive industry*

The progression of the Malaysian automotive industry towards GDP targets is hindered by a diverse set of challenges. Chief among these is the industry's heavy reliance on imported vehicles, despite the National Automotive Policy (NAP) aiming to strengthen the domestic sector. This reliance contributes to trade imbalances and impedes the growth potential of the local automotive industry. Additionally, challenges in competitiveness extend to Malaysian automotive brands, as seen in Proton's struggles to increase market share and overall viability due to issues like quality concerns, limited model offerings, and perceived high prices compared to foreign counterparts. Limited market access further compounds these problems, with Malaysian manufacturers facing obstacles in expanding beyond domestic borders due to factors such as the lack of international recognition, regulatory barriers, and insufficient global distribution networks. Figure 1 suggest such conceptual framework.

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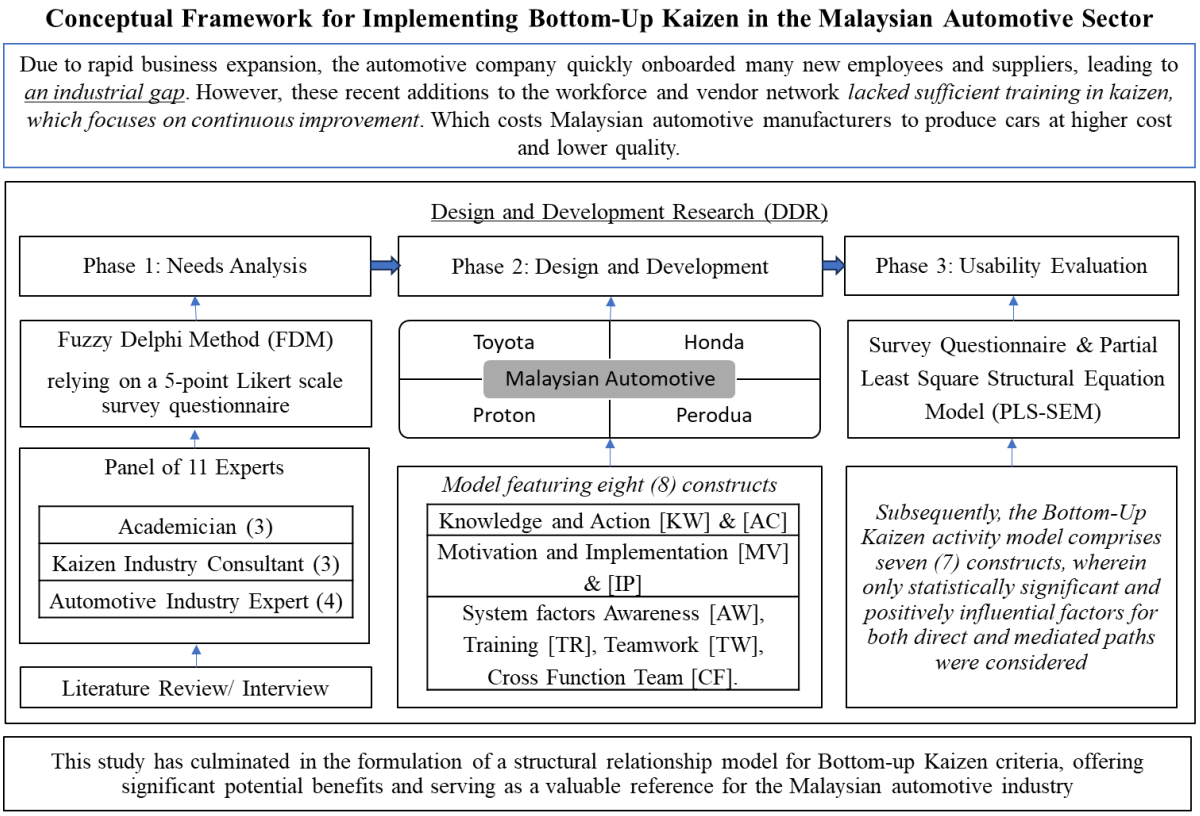

Fig. 1. Conceptual framework for implementing bottom-up kaizen in the malaysian automotive sector

The technological and innovation gap is another critical concern, with Malaysian players lagging behind global competitors in areas such as electric vehicles (EVs), autonomous driving, and connectivity. Slow EV adoption in the country is attributed to infrastructure challenges and the high initial costs associated with EVs. The shortage of skilled workers in automotive engineering, digitalization, and advanced manufacturing exacerbates the industry's struggle to embrace emerging opportunities. Environmental considerations pressure Malaysian manufacturers to align with global sustainability standards and invest in cleaner technologies.

To address these challenges, the Malaysian government and industry stakeholders have initiated comprehensive initiatives, including policy reforms, industry collaborations, skill development programs, EV infrastructure enhancement, and the promotion of green technologies. Through these collective efforts, Malaysia aims to achieve the objectives outlined in the National Automotive Policy, fostering a competitive and sustainable automotive industry capable of navigating the complexities of the global market.

1. *Specific roadmap underpinning the skilled worker's issues from NAP*

This research aims to develop a structural relationship model based on influencing factors of Bottom-up kaizen for the Malaysian automotive industry, to understand and improve their Kaizen (Continuous Improvement) activity.

For the research question, this research has nine research questions, which are as follows:

Phase One: Need Analysis

1. What is the profile of top Malaysian automotive manufacturers of bottom-up kaizen activity in the Malaysian automotive industry?
2. Based on expert evaluation, what are the influencing factors of bottom-up kaizen activity for the Malaysian automotive industry?
3. Based on expert opinion, what is the position of influencing factors of bottom-up kaizen activity for Malaysia's automotive industry?

Phase two: Design and Development

4. To explore the influencing factors that affect the implementation of bottom-up Kaizen in the Malaysian automotive sector.
5. To examine the factors that affect the implementation of bottom-up Kaizen teamwork in the Malaysian automotive industry.
6. To examine how employee motivation mediates the relationship between the influencing factors and the implementation of bottom-up Kaizen in the Malaysian automotive industry.
7. To investigate the mediation effects of employee motivation between the relationship of influencing factors and teamwork amongst employees in the Malaysian automotive industry.

8. To develop a research model for bottom-up Kaizen and lean production management for the Malaysian automotive industry.

Phase Three: Model Evaluation

9. To analyze the influence of bottom-up Kaizen and lean production management on the Malaysian automotive industry.

The overarching process of Design and Development Research (DDR) typically encompasses three phases and is associated with research that aligns with specific criteria as outlined (J. Ellis & Levy, 2008). Table 1 provides a detailed elucidation of these criteria within the DDR approach. This research, aimed at problem-solving, is grounded in existing literature, and the findings derived from such studies have the potential to make significant contributions to the field of operations management. The outcomes of these investigations are intended to benefit both industry practitioners and academicians.

Table 1
Criteria in design and development research approach

Criteria	Statement
1	Able to solve a problem
2	It is conducted based on the literature
3	Outcomes from studies can contribute to a field of study

1.3 Research hypothesis

Research Hypothesis, H1: To investigate the factors influencing the bottom-up Kaizen implementation in the Malaysian automotive industry, 6 hypotheses were formulated.
H1:1: Knowledge of Kaizen influences the implementation of bottom-up Kaizen amongst employees.
H1:2: Action of Kaizen from the management influences the implementation of bottom-up Kaizen amongst employees.
H1:3: Training of Kaizen influences the implementation of bottom-up Kaizen amongst employees.
H1:4: Awareness of Kaizen influences the implementation of bottom-up Kaizen amongst employees.
H1:5: Cross-functional team by employees influences the implementation of bottom-up Kaizen amongst employees.
H1:6: Motivation of employees influences the implementation of bottom-up Kaizen amongst employees.
Research Hypothesis, H2: To investigate the factors influencing the bottom-up Kaizen teamwork in the Malaysian automotive industry, 6 hypotheses were formulated.
H1:7: Knowledge of Kaizen influences teamwork amongst employees.
H1:8: The action of Kaizen from the management influences the teamwork amongst employees.
H1:9: Training of Kaizen influences teamwork amongst employees.
H1:10: Awareness of Kaizen influences teamwork amongst employees.
H1:11: Cross-functional team by employees influences teamwork amongst employees.
H1:12: Motivation of employees influences teamwork amongst employees.

Research Hypothesis, H3: To examine the mediating role of employee motivation in the relationship between influencing factors and the implementation of bottom-up Kaizen in the Malaysian automotive industry, five hypotheses were formulated.
H1:13: Motivation of employees mediates the relationship between the knowledge of Kaizen and the implementation of bottom-up Kaizen amongst employees.
H1:14: Motivation of employees mediates the relationship between the action of Kaizen from the management and the implementation of bottom-up Kaizen amongst employees.
H1:15: Motivation of employees mediates the relationship between the training of Kaizen and the implementation of bottom-up Kaizen amongst employees.
H1:16: Motivation of employees mediates the relationship between the awareness of Kaizen and the implementation of bottom-up Kaizen amongst employees.
H1:17: The motivation of employees mediates the relationship between the cross-functional team employees and the implementation of bottom-up Kaizen amongst employees.

Research Hypothesis, H4: Five hypotheses were also developed to examine the mediation effects of employee motivation between the relationship of influencing factors and employee teamwork in the Malaysian automotive industry.
H1:18: The motivation of employees mediates the relationship between the knowledge of Kaizen and teamwork among employees.
H1:19: The motivation of the employees mediates the relationship between the action of Kaizen from the management and teamwork among employees.
H1:20: The motivation of employees mediates the relationship between the training of Kaizen and teamwork among employees.
H1:21: The motivation of employees mediates the relationship between the awareness of Kaizen and teamwork among employees.
H1:22: Motivation of employees mediates the relationship between the cross-functional team by employees and teamwork amongst employees.

The primary objective of constructing a structural relationship model in this research is to provide valuable support to researchers and practitioners within the automotive industry. This assistance is aimed at refining their comprehension of Kaizen leadership implementation and evaluating organizational performance while identifying potential avenues for improvement. Given the backdrop of intense global competition and the unpredictable nature of the global economy, organizations find strategic value in evaluating the alignment of Daily Bottom-up Kaizen activities with their objectives,

prevailing requirements, and work environment dynamics (Shatrov et al., 2021).

2. Literature Review

This review delves into lean management and Kaizen practices within the Malaysian automotive industry, elucidating the specific research focus, methodologies employed, and key findings derived from various studies. It sheds light on the diverse approaches and challenges associated with the implementation of Kaizen for continuous improvement. The review underscores the importance of adopting both top-down and bottom-up approaches to instigate organizational change and enhance efficiency. Furthermore, it highlights the crucial role played by factors such as employee knowledge, motivation, implementation strategies, awareness, training, teamwork, and leadership commitment in achieving sustainable improvements. Additionally, the influence of national policies and the advent of Industry 4.0 on the automotive sector is explored, as discussed (Kumar et al. 2019). Through an examination of these research articles, the review establishes a solid foundation for comprehending the intricate dynamics and potential advantages associated with incorporating lean principles, total quality management, and Kaizen strategies within the unique context of the Malaysian automotive industry. In conclusion, the researcher explains the underlying theories that form the basis of the proposed research framework.

2.1. Bottom-up kaizen empowerment

According to Mackus et al. (2018), automotive companies heavily rely on practices such as Kaizen, Jishuken, and Genchi Genbutsu to ensure systematic operations. These practices encompass various tools that contribute to the methodical functioning of organizations. Figure 2 illustrates the Bottom-up approach in Japanese organizations, where the initiative aids team leaders in maintaining a disciplined work environment. The framework established by Kaizen plays a pivotal role in fostering lean technological efficiency within the automotive industry. This framework ensures that organizations maintain a long-term consumer focus, thereby keeping the employees' interests aligned cooperatively. (Mackus et al., 2018) argue that a sustained long-term buyer-supplier relationship is advantageous for organizations to systematically compete with others. Conversely, a short-term buyer-supplier relationship can hinder the organization's growth due to reduced material production resulting from a limited stock of raw components.

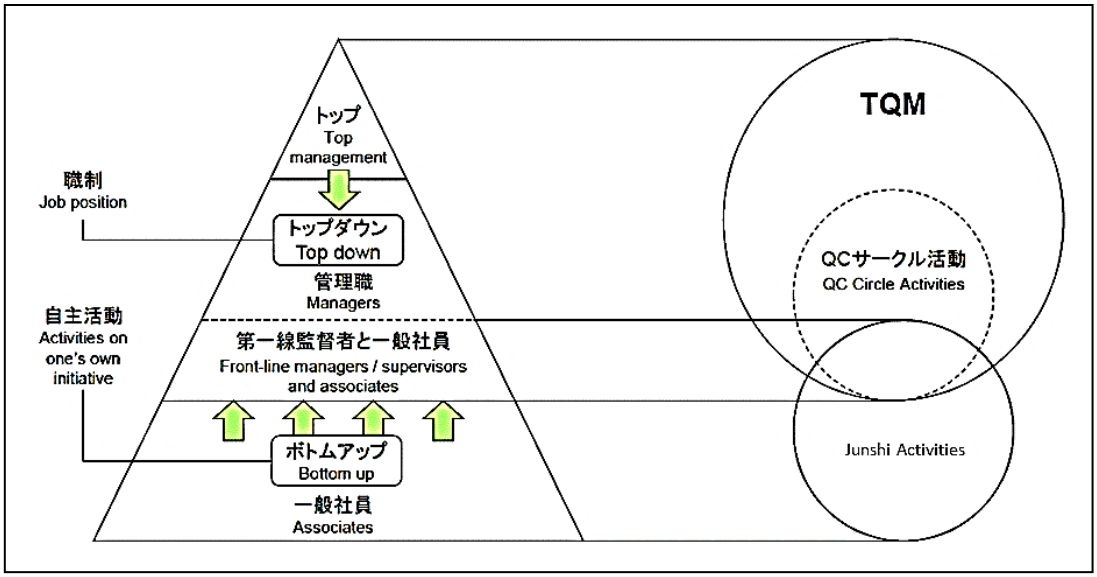

Fig. 2. Bottom-up approach in Japanese organization

The implementation of these strategies enables organizations to maintain a favorable balance in their operations, leading to an increase in their profitability. In this context, it can be asserted that companies effectively utilizing their data and maintaining accurate records benefit from these strategies, as highlighted (Sexton et al., 2016). As (Mackus et al., 2018) state, Ambidexterity plays a crucial role in enhancing an organization's ability to perform tasks within its specific operational environment. Ambidexterity, in this context, refers to the adaptive capacity of both managers and employees. A well-structured framework facilitates the organization in attracting more customers and suppliers, as emphasized (Sexton et al., 2016).

2.2. Daily kaizen measurement factors

Toyota was the pioneer in adopting Kaizen for its manufacturing process, aiming to improve efficiency, and another prominent example is Ford Motor Company. Ford turned to Kaizen in 2006 when facing significant financial challenges, with the CEO, Alan, leveraging Kaizen and other effective lean management strategies to steer the company away from bankruptcy (Garza-Reyes et al., 2022). This move not only helped Ford avoid a government

bailout but also proved beneficial for the entire automotive industry. Beyond automotive, Nestle, a major food company, also embraces lean principles, particularly the Kaizen approach. Additionally, Nissan employs the Kaizen methodology to continually enhance its production processes and reduce waste (Suárez-Barraza, 2023). The healthcare sector has also successfully applied Kaizen principles to handle patients' data effectively. It is essential to consider various critical factors for the successful implementation of Kaizen principles.

1. *KNOWLEDGE:* "Kaizen knowledge" refers to the understanding, principles, methodologies, and skills required for the successful implementation of the Kaizen philosophy within an organization (Garza-Reyes et al., 2018). It encompasses the collective expertise and insights that individuals and teams gain as they engage in continuous improvement activities and work towards creating a culture of ongoing enhancement.
2. *Employee ACTION and Empowerment***:** Involving employees at all levels in the improvement process is crucial. Empowered employees are more likely to contribute innovative ideas, take ownership of improvement projects, and actively participate in finding solutions (Iskandar et al., 2019).
3. *MOTIVATION:* A culture of open communication and collaboration is essential for sharing ideas, feedback, and lessons learned. Cross-functional teams working together can identify opportunities for improvement across different departments and functions (Oztemel et al., 2020).
4. *IMPLEMENTATION:* Processes need to be standardized and documented before improvement can occur. This provides a baseline for measuring changes and ensures that everyone understands the current state (Hameed Qureshi & Farooq, 2020).
5. *AWARENESS:* Kaizen relies on data to identify areas for improvement, monitor progress, and evaluate the impact of changes. Decisions should be based on factual data rather than assumptions (Latif & Saari, 2023).
6. *TRAINING:* Providing ongoing training and skill development opportunities ensures that employees have the knowledge and skills required to contribute effectively to improvement projects (Yuik et al., 2020).
7. *TEAMWORK:* Identifying and eliminating various forms of waste, such as defects, overproduction, waiting, unnecessary motion, inventory, and transportation (often referred to as the "7 Wastes"), is central to Kaizen's goals (Pakeltiene & Ragauskaite, 2017).
8. *CROSS FUNCTION TEAM:* When addressed and integrated effectively, these eight critical success factors contribute to successfully implementing Kaizen principles within an organization. They help create a culture of continuous improvement that drives sustainable growth, enhanced efficiency, and increased customer value (ISNAINI et al., 2021).

In conclusion, the effective application of Kaizen principles hinges on meticulous attention to pivotal elements. These elements encompass establishing a robust understanding of Kaizen, empowering employees across all hierarchical levels, cultivating motivation, and an environment conducive to open communication. Furthermore, success depends on ensuring efficient implementation through standardized processes, making decisions based on data, offering ongoing training, emphasizing teamwork, and deploying cross-functional teams (Suárez-Barraza, 2023).

3. Methodology

This section aims to outline the methodologies and processes employed in the research, serving a crucial role in providing clarity on the research methodology framework. The commencement involves an examination of the three essential phases inherent in the Design and Development Research (DDR) methodology. These phases include Phase 1, which entails the Overall Research Design and Need Analysis, Phase 2 incorporates the Fuzzy Delphi Method (FDM), and Phase 3 concentrates on Data Analysis and Hypothesis Testing (Govindasamy et al., 2023).

The research methodology and survey methodology are extensively detailed in the following section. The initial phase provides a comprehensive exploration of the study design, population, and sampling design, along with a thorough discussion on data collection and management. In the survey methods section, a meticulous examination is conducted on the process of questionnaire development using the Fuzzy Delphi Method (FDM), encompassing aspects like expert validation, insights from pilot studies, population, and sampling techniques, and a comprehensive assessment of reliability and validity. The section culminates in the application of the Partial Least Squares Structural Equation Model (PLS-SEM) for evaluating usability (Theresia et al., 2022). The primary aim of this section is to conceptualize and establish the research model while addressing the research hypotheses posited in this study. In conclusion, the final section succinctly summarizes the entire research flow, as depicted in Figure 3, encapsulating the sequential progression of the research methodologies employed.

3.1. Design and development research (DDR)

The term "research design" pertains to the arrangement or blueprint that delineates the quantity of research entities or variables and their interconnectedness. In this research, a descriptive research design was utilized, employing the survey method. This approach is well-suited for elucidating a phenomenon by collecting data in the form of opinions, attitudes, and perceptions from individual responses, which can be sampled from a population, as outlined (John W. Creswell 2014). In the Design and Development Research (DDR) methodology, there are generally three crucial phases that provide direction to the process:

1. Need Analysis Phase 1:

- *Problem Identification and Definition:* In this initial phase, the researcher identifies the problem or need that the design and development research will

address. This involves understanding the context, target users, and the specific challenges that need to be overcome.

- *Literature Review:* Conduct a comprehensive review of existing literature, similar projects, and relevant research to gather insights and best practices. This informs the design and development process.
- *Conceptualization and Ideation:* Generate ideas and concepts for addressing the identified problem or need. Brainstorming, concept sketches, and initial model may be part of this phase.
- *Needs Assessment:* Assess the requirements and preferences of the intended users or stakeholders. Understand their expectations, pain points, and priorities.

2. Design & Development Phase 2:

- *Structural Model Design:* Create design or models of the design or solution. These models can range from basic to complex mediation or moderation models.
- *Delphi Iterative Design:* Implement an iterative design process where the model is tested, refined, and improved based on expert feedback. Multiple iterations may be necessary to achieve an optimal solution
- *Technical Skills Development***:** The research involves soft skills, hard skills, or other technical components, this phase focuses on the actual development of the bottom-up daily kaizen system.
- *Usability Testing:* Conduct usability tests to evaluate the design's effectiveness, user-friendliness, and functionality. Make necessary adjustments based on expert and respondent feedback.
- *Internal and Content Validation***:** Validate the design or solution against the original problem statement and user requirements. Ensure that it meets the defined research objectives.

3. Usability Evaluation Phase 3:

- *Pilot Testing:* Perform rigorous pilot testing and evaluation of the final design or developed solution. This may include reliability testing, validity testing, and other relevant assessments.
- *Hypothesis Testing:* Engage respondents in the evaluation process to determine their satisfaction with the final model or solution. Gather feedback on their overall experience and any issues they encounter.
- *Documentation:* Create comprehensive documentation that covers the design or development process, including technical specifications, survey manuals, and any necessary guides for implementation.

Reporting and Recommendations: Summarize the findings from the evaluation phase and provide recommendations for any necessary refinements or improvements.

Fig. 3. The overall flow chart of the research

The three stages, namely, Needs Analysis, Development, and Evaluation, form a holistic framework for designing and conducting research. Table 2 illustrates the phases integral to the Design and Development Research (DDR) approach, as presented (Seni Issn ; Mariappan et al., 2022). Conversely, it offers a more exhaustive depiction of the analytical flow.

Table 2
The Three phases of DDR

Phases	Method
Phase 1: Need Analysis	Literature Review/ Interview
Phase 2: Design & Development	Fuzzy Delphi Method (FDM)
Phase 3: Usability Evaluation	Survey & Partial Least Squares Structural Equation Model (PLS-SEM)

The research methodology framework delineates the research progression, commencing with the DDR approach and progressing through the sequential phases. It is crucial to adhere to a methodical and iterative approach to ensure that the resultant product or solution adequately addresses the identified problem or requirement, meeting user specifications and quality benchmarks. The outcomes of these endeavors laid the groundwork for constructing a research model, formulating research hypotheses, and devising a survey instrument to examine the implementation of Bottom-up Kaizen in the industry. Additionally, this stage encompassed influencing the population, determining sample size, refining the selection process, developing and adapting the survey instrument, selecting companies for the pilot study and comprehensive survey, and obtaining requisite permissions for research execution (Sunder M & Prashar, 2020).

3.2. Fuzzy delphi method (FDM)

The FDM, currently prominent in consulting with experts, represents a modified version of the traditional Delphi method initially formulated (Dalkey & Helmer, 1963). Widely utilized for obtaining expert opinions through surveys, the FDM, as described (Marzukhi & Mawar, 2020), is not without drawbacks. These drawbacks include potential misinterpretation of expert opinions due to a lack of consideration for fuzziness, absence of specific rules for achieving desired outcomes, waning interest, and data loss from experts due to its time-intensive nature, leading to repetitive surveys and analyses, ultimately escalating the study's costs, as depicted in Figure 4. Acknowledging the significance of resolving expert ambiguity, particularly when there is a shared understanding, as highlighted (Jittrapirom et al., 2020).

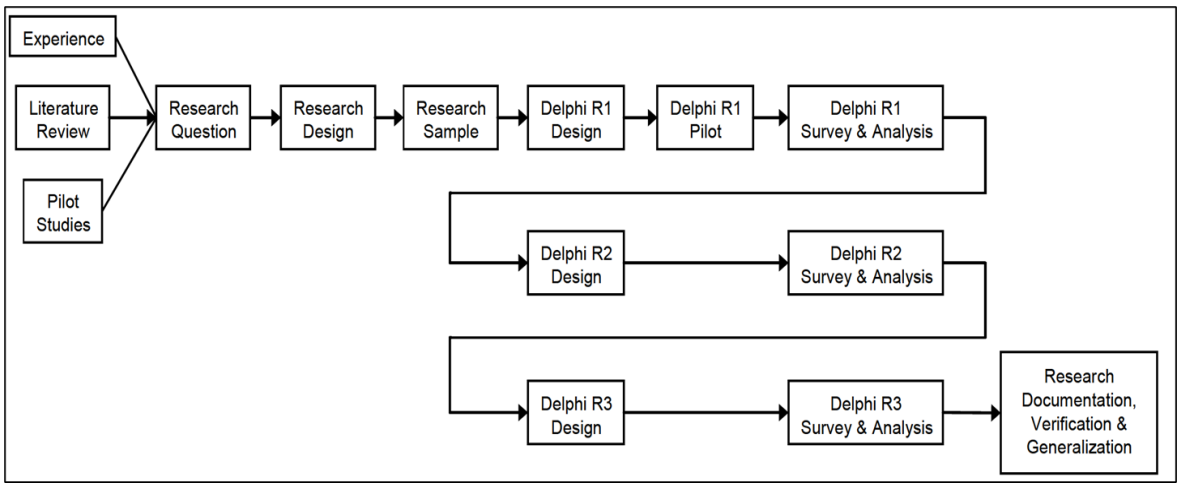

Fig. 4. Fuzzy Delphi method process

For the analysis of data through the fuzzy Delphi method, three key conditions are utilized: defining the threshold value (d), determining the percentage of expert agreement, and establishing the fuzzy score value. The choice of values for the Likert scale is crucial, and researchers often rely on the utilization of frequency and percentage values to assess expert agreement in studies employing the Delphi method, as indicated (Sulaiman et al., 2020).

4. Results and Findings

Drawing insights from the outcomes of research objectives two, three, four, and five, this study proposes a model aimed at the effective implementation of bottom-up KAIZEN and fostering teamwork among employees in the Malaysian automotive industry. The model selectively incorporates only the significant and positively impactful influencing factors for both direct and mediation pathways. The training in KAIZEN and the establishment of cross-functional teams emerged as direct predictors of the successful implementation of bottom-up KAIZEN among employees in the Malaysian automotive industry. Notably, the training in bottom-up KAIZEN (β=.23) exhibited superior predictive capabilities compared to the cross-functional team (β=.09). Furthermore, employee motivation towards bottom-up KAIZEN was identified as a partial predictor of the relationship between the training in bottom-up KAIZEN and the successful implementation of bottom-up KAIZEN among employees in the Malaysian automotive industry.

Conversely, managerial implementation of KAIZEN, training in bottom-up KAIZEN, employees' awareness of bottom-up KAIZEN, and the involvement of cross-functional teams by employees were identified as direct

predictors of successful teamwork among employees. Notably, awareness of bottom-up KAIZEN (β=.39) emerged as the most robust predictor for successful teamwork, followed by employees' engagement in cross-functional teams (β=.36), managerial action in KAIZEN (β=.29), and training in bottom-up KAIZEN (β=.15). Figure 5 illustrates the proposed model depicting the successful implementation of bottom-up KAIZEN and teamwork among employees in the Malaysian automotive industry.

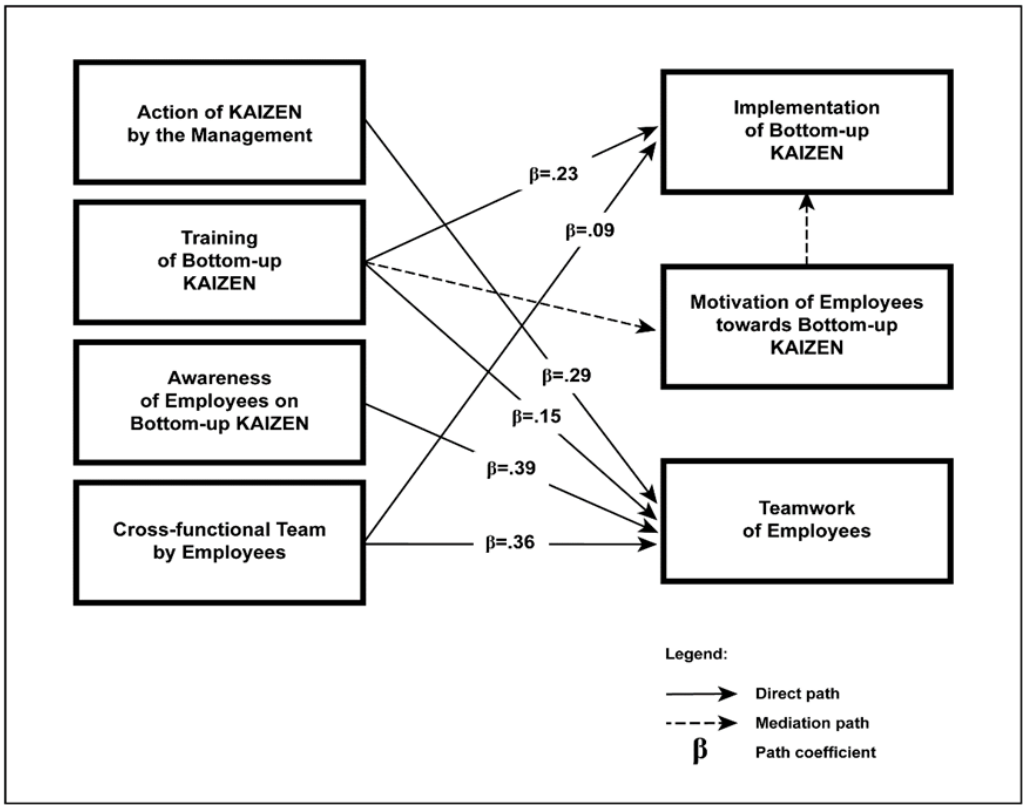

Fig. 5. Proposed model for the successful implementation of bottom-up Kaizen and teamwork amongst employees in the Malaysian automotive industry.

4.1. Need analysis

Result and Discussion of Research Question One

1. To understand the demographic background information/ profile of Top Malaysian Automobile manufacturers of Daily Bottom-up Kaizen activity in the Malaysian automotive industry.

Initially, a total of 365 participants engaged in the self-administered questionnaire across four Malaysian car manufacturers—Proton, Perodua, Toyota, and Honda. Following the data screening process and exploratory data analysis (EDA), the analysis focused on three hundred retained respondents. Specifically, Table 3 outlines the distribution of respondents, with the highest percentage recorded for Honda at 25.7% (77), followed by Perodua at 25.3% (76), Proton at 25.0% (75), and Toyota at 24.0% (72). Table 4 provides a breakdown of respondents categorized by car manufacturer. Examining respondents' current positions, 63% (189) were union staff, while 37% (111) held management positions

Table 3
Distribution of respondents according to car manufacturer (N=300)

Car Manufacturer	Frequency	Percentage (%)
Proton	75	25.0
Toyota	72	24.0
Honda	77	25.7
Perodua	76	25.3
Total	**300**	**100.0**

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Table 0
Distribution of respondents according to current position (N=300)

Current Position	Frequency	Percentage (%)
Management staff	111	37
Union staff	189	63
Total	300	100

Furthermore, 62% (186) of the participants were noted to be working on the production line, with 26% (78) in managerial roles, and 12% (36) in other departments, as presented in Table 5. Lastly, concerning the respondents' years of service, the distribution indicates that 60% (180)

had more than 10 years of service, 19% (57) had 1-5 years of service, 18% (54) had 5-10 years of service, and only 3% (9) had less than 1 year of service, as outlined in Table 6.

Table 5
Distribution of respondents according to department (N=300)

Department	Frequency	Percentage (%)
Production	186	62
Management	78	26
Others	36	12
Total	**300**	**100**

Table 6
Distributions of respondents according to years of service (N=300)

Years of Service	Frequency	Percentage (%)
Less than 1 year	9	3
1-5 years	57	19
5-10 years	54	18
More than 10 years	180	60
Total	**300**	**100**

The research sought to explore different facets associated with Kaizen implementation within four major Malaysian car manufacturers, namely Proton, Perodua, Toyota, and Honda. After a thorough screening of data and conducting exploratory data analysis (EDA), the dataset underwent refinement, with the inclusion of responses from 300 participants for subsequent analysis.

Result and Discussion of Research Question Two

2. Based on expert evaluation, what are the elements needed for Bottom-up Kaizen activity in the Malaysian automotive industry?

Table 7 outlines the constructs and corresponding items essential for Bottom-Up Kaizen endeavors within the Malaysian automotive industry. This summary offers a comprehensive view of the pivotal elements and their significance in cultivating a culture of ongoing improvement and innovation. These constructs and items collectively constitute a thorough set of factors influencing the efficacy of Bottom-Up Kaizen activities in the Malaysian automotive sector. Encompassing dimensions such as knowledge, action, training, system awareness, teamwork, motivation, and potential obstacles, a comprehensive understanding and addressing of these elements prove crucial for nurturing a culture of continuous improvement and attaining success in Kaizen initiatives, as assessed by experts.

Table 7
Constructs/ Item/ Element needed for Bottom-up Kaizen activity for the Malaysian automotive industry.

No.	*[Construct] Item/ Element needed for Bottom-up Kaizen activity for the Malaysian automotive industry.*
1	[KNOWLEDGE 1] I have knowledge of Bottom-Up Kaizen Development activity for my job
2	[KNOWLEDGE 4] Do you use VSM/ MIFC to see the needs for Kaizen development strategy
3	[KNOWLEDGE 8] Knowledge of another company's use of Bottom-Up Kaizen activities prompts our company's decision to perform Bottom-up Kaizen activity
4	[ACTION 2] I do involve Bottom-Up Kaizen activities in my job
5	[ACTION 3] I think our company has advanced performance of Bottom-Up Kaizen activities
6	[ACTION 5] Sales growth prompts our company's decision to perform the Bottom-Up Kaizen activity
7	[ACTION 6] Total Cycle time reduction prompts our company's decision to perform the Bottom-Up Kaizen activity
8	[ACTION 7] Stock reduction prompts our company's decision to perform the Bottom-Up Kaizen activity
9	[TRAINING 1] Managers receive regular training in Bottom-Up Kaizen skills and strategies
10	[TR TRAINING 2] Employees are regularly trained in Bottom-Up Kaizen skills and strategies
11	[AWARENESS 1] My company's leadership is committed to the Bottom-Up Kaizen activity
12	[AWARENESS 2] My company's employees are committed to the Bottom-Up Kaizen activity
13	[AWARENESS 3] My company has a clear policy statement of its dedication to the performance of the bottom-up Kaizen leadership
14	[AWARENESS 4] My company has a clear target for its Bottom-Up Kaizen activity goals
15	[AWARENESS 5] My company frequently communicates its Bottom-Up Kaizen goals and strategies with employees.
16	[AWARENESS 6] I am encouraged to provide input on Bottom-Up Kaizen goals and strategies
17	[CROSS FUNCTION TEAM 1] My company creates small project teams with employees with different job functions
18	[CROSS FUNCTION TEAM 2] My company uses job rotations to create multifunctional employees
19	[CROSS FUNCTION TEAM 3] My company uses multifunctional teams for Bottom-Up Kaizen activity

No.	*[Construct] Item/ Element needed for Bottom-up Kaizen activity for the Malaysian automotive industry.*
20	[IMPLEMENTATION 1] I have a small interest in implementing Bottom-Up Kaizen activities [-VE]
21	[IMPLEMENTATION 2] I do not know how to implement Bottom-Up Kaizen activities [-VE]
22	[IMPLEMENTATION 3] I have a doubtful on Bottom-Up Kaizen activities implementation [-VE]
23	[IMPLEMENTATION 4] Middle management resists implementing Bottom-Up Kaizen activities [-VE]
24	[IMPLEMENTATION 5] Union employees resist implementing Bottom-Up Kaizen activities [-VE]
25	[IMPLEMENTATION P6] Implementing Bottom-Up Kaizen would pose a challenge to my workplace culture [-VE]
26	[IMPLEMENTATION 7] I do not have enough time for the company to implement Bottom-Up Kaizen activities [-VE]
27	[IMPLEMENTATION 10] It is impossible to implement Bottom-Up Kaizen activity [-VE]
28	[IMPLEMENTATION 11] Bottom-Up Kaizen activities depend on top management direction [-VE]
29	[IMPLEMENTATION 12] Kaizen activities can only be done through the top-down deployment [-VE]
30	[TEAMWORK 1] I am knowledgeable of other teammates' job duties and functions
31	[TEAMWORK 2] I am knowledgeable of each employee's job duties and functions within a Bottom-Up Kaizen project team
32	[TEAMWORK 3] My superior successively clarifies and communicates each team member's job duties and functions
33	[TEAMWORK 4] Duties and functions are effectively delegated among team members
34	[TEAMWORK 5] My company actively identifies and addresses barriers to teamwork
35	[TEAMWORK 6] My company has difficulties in establishing effective teamwork [-VE]
36	[TEAMWORK 7] Lack of understanding of other teammates' roles and responsibilities is a challenge to teamwork in our company [-VE]
37	[MOTIVATION 8] I have poor experience with past Bottom-up Kaizen activities [-VE]
38	[MOTIVATION 9] I lack of computer skills and capability to do Bottom-Up Kaizen activities [-VE]
39	[MOTIVATION 13] Bottom-Up Kaizen activity has increased innovation and employee motivation
40	[MOTIVATION 14] Bottom-Up Kaizen activities enable to improve standards, delivery, and safety
41	[MOTIVATION 15] Bottom-Up Kaizen activity has increased employee engagement and creative idea

Result and Discussion of Research Question Three

3. Based on expert opinion, what is the position of elements required for bottom-up Kaizen activity in the Malaysian automotive industry?

The outcomes from Table 7 suggest employing the FDM to arrange different items or components associated with Bottom-Up Kaizen initiatives in the Malaysian automotive industry. In this context, the aim of utilizing the FDM is to recognize and rank particular elements or items deemed essential for the effective execution of Bottom-Up Kaizen activities in the Malaysian automotive sector. The FDM process entails gathering insights from experts, evaluating their input, and reaching a consensus on the significance of these elements.

Triangular Fuzzy Numbers Requirements:

In the FDM, the use of triangular fuzzy numbers helps capture the inherent uncertainty in expert judgments. It involves specifying lower and upper bounds (a, b) and a modal value (c) for each item or element.

Fuzzy Evaluation Process Requirements:

This aspect involves defining the criteria for accepting or rejecting an item based on expert agreement. It typically includes a threshold value (d) and a percentage of expert group agreement.

Expert Agreement:

Expert agreement is assessed by calculating the percentage of agreement among experts for each item or element.

Results and Implications:

1. *Knowledge 1:*

The item "I have knowledge of Bottom-Up Kaizen Development activity for my job" received a high consensus score of 0.782, indicating that experts unanimously agreed on its importance. This suggests that knowing Kaizen's activities is crucial for employees involved in the process.

2. *Action 2,3,5,6,7:*

Multiple items related to taking action in Kaizen activities scored highly, with scores ranging from 0.782 to 0.800. This emphasizes the significance of active participation and engagement in Kaizen initiatives.

3. *Motivation 9,13,14,15:*

Items associated with motivation in Kaizen activities garnered acceptable consensus scores, with scores ranging from 0.618 to 0.691. While there is agreement on their importance, it is worth noting that some motivation-related items received lower scores than knowledge and action items.

4. *Implementation 4,10,11,14,16:*

Implementation-related items received favorable consensus scores, ranging from 0.636 to 0.800. Experts concurred on their significance, highlighting the importance of effective implementation processes.

5. Awareness 3,6:

Items related to awareness of Kaizen goals and strategies achieved consensus scores of 0.800. This indicates that experts agree on the need for clear policies and encouragement for providing input.

6. Training 1,2:

Training-related items received full consensus with scores of 0.800, underscoring the importance of regular training for managers and employees in Kaizen skills and strategies.

7. Teamwork 1,2,3,4,5, 6,7:

Items associated with teamwork obtained consensus scores ranging from 0.655 to 0.800. While there was broad agreement on their importance, some specific teamwork aspects received slightly lower scores.

8. Cross-Function1,2,3:

Cross-functional items were generally accepted, with consensus scores ranging from 0.655 to 0.800. This suggests that experts recognize the value of creating small project teams, using job rotations, and employing multifunctional teams in Kaizen activities.

Negative (-VE) Constructs:

Some items, denoted with (-VE), indicate potential challenges or barriers. These items include factors such as lack of interest, doubts, resistance from middle management or union employees, workplace culture challenges, time constraints, and perceptions of impossibility. While these items received lower consensus scores, their acknowledgment is essential for addressing potential obstacles in Kaizen implementation.

Expert Agreement:

The percentage of expert agreement for all items was generally high, with values ranging from 81.82% to 100.00%. This indicates a strong consensus among experts regarding the importance of these elements in the context of Bottom-Up Kaizen activities in the Malaysian automotive industry.

4.2. Design and development

Findings of Research Question Four

To investigate the factors influencing the execution of bottom-up Kaizen in the Malaysian automotive industry, six hypotheses were developed and subjected to testing. In brief, Table 8 presents the path coefficient, t-statistics, p-value, R-squared, f-squared, Q-squared, and q-squared values indicating the relationships between the factors and the implementation of KAIZEN among employees. Meanwhile, Table 9 outlines the outcomes of hypothesis testing, providing key insights into the associations between factors and the implementation of KAIZEN among employees based on the respective paths.

Table 1

Path coefficient, *t*-statistics, *p*-value, R-squared, *f*-squared, *Q*-squared, and *q*-squared values between the factors and the implementation of Kaizen amongst employees

Path(s)	**Path Coef. (β)**								
	Mean (O)	**Mean (M)**	**SD**	***t-stats***	***p-value***	R^2	f^2	Q^2	q^2
Knowledge of kaizen→ Implementation of KAIZEN	-.01	-.01	.07	0.12	.91	.35*	<.001	.28*	<.001
The action of KAIZEN by the Management→ Implementation of KAIZEN	-.26	-.26	.05	4.79	<.001		.07		.06
Training of KAIZEN→ Implementation of KAIZEN	.23	.23	.06	3.62	<.001		.04		.04
Awareness of KAIZEN→ Implementation of KAIZEN	-.36	-.36	.07	5.17	<.001		.09		.17
Cross-functional Team by Employee→ Implementation of KAIZEN	.09	.09	.04	2.05	.04		.01		<.001
Motivation of Employee→ Implementation of KAIZEN	-.26	-.26	.06	4.33	<.001		.07		<.001

Note: *R-squared and Q-squared for 'Implementation of KAIZEN' respectively. p-value cut-off value is at .05. Bootstrapping procedure at 5,000 subsamples. Coef. =coefficient, O=original mean, M=subsample mean.

Table 2

Results of hypothesis testing and key findings of the relationship between factors and the implementation of Kaizen amongst employees according to path(s)

Path(s)	**Hypotheses**	**Accept. of Hypothesis**	**Key Findings**
Knowledge of KAIZEN→	**$H_{1:1}$**: Knowledge of KAIZEN influences the implementation of	No	Knowledge of KAIZEN did not influence the implementation of

Path(s)	Hypotheses	Accept. of Hypothesis	Key Findings
Implementation of KAIZEN	bottom-up KAIZEN amongst employees.		bottom-up KAIZEN amongst employees.
The action of KAIZEN by the Management→ Implementation of KAIZEN	**$H_{1:2}$**: Action of KAIZEN from the management influences the implementation of bottom-up KAIZEN amongst employees.	Yes	The action of KAIZEN from the management did influence** the implementation of bottom-up KAIZEN amongst employees.
Training of KAIZEN→ Implementation of KAIZEN	**$H_{1:3}$**: Training of KAIZEN influences the implementation of bottom-up KAIZEN amongst employees.	Yes	Training of KAIZEN did influence* the implementation of bottom-up KAIZEN amongst employees.
Awareness of KAIZEN→ Implementation of KAIZEN	**$H_{1:4}$**: Awareness of KAIZEN influences the implementation of bottom-up KAIZEN amongst employees.	Yes	Awareness of KAIZEN did influence** the implementation of bottom-up KAIZEN amongst employees.
Cross-functional Team by Employee→ Implementation of KAIZEN	**$H_{1:5}$**: Cross-functional team by employees influences the implementation of bottom-up KAIZEN amongst employees.	Yes	The cross-functional team did influence* the implementation of bottom-up KAIZEN amongst employees.
Motivation of Employee→ Implementation of KAIZEN	**$H_{1:6}$**: Motivation of employees influences the implementation of bottom-up KAIZEN amongst employees.	Yes	Motivation did influence** the implementation of bottom-up KAIZEN amongst employees.

Note: Accept. =Acceptance. *Positive influence. **Negative influence.

Findings of Research Question Five

To assess the factors influencing the implementation of bottom-up Kaizen teamwork in the Malaysian automotive sector, six hypotheses were formulated and subsequently tested. In brief, Table 10 provides details on the path coefficient, t-statistics, p-value, R-squared, f-squared, Q-squared, and q-squared values, outlining the relationships between the factors and teamwork among employees. Additionally, Table 11 summarizes the outcomes of hypothesis testing, presenting key findings regarding the associations between factors and teamwork among employees based on the respective paths.

Table 3

Path coefficient, *t*-statistics, *p*-value, R-squared, *f*-squared, *Q*-squared, and *q*-squared values between the factors and teamwork among employees

Path(s)	Path Coef. (β)								
	Mean (O)	Mean (M)	SD	*t-stats*	*p-value*	*R2*	*f2*	*Q2*	*q2*
Knowledge of KAIZEN→ Teamwork of Employee	-.12	-.11	.04	2.84	<.001	.63*	.02	.60*	.03
The action of KAIZEN by the Management→ Teamwork of Employee	.29	.28	.04	7.51	<.001		.14		.15
Training of KAIZEN→ Teamwork of Employee	.15	.14	.07	2.20	.03		.03		.03
Awareness of KAIZEN→ Teamwork of Employee	.39	.39	.06	6.63	<.001		.17		.15
Cross-functional Team by Employee→ Teamwork of Employee	.36	.36	.05	6.63	<.001		.24		.20
Motivation of Employee→ Teamwork of Employee	-.07	-.07	.04	1.69	.09		.01		<.001

Note: *R-squared and Q-squared for 'Teamwork of Employee' respectively. p-value cut-off value is at .05. Bootstrapping procedure at 5,000 subsamples. Coef. =coefficient, O=original mean, M=subsample mean.

Table 4
Results of hypothesis testing and key findings of the relationship between factors and teamwork amongst employees according to path(s)

Path(s)	Hypotheses	Accept. of Hypothesis	Key Findings
Knowledge of KAIZEN→ Teamwork of Employee	**$H_{1:7}$**: Knowledge of KAIZEN influences teamwork amongst employees.	Yes	Knowledge of KAIZEN amongst employees did influence** teamwork amongst employees.
The action of KAIZEN by the Management Teamwork of Employee	**$H_{1:8}$**: The action of KAIZEN from the management influences teamwork amongst employees.	Yes	The action of KAIZEN by the management did influence* teamwork among employees.
Training of KAIZEN→ Teamwork of Employee	**$H_{1:9}$**: Training of KAIZEN influences teamwork amongst employees.	Yes	Training of KAIZEN did influence* teamwork among employees.
Awareness of KAIZEN→ Teamwork of Employee	**$H_{1:10}$**: Awareness of KAIZEN influences teamwork amongst employees.	Yes	Awareness of KAIZEN did influence* teamwork among employees.
Cross-functional Team by Employee→ Teamwork of Employee	**$H_{1:11}$**: Cross-functional team by employees influences teamwork amongst employees.	Yes	The cross-functional teams did influence* teamwork among employees.
The Motivation of Employee→ Teamwork of Employee	**$H_{1:12}$**: Motivation of employees influences teamwork amongst employees.	No	Motivation did not influence the teamwork among employees.

Note: Accept. =Acceptance. *Positive influence. **Negative influence.

4.3. Mediation analysis

Findings of Research Question Six

To explore the mediation effects of employee motivation in the relationship between influencing factors and the implementation of bottom-up KAIZEN in the Malaysian automotive industry, five hypotheses were formulated and tested. In brief, regarding $H_{1:13}$, it was evident that 'Employee Motivation' fully acts as a mediator in the relationship between 'Knowledge of KAIZEN' and 'Implementation of KAIZEN,' leading to the acceptance of the hypothesis. Concerning $H_{1:14}$, 'Employee Motivation' does not serve as a mediator in the relationship between 'Action of KAIZEN from the Management' and 'Implementation of KAIZEN,' resulting in the rejection of the hypothesis. Moving to $H_{1:15}$, 'Employee Motivation' is identified as a partial mediator in the relationship between 'Training of KAIZEN' and 'Implementation of KAIZEN,' leading to the acceptance of the hypothesis. Regarding $H_{1:16}$, 'Employee Motivation' is also recognized as a partial mediator in the relationship between 'Awareness of KAIZEN' and 'Implementation of KAIZEN,' leading to the acceptance of the hypothesis. Lastly, concerning $H_{1:17}$, 'Employee Motivation' does not act as a mediator in the relationship between 'Cross-functional team by Employee' and 'Implementation of KAIZEN,' resulting in the rejection of the hypothesis. Table 12 provides a summary of the mediation analysis based on hypotheses $H_{1:13}$ to $H_{1:17}$.

Table 12
Summary of mediation analysis according to hypotheses $H_{1:13}$ to $H_{1:17}$

Hypo.	Statement	Accept. of Hypo.	Type of Mediation
$H_{1:13}$	Motivation of employees mediates the relationship between the knowledge of KAIZEN and the implementation of bottom-up KAIZEN amongst employees.	Yes	Indirect only* (Full mediation)
$H_{1:14}$	Motivation of employees mediates the relationship between the action of KAIZEN from the management and the implementation of bottom-up KAIZEN amongst employees.	No	Direct-only (No mediation)
$H_{1:15}$	Motivation of employees mediates the relationship between the training of KAIZEN and the implementation of bottom-up KAIZEN amongst employees.	Yes	Complementary (Partial mediation)
$H_{1:16}$	Motivation of employees mediates the relationship between the awareness of KAIZEN and the implementation of bottom-up KAIZEN amongst employees.	Yes	Complementary* (Partial mediation)
$H_{1:17}$	Motivation of employees mediates the relationship between the cross-functional team by employees and the implementation of bottom-up KAIZEN amongst employees.	No	Direct-only (No mediation)

Note: Hypo=Hypothesis. Accept. =Acceptance. *Negative influence.

Findings of Research Question Seven

To explore the mediation effects of employee motivation in the relationship between influencing factors and teamwork among employees in the Malaysian automotive industry, five hypotheses were formulated and tested. In brief, regarding $H_{1:18}$, it was found that 'Employee Motivation' does not act as a mediator in the relationship between 'Knowledge of Employee' and 'Teamwork of Employee,' leading to the rejection of the hypothesis. Concerning $H_{1:19}$, 'Employee Motivation' does not serve as a mediator in the relationship between 'Action of KAIZEN from the Management' and 'Teamwork of Employee,' resulting in

the rejection of the hypothesis. Moving on to $H_{1:20}$, 'Employee Motivation' does not act as a mediator in the relationship between 'Training of KAIZEN' and 'Teamwork of Employee,' resulting in the rejection of the hypothesis. Regarding $H_{1:21}$, 'Employee Motivation' is not identified as a mediator in the relationship between 'Awareness of KAIZEN' and 'Teamwork of Employee,' leading to the rejection of the hypothesis. Lastly, concerning $H_{1:22}$, 'Employee Motivation' does not serve as a mediator in the relationship between 'Cross-functional Team by Employee' and 'Teamwork of Employee,' resulting in the rejection of the hypothesis. Table 13 provides a summary of the mediation analysis based on hypotheses $H_{1:18}$ to $H_{1:22}$.

Table 13
Summary of mediation analysis according to hypotheses $H_{1:18}$ to $H_{1:22}$

Hypo.	Statement	Accept. of Hypo.	Type of Mediation
$H_{1:18}$	Motivation of employees mediates the relationship between the knowledge of KAIZEN and teamwork amongst employees.	No	Direct-only (No mediation)
$H_{1:19}$	Motivation of employees mediates the relationship between the action of KAIZEN from the management and teamwork among employees.	No	Direct-only (No mediation)
$H_{1:20}$	Motivation of employees mediates the relationship between the training of KAIZEN and teamwork amongst employees.	No	Direct-only (No mediation)
$H_{1:21}$	Motivation of employees mediates the relationship between the awareness of KAIZEN and teamwork amongst employees.	No	Direct-only (No mediation)
$H_{1:22}$	The motivation of employees mediates the relationship between the cross-functional team by employees and teamwork among employees.	No	Direct-only (No mediation)

Note: Hypo=Hypothesis. Accept. =Acceptance.

4.4. Model evaluation and summary

Result of Research Question Eight

Formulation of a research model for bottom-up Kaizen in the Malaysian automotive industry involved the elimination of six indicators during data screening and exploratory data analysis (EDA) due to extreme and consistent feedback from respondents. These excluded indicators encompass ACTION 2, 3, 5, and AWARENESS 1, 2, 3, with the first three linked to the action of Kaizen by the management construct, and the last three associated with the awareness of the Kaizen construct. The evaluation of the measurement model holds significance as it aims to establish empirical measures reflecting the relationships between the indicators and latent constructs, following the guidelines outlined (Hair et al., 2017). The primary objective is to gauge the effectiveness of the indicators in measuring latent constructs within the study. The assessment of the measurement model encompasses various facets, including (1) the evaluation of validity, (2) scrutiny of collinearity utilizing the variance inflation factor (VIF), and (3) evaluation of reliability.

Result of Research Question Nine

The evaluation of the measurement model shows that the construct and items are reliable and valid. Only twenty-six out of 41 indicators are retained in the final measurement model. The factor loadings of the indicators are all significant (p<.05) and are estimated between .66 and .97. The convergent validity assessment yields adequate AVEs (AVE>.50) supporting the convergent validity of all latent constructs. Figure 6 illustrates the factor loadings of indicators according to constructs and AVEs of constructs after the iteration of the measurement model.

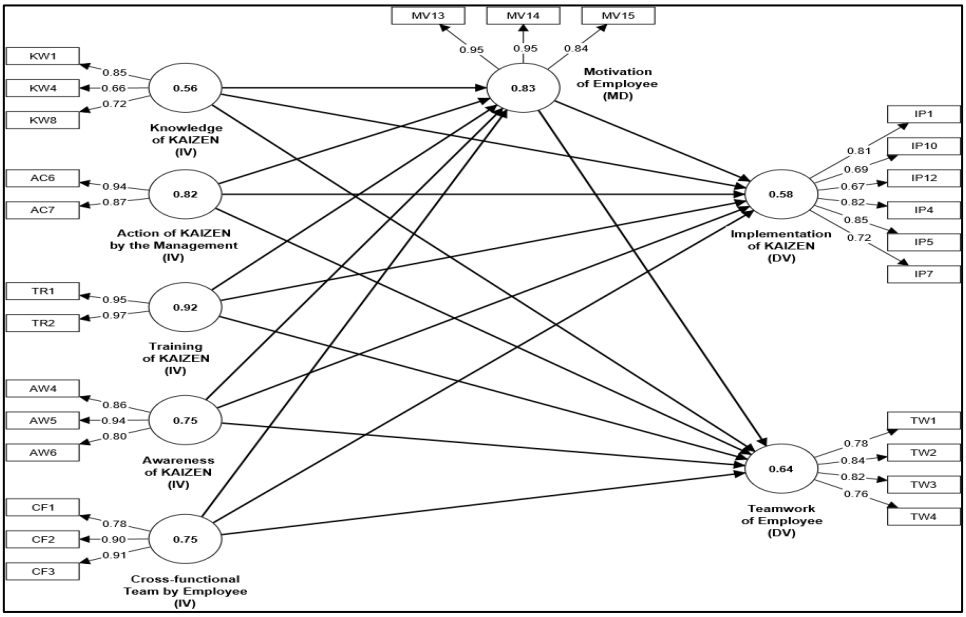

Fig. 6. Factor loadings of indicators according to constructs and AVEs of constructs after the iteration of the measurement model.

Note: IV=Independent variable, DV=Dependent variable, MD: Mediator/independent variable.
Values in constructs=Average variance extracted (AVE).

All Cronbach's alpha and composite reliability values are between .62 to .94, indicating an acceptable to good internal consistency reliability. Regarding the discriminant validity, all latent constructs show an acceptable HTMT ratio of less than .90, i.e., no violation of discriminant validity.

5. Conclusion

This study utilized a survey research design to evaluate the competitiveness of manufacturing firms, focusing on the entire population of operations and production managers within four selected manufacturing companies. Primary data collection involved structured questionnaires designed for both descriptive and partial least squares analyses, following the methodology outlined (Bolarinwa, 2015). Referring to Figure 6, the proposed model for the successful implementation of bottom-up Kaizen and teamwork among employees in the Malaysian automotive industry is influenced directly by the training of Kaizen and the cross-functional team. Furthermore, employee motivation towards bottom-up Kaizen was identified as a partial predictor in the relationship between the training of bottom-up Kaizen and the successful implementation of bottom-up Kaizen among employees in the Malaysian automotive industry. Conversely, the action of Kaizen by the management, training in bottom-up Kaizen, awareness of employees on bottom-up Kaizen, and the involvement of cross-functional teams by employees were identified as direct predictors of successful teamwork among employees

5.1 Academic and Practical Contributions

The study findings revealed that senior management engagement, shop employee engagement, and capacity, and the lean transformation phase were each identified as key success factors. Assigning responsibilities to the workshop was found to have a positive impact on the degree of Kaizen's involvement in the workshop (Bryman, 2016). Bottom-up Kaizen activities have both academic and practical contributions that can significantly impact organizations (CORDONI, 2022). Here is an overview of these contributions:

Academic Contributions:

1. *Research Opportunities:* Bottom-up Kaizen activities provide fertile ground for academic research in fields such as organizational behaviors, management, and industrial engineering. Researchers can study the dynamics, success factors, and challenges associated with employee-driven improvement initiatives.
2. *Theory Development:* These activities can contribute to the development of theories related to employee empowerment, motivation, and innovation within organizations. Academics can explore how bottom-up Kaizen aligns with existing management theories and principles.
3. *Empirical Insights:* Through case studies and empirical research, academics can generate valuable insights into the effectiveness of bottom-up Kaizen in various industries and cultural contexts. This research can inform best practices and contribute to the body of knowledge in the field.
4. *Measurement and Evaluation Models:* Academics can develop models and frameworks for measuring the impact of bottom-up Kaizen on organizational performance, employee satisfaction, and other relevant outcomes. These models can guide practitioners in assessing the effectiveness of their initiatives.

Practical Contributions:

1. *Continuous Improvement Culture*: Bottom-up Kaizen activities foster a culture of continuous improvement within organizations. This culture encourages employees at all levels to proactively identify and address problems, leading to increased efficiency and quality.
2. *Enhanced Employee Engagement:* Employees who actively participate in Kaizen activities tend to feel more engaged and empowered. This can result in higher job satisfaction, lower turnover rates, and improved overall morale.
3. *Operational Efficiency:* Practical contributions include tangible improvements in operational efficiency, cost reduction, and productivity. By tapping into the collective knowledge and creativity of employees, organizations can streamline processes and eliminate waste.
4. *Quality Improvement:* Kaizen is often associated with quality improvement efforts. Practical contributions in this regard include higher product and service quality, fewer defects, and enhanced customer satisfaction.
5. *Innovation and Adaptability:* Bottom-up Kaizen encourages innovation and adaptability. Employees may suggest novel approaches to problem-solving and process optimization, helping organizations stay competitive in a rapidly changing business environment
6. *Bottom-Line Impact:* Ultimately, these activities can lead to a positive impact on the organization's bottom line. Cost savings, increased revenue, and improved customer retention are some of the financial benefits that can result from successful Kaizen initiatives.
7. *Knowledge Sharing:* Practical contributions also involve the sharing of knowledge and best practices among employees. This knowledge transfer can result in a more skilled and capable workforce.
8. *Sustainability:* Bottom-up Kaizen often includes sustainability considerations, contributing to environmental and social responsibility efforts within organizations.

In conclusion, bottom-up Kaizen activities contribute to the academic understanding of organizational dynamics and employee involvement while providing practical benefits in terms of improved efficiency, quality, employee engagement, and innovation within organizations. They represent a holistic approach to continuous improvement that can lead to sustained success.

5.2. Recommendations to the policy makers

This study's conclusions recognize the significant role played by automotive manufacturing in Malaysia in achieving Vision 2030(Schuckmann et al., 2012). As a result, the study recommends that policymakers in both private and public entities, such as the Malaysia Association of Automotive Manufacturers, and the Ministry of International Trade and Industry (MITI)(Iskandar et al., 2019; Siew Yean, 2021), should establish relationships to ensure that manufacturing sector policies are developed and implemented harmoniously for the benefit of all. These policies include customs levies, export, and import regulations, and quality standardization. The study's findings reveal that the six lean manufacturing practices have a significant impact on firm competitiveness, and any unexplained variations should be taken into account when formulating policies, with input from all stakeholders to identify potential determinants of firm competitiveness.

Recommendations to policymakers regarding bottom-up Kaizen activities, it is essential to consider how these initiatives can benefit organizations, employees, and the broader economy(Iskandar et al., 2019; Kuchiki, 2007; Roy et al., 2023). Here are some key recommendations:

1. *Promote a Culture of Continuous Improvement:*
Encourage organizations across various sectors to foster a culture of continuous improvement by embracing bottom-up Kaizen. Recognize that continuous improvement can lead to enhanced productivity, quality, and competitiveness.

2. Provide Training and Education:
Support policies that promote training and education programs related to Kaizen principles and methodologies. This can include offering subsidies, grants, or tax incentives for organizations investing in employee development.

3. Create Incentives for Employee Participation:
Offer incentives or tax benefits to organizations that actively involve employees in bottom-up Kaizen activities. Recognize and reward companies that demonstrate a commitment to employee-driven improvements.

4. Facilitate Knowledge Sharing:
Promote the sharing of best practices and lessons learned from successful Kaizen initiatives. Encourage organizations to collaborate and share their experiences, possibly through industry associations or government-sponsored forums.

5. Provide Resources for Implementation:
Allocate resources, such as grants or low-interest loans, to help organizations implement Kaizen initiatives effectively. These resources can be used for training, technology investments, or process improvement projects.

6. Measurement and Reporting Standards:
Develop standardized metrics and reporting frameworks to assess the impact of Kaizen activities. This allows for benchmarking and transparency, helping organizations track and communicate their progress.

7. Support Research and Development:
Invest in research that explores the effectiveness of bottom-up Kaizen in different industries and contexts. This research can provide valuable insights for policymakers and organizations.

8. Regulatory Flexibility:
Consider regulatory frameworks that allow organizations the flexibility to experiment with Kaizen approaches without excessive bureaucratic hurdles. Streamline approval processes for small-scale process improvements.

9. Encourage Public Sector Kaizen:
Implement Kaizen principles within public sector organizations to improve government efficiency and service delivery. Share success stories to inspire private sector organizations to adopt similar practices.

10. Monitoring and Evaluation:
Establish mechanisms for monitoring the implementation of Kaizen-related policies and evaluating their impact. Regularly review and adjust policies based on the feedback and outcomes.

11. SME Support:
Pay particular attention to supporting small and medium-sized enterprises (SMEs) in adopting bottom-up Kaizen practices. SMEs may need targeted assistance, as they often have limited resources for process improvement initiatives.

12. International Collaboration:
Collaborate with international organizations and governments to exchange best practices and facilitate cross-border learning in Kaizen and continuous improvement.

13. Public Awareness Campaigns:
Launch public awareness campaigns to educate businesses, employees, and the public about the benefits of Kaizen and the role they can play in driving improvements.

By implementing these recommendations, policymakers can create an environment conducive to bottom-up Kaizen activities, fostering innovation, competitiveness, and sustainable economic growth while enhancing the well-being of employees and organizations (Alid et al., 2021; Frumence et al., n.d.; Ocello, 2019).

Acknowledgment

This research work is supported by the Malaysian Ministry of Higher Education (MOHE) for a Mybrain15 program to fund my PhD work.

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