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Factor Analysis of Knowledge Transfer for Non-Management Levels in the Heavy Equipment Industry Using the Delphi-AHP-TOPSIS Framework

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Abstract: *In their day-to-day work, personnel rely on the knowledge of their colleagues to solve problems, indicating they may need assistance from others who are more competent and knowledgeable in certain areas. Drawing on a case study of the heavy equipment maintenance department, this study contributes to knowledge transfer at the individual level among non-management personnel and aims to formulate a knowledge management strategy. The study employed a framework combining Delphi, AHP and TOPSIS methods, divided into three stages. The first stage involved the Delphi method, where important factors of knowledge transfer were identified. The second stage used the Analytical Hierarchy Process (AHP) to determine the weight of these factors. In the third stage, the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) was applied to prioritize the knowledge management strategies. This study identified three major strategies for non-management personnel: training and assignment/involvement in projects, establishing a reward system and conducting after-action reviews. Among these, the personalization strategy emerged as the most preferred strategy.*

Keywords: knowledge management, knowledge transfer, knowledge sharing, non-management levels, knowledge management strategy

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1. Introduction

Knowledge is increasingly seen as a crucial strategic element for organizations. Typically, individuals tend to retain their knowledge, as it is a key factor that makes them valuable assets to their organizations. However, organizations that facilitate knowledge sharing among their management and employees become stronger and more competitive. This principle lies at the heart of knowledge management: the effective distribution and sharing of knowledge (Uriarte, 2008). Knowledge is essential for achieving an organization's objectives and executing its strategies. Given its importance, knowledge must be carefully managed and retained within the organization, where it should be cultivated and developed. A significant portion of an organization's knowledge is generated and maintained at the individual level, residing in the minds of its employees, managers and top executives. Based on research by the Delphi Group, knowledge in organizations is stored in a structured manner: 42% of knowledge is held by employees, 26% is documented on paper, 20% is stored electronically, and the remaining 12% is contained in electronic knowledge bases (Uriarte, 2008). Organizations hold extensive reserves of unexplored knowledge and expertise. However, a common issue is that senior

management often lacks awareness of who possesses specific information within the organization. Understanding where knowledge resides and how it circulates is crucial. This underscores the fundamental aim of knowledge management (Uriarte, 2008). If knowledge remains confined to databases or individuals' domain expertise without being utilized by the organization, it becomes inaccessible. Hence, facilitating knowledge transfer becomes crucial for achieving organizational goals. Despite its apparent simplicity, knowledge transfer is a complex process influenced by various prerequisites and factors (Liyanage et al., 2009).

Knowledge transfer occurs across multiple levels: individual, intra-organizational and inter-organizational. Intra-organizational knowledge transfer refers to the sharing of knowledge between departments within an organization. At the individual level, units are represented by members of the organization; at the intra-organizational level, they are business units or departments; and at the inter-organizational level, they are organizations or companies (Wilkesmann & Wilkesmann, 2011).

Previous research conducted by scholars has predominantly focused on intra-organizational knowledge transfer, examining topics such as knowledge exchange among expatriates, repatriates and top management teams (Crowne, 2009). Then knowledge transfer occurs in client-vendor relationships within outsourcing projects (Teo, 2012). Knowledge transfer on a larger scale includes inter-organizational aspects, such as the role of global managers acting as intermediaries to facilitate knowledge search and create opportunities for knowledge exchange (Patriotta et al., 2013). Knowledge transfer between the headquarters of a multinational corporation and its subsidiaries is an important aspect of organizational dynamics (Boh et al., 2013), knowledge transfer within multinational corporations is a critical aspect of organizational operations (Shiue et al., 2010) and knowledge transfer among small businesses operating in industrial clusters in Brazil is an area of significant interest (Hoffmann et al., 2014).

However, these studies focus solely on knowledge transfer between organizations. What is currently lacking is a comprehensive understanding of effective knowledge transfer within organizations (Goh, 2002). Research in narrower contexts includes knowledge transfer at the individual level, such as from experts to novices (Wilkesmann & Wilkesmann, 2011), similar studies on knowledge transfer from experts to newcomers (Guechtouli et al., 2013), among R&D employees (Kang & Kim, 2013), across different experience levels at offshore technical support centers (Chen & Mcqueen, Knowledge transfer processes for different experience levels of knowledge recipients at an offshore technical support center, 2010) and within academia (university teaching and research staff) (Gururajan & Fink, 2010).

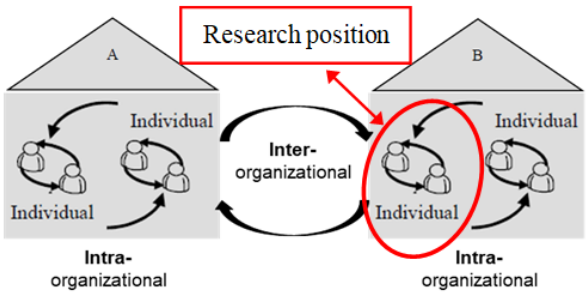

Figure 1: Research Areas and Positions in Knowledge Transfer Studies (adapted from Wilkesmann & Wilkesmann, 2011)

This research addresses knowledge transfers at the individual level (Figure 1). Specifically, there are few studies focusing on knowledge transfer at this level for non-management levels. Due to this gap, research on knowledge transfer remains largely limited to management levels, such as among expatriates, repatriates and top management teams (Crowne, 2009). Knowledge transfer is a process where individuals within an organization – whether teams, units or the organization as a whole – exchange, receive and influenced by the experiences and knowledge of others (Argote & Ingram, Knowledge Transfer: A Basis for Competitive Advantage in Firms, 2000), (Inkpen & Tsang, Social Capital, Network, and Knowledge Transfer, 2005), (Wijk et al., 2008). Knowledge transfer is central to knowledge management (KM) (Uriarte, 2008), which focuses on enhancing individual development in the organizations (Gonzalez & Martins, 2014). Therefore, this study focuses on the process of knowledge transfer at the individual level among non-management levels. Key topics for discussion include the lack of specific studies on factors supporting successful knowledge transfer among non-management levels and the required knowledge management strategies for this group in the organizations.

2. Literature Review

2.1 Knowledge

Knowledge encompasses skills and competencies, defined as the accumulated practical skill or expertise that enables efficient performance (Kogut & Zander, 1992). In the business context, knowledge is viewed as pertinent information grounded in experience (Alavi & Leidner, 2001), (Leonard & Sensiper, 1998). This understanding enhances an individual's ability to take effective action (Al-Salti Z. S., 2011).

Two primary dimensions of knowledge have been identified: explicit and tacit knowledge (Nonaka & Takeuchi, 1995). Tacit knowledge resides in individuals' minds and encompasses insights, intuitions, expertise and experiential knowledge (Liyanage et al., 2009), (King, 2007), (Al-Busaidi & Olfman, 2005), (Jashapara, 2004). For instance, a mechanic may possess tacit knowledge that allows them to assess the quality of a car engine based on its sound and vibrations, a skill acquired through years of experience (Al-Salti Z. S., 2011). This type of knowledge is typically learned over extended periods of practice and cannot be effectively transmitted through written documentation (Love et al., 2005). Effective transfer of tacit knowledge often requires close personal interaction between the knowledge source and recipient (Chen et al., The impact of national cultures on structured knowledge transfer, 2010). Tacit knowledge constitutes more than 70% of organizational knowledge (McManus & Snyder, 2003). On the other hand, explicit knowledge refers to information that can be documented or codified in various forms (Voigt, 2009). This knowledge can be expressed through diagrams and charts, making it relatively straightforward to transfer and acquire (Inkpen, Learning Through Joint Ventures: A Framework of Knowledge Acquisition, 2000).

2.2 Knowledge Management

The concept of knowledge management varies depending on how knowledge is perceived, with different perspectives shaping its focus and approach. If knowledge is perceived as an object or equated with information access, then knowledge management focuses on constructing and overseeing knowledge (Alavi & Leidner, 2001). Alternatively, if knowledge is seen as a process, knowledge management centers on the flow of knowledge and the processes involved in its creation, sharing and distribution (Liyanage et al., 2009). Knowledge management is described as a process consisting of specific stages, aimed at disseminating knowledge for reuse by others, facilitating its transformation and fostering the generation of new knowledge

(Argote et al., Managing Knowledge in Organizations: An Integrative Framework and Review of Emerging Themes, 2003), (Yang, 2010).

2.3 Knowledge Transfer

The terms knowledge sharing and knowledge transfer are frequently used interchangeably (Renzl, 2008). Knowledge transfer, knowledge sharing and knowledge flow share a common characteristic–they involve the exchange of knowledge, where knowledge is imparted by one or more entities and received by others. Therefore, they are essentially similar (Kumar J. & Ganesh, 2009). For clarity in terminology, these concepts are collectively referred to as knowledge transfer (Al-Salti Z. S., 2011).

Knowledge transfer is defined as a process where knowledge is exchanged among individuals, teams, groups or organizations (Duan et al., 2010). It involves the exchange of explicit or tacit knowledge between two agents, where one agent provides knowledge that is received and used by another. An agent can be an individual, a team, an organizational unit or a cluster of organizations. This exchange process consists of two complementary actions: the giving or delivery of knowledge by one agent (the source) and the receiving and utilization of knowledge by another (the recipient). The process of transfer is incomplete without both the source and the recipient (Kumar J. & Ganesh, 2009). The primary goal of knowledge transfer is to bridge the gap between knowledge owners and recipients, enabling the recipients to assimilate and utilize the knowledge effectively, thereby fostering the co-development of individuals and organizations (Wan et al., 2010).

The benefits of knowledge transfer include avoiding redundant efforts, saving time and energy in accessing information and solutions, adopting best practices from others and achieving efficiency on a global scale (Patriotta et al., 2013). Effective knowledge management leads to substantial reductions in task completion time and minimizes unnecessary duplication (Uriarte, 2008). In the absence of efforts to retain knowledge, organizations risk repeating lessons learned but not documented for future reference (Hawkinson, 2014).

a) Factors Affecting Knowledge Transfer

Through a review of previous studies in journals, 42 factors supporting successful knowledge transfer were identified and are summarized in Table 1.

Table 1: Factors Affecting Knowledge Transfer

Factors	Researcher
Language/knowledge articulability	(Bresman et al., 1999), (Duan et al., 2010), (Joia & Lemos, 2010), (Li et al., 2014)
Learning culture/learning organization	(Storey & Barnett, 2000), (Goh, 2002), (Susanty et al., 2012), (Gonzalez & Martins, 2014), (Palacios-Marqués et al., 2013)
Centrality	(Kang & Kim, 2013), (Li et al., 2014)
Common cognition/values/objectives	(Duan et al., 2010)
Retentive capacity	(Szulanski, 1996), (Chen & Mcqueen, Knowledge transfer processes for different experience levels of knowledge recipients at an offshore technical support center, 2010)
Demography (knowledge background, working experience)	(Nan et al., 2013), (Shaari et al., 2014)
Management support & involvement/policy	(Duan et al., 2010), (McNichols, 2010)

Technical support/ information technology (IT)/ information systems (IS) infrastructure	(Goh, 2002), (Teerajetgul et al., 2009), (Palacios-Marqués et al., 2013), (Wan et al., 2010), (Gonzalez & Martins, 2014)
Embedded resources	(Kang & Kim, 2013)
Hierarchy/organization structure/tenure	(Goh, 2002), (Susanty et al., 2012), (Gonzalez & Martins, 2014), (Lee & Wu, 2006), (Joia & Lemos, 2010), (Jasimuddin et al., 2014)
Holistic business view	(Palacios-Marqués et al., 2013)
Relationship/social tie	(Szulanski, 1996), (Goh, 2002), (Duan et al., 2010), (Joia & Lemos, 2010), (Al-Salti et al., 2011), (Jasimuddin et al., 2014), (Li et al., 2014)
Organization distance	(Al-Salti et al., 2011), (Jasimuddin et al., 2014)
Type of training	(Joia & Lemos, 2010), (Shiue et al., 2010)
Capability	(Sié & Yakhlef, 2009), (Al-Salti et al., 2011), (Shiue et al., 2010)
Absorptive capacity	(Szulanski, 1996), (Ko et al., 2005), (Easterby-Smith et al., 2008), (Gururajan & Fink, 2010), (Chen & Mcqueen, Knowledge transfer processes for different experience levels of knowledge recipients at an offshore technical support center, 2010), (Nan et al., 2013), (Wan et al., 2010), (Al-Salti et al., 2011), (Lee & Wu, 2006), (Gonzalez & Martins, 2014)
Transfer capacity	(Wan et al., 2010), (Li et al., 2014)
Knowledge characteristic	(Goh, 2002), (Jasimuddin et al., 2014), (Al-Salti et al., 2011)
Willingness to receipt	(McBeath & Ball, 2012), (Liyanage et al., 2009)
Willingness to transfer	(Xu & Ma, 2008), (Wan et al., 2010), (McBeath & Ball, 2012)
Trust	(Goh, 2002), (Pardo et al., 2006), (Teerajetgul et al., 2009), (Gururajan & Fink, 2010), (Duan et al., 2010), (Wan et al., 2010), (Teo, 2012), (Li et al., 2014), (Boh et al., 2013), (Joia & Lemos, 2010), (Holste & Fields, 2010)
Openness	(Duan et al., 2010)
Tolerating mistakes	(Davenport & Prusak, 2000)
Knowledge gap/knowledge capacity	(Goh, 2002), (Duan et al., 2010)
Collaboration	(Teerajetgul et al., 2009), (Duan et al., 2010), (Hoffmann et al., 2014)
Employee commitment	(Shiue et al., 2010)
Effective communication	(McNichols, 2010)
Credibility	(Holste & Fields, 2010), (Al-Salti et al., 2011), (Li et al., 2014)
Competences management	(Palacios-Marqués et al., 2013), (Gonzalez & Martins, 2014)
Time management	(Goh, 2002), (Joia & Lemos, 2010)
Respect & appreciate	(Duan et al., 2010), (McNichols, 2010)
Workforce mobility	(Hoffmann et al., 2014)
Motivation	(Szulanski, 1996), (Argote, Organizational Learning: Creating, Retaining, and Transferring Knowledge, 1999), (Osterloh & Frey, 2000), (Ko et al., 2005), (Easterby-Smith et al., 2008), (Duan et al., 2010), (Gururajan & Fink, 2010), (Al-Salti et al., 2011), (Yuan et al., 2012), (Teo, 2012)
Passion	(Sié & Yakhlef, 2009)

Problem solving	(Gonzalez & Martins, 2014), (Jasimuddin et al., 2014)
Partner choice/preference	(Duan et al., 2010), (Jasimuddin et al., 2014)
Leadership & practice	(Goh, 2002), (Teerajetgul et al., 2009)
Reciprocity	(Kang & Kim, 2013)
Rewards/incentives	(Goh, 2002), (Pardo et al., 2006), (Teerajetgul et al., 2009), (Joia & Lemos, 2010), (Yuan et al., 2012), (Wan et al., 2010)
Innovation strategy	(Gonzalez & Martins, 2014), (Joia & Lemos, 2010)
Teamwork	(McNichols, 2010)
Transfer channel/media	(Duan et al., 2010)

2.4 Delphi Method

The Delphi method aims to achieve consensus among experts through a series of questionnaires that gather and combine informed judgments on specific questions or issues (Duan et al., 2010). This method requires experts with deep knowledge of the relevant topics being discussed (Okoli & Pawlowski, 2004). Leveraging the knowledge and experience of experts is an effective approach for making scientific decisions. In the Delphi method, questionnaires are sent to experts, who provide their feedback via letters or email without the need for face-to-face meetings (Tang et al., 2014).

2.5 AHP

AHP is a decision-making method that breaks down complex, unstructured situations into their component parts, arranges them hierarchically, assigns numerical values based on subjective judgments about the relative importance of each variable and synthesizes these considerations to identify the variable with the highest priority to influence the situation (Saaty, 1980).

2.6 TOPSIS

TOPSIS is a decision-making tool that uses the closeness index to the ideal positive solution. Developed by Hwang and Yoon, this concept assumes that in a decision-making scenario with *m* alternatives and *n* criteria, the *n* alternatives can be represented in *m*-dimensional space. TOPSIS is a straightforward ranking method in both concept and application. They posit that the optimal solution is the one closest to the positive ideal solution and farthest from the negative ideal solution (Hwang & Yoon, 1981).

3. Research Methodology

This research was conducted through a case study in a cement manufacturing company in Indonesia, focusing on the Heavy Equipment Maintenance (HEM) department, which is responsible for maintaining heavy equipment. In this organization, the workers need to possess certain competencies to perform their duties effectively. These competencies include Awareness to Safety (AS), Contamination Control (CC), using Mechanic Tools (USM), using One Safe Source Book (OSSB), reading Part Book and Service Manual (PB & SM), Heavy Equipment Maintenance (HEM) and Electric & Electronic Unit (E & EU). Table 2 shows the mastery of competencies of non-management levels in the HEM department.

In Table 2, it can be seen that most members have mastered the competencies CC and PB & SM, with 75% and 81% of members respectively having achieved proficiency in these areas. However, 44% of the members have not yet mastered the OSSB competency and 50% have not mastered HEM. Notably, 81% of the members have not mastered the E & EU competency.

This highlights the urgency of researching knowledge transfers among non-management levels.

Table 2: Mastery of Competencies Members of Non-Management Levels

Competencies	Incompetent	Competent
E & EU	81%	19%
HEM	50%	50%
OSSB	44%	56%
AS	38%	63%
USM	31%	69%
CC	25%	75%
PB & SM	19%	81%

3.1 Delphi-AHP-TOPSIS Framework

The Delphi method is used to identify the factors that support a successful knowledge transfer process by reviewing existing literature, which is then validated by experts to determine the factors relevant to the success of knowledge transfer for non-management levels. The AHP method is employed to weight the factors that have been validated by experts. The TOPSIS method is used to determine the priority of a knowledge management strategy, based on journal reviews and discussions with experts. The detailed steps in this study, from data collection, data processing, to data analysis, can be seen in Figure 2.

Because the Delphi method requires qualified experts with a deep understanding of relevant issues (Okoli & Pawlowski, 2004), several qualified experts in the fields of KM and maintenance were included in this study. Internal experts included 2 KM Coordinators and 1 Department Manager from a subsidiary company based in Indonesia and 1 KM Consultant from the headquarters based in Switzerland. External experts were also involved to eliminate subjectivity. These external experts, who are also proficient in KM and maintenance, come from different companies. They included 1 Improvement Manager, 2 KM Consultants and 1 Engineering Manager. Internal experts were asked to select the factors that support successful knowledge transfer for non-management levels. Both internal and external experts participated in a pairwise comparison questionnaire of knowledge transfer factors to determine the weight of each factor.

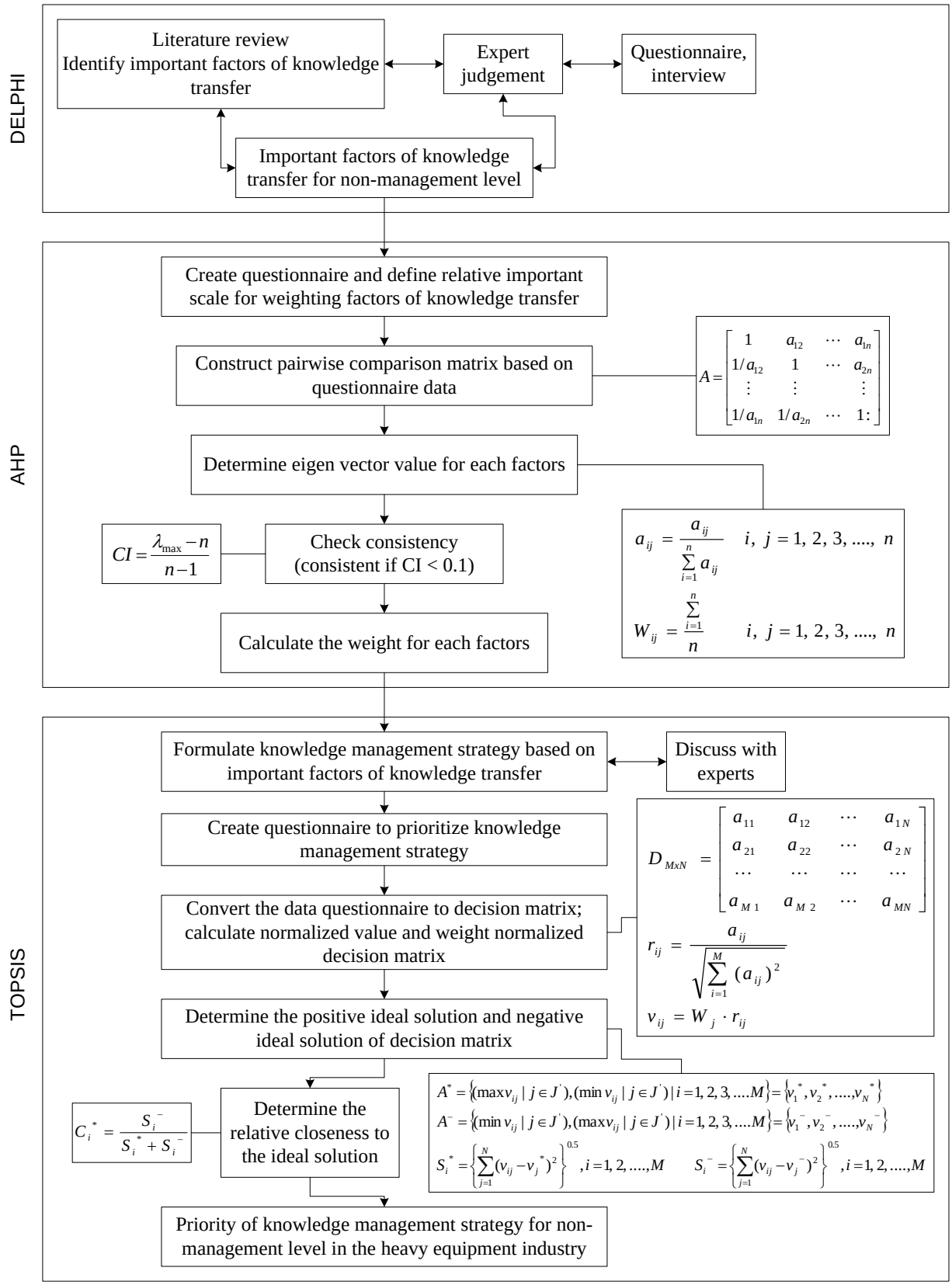

Figure 2: Detail Steps of Research

In this research, the Delphi-AHP-TOPSIS framework is used as shown in Figure 3. This framework helps decision-makers better understand the complex relationships of the relevant factors in decision-making (Joshi & Banwet, 2011), (Tang et al., 2014).

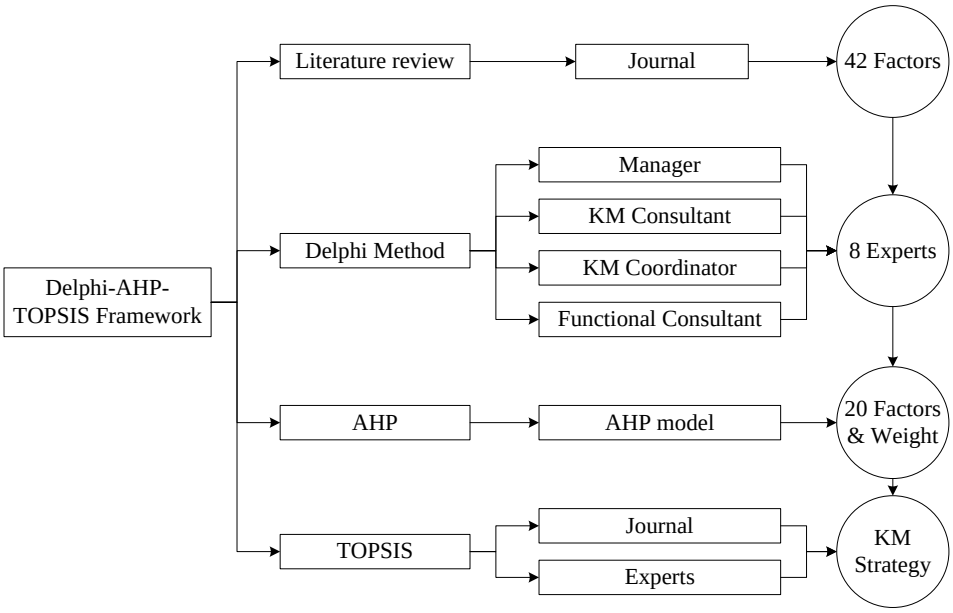

Figure 3: Delphi-AHP-TOPSIS Framework

4. Result and Discussion

4.1 Important Factors of Knowledge Transfer

Important factors for knowledge transfer among non-management levels are summarized in Table 3, including the weights of the factors determined using the AHP method. There are 20 factors, sorted from the highest weighting factor to the lowest, considered important by internal experts and approved by the majority of experts.

Table 3: Important Factors of Knowledge Transfer for Members of Non-Management Levels

Knowledge Transfer Factors	Weight	Cumulative
Learning culture/learning organization	0.093	9%
Teamwork	0.092	19%
Collaboration	0.069	25%
Employee commitment	0.068	32%
Management support & involvement/policy	0.065	39%
Leadership & practice	0.065	45%
Motivation	0.063	52%
Willingness to transfer	0.056	57%
Openness	0.055	63%
Rewards/incentives	0.047	67%
Respect & appreciate	0.045	72%
Problem solving	0.044	76%
Reciprocity	0.037	80%
Innovation strategy	0.034	83%
Common cognition/values/objectives	0.031	86%
Willingness to receipt	0.031	90%
Transfer capacity	0.031	93%
Time management	0.027	95%
Transfer channel/media	0.023	98%
Technical support/IT/IS infrastructure	0.023	100%

a) According to Experts

The important factors for knowledge transfer according to experts, as shown in Table 3, with a cumulative weight of 80%, include learning culture/learning organization, teamwork, collaboration, employee commitment, management support and involvement/policy, leadership and practice, motivation, willingness to transfer, openness, rewards/incentives, respect and appreciation, problem-solving and reciprocity.

b) According to Members of Non-Management Levels

In addition to experts, members of non-management levels were also included in this study. Members were asked to assess the 20 factors of knowledge transfer using a Likert scale of 1-5. Table 4 shows the results of these questionnaires, with average values. In this study, factors with mean value greater than 4 were defined as important factors for knowledge transfer from the members' perspective. According to the members, the important factors for knowledge transfer are rewards/incentives, leadership and practices, teamwork, collaboration, problem solving, respect and appreciation, willingness to receive, learning culture/learning organization, openness, motivation and technical support/IT/IS infrastructure.

Table 4: Important Factors of Knowledge Transfer According to Members of Non-Management Levels

Knowledge Transfer Factors	Mean
Rewards/incentives	4.60
Leadership & practice	4.40
Teamwork	4.40
Collaboration	4.30
Problem solving	4.30
Respect & appreciate	4.20
Willingness to receipt	4.10
Learning culture/learning organization	4.10
Openness	4.10
Motivation	4.10
Technical support/IT/IS infrastructure	4.10
Transfer capacity	4.00
Common cognition/values/objectives	4.00
Transfer channel/media	4.00
Employee commitment	4.00
Time management	4.00
Management support & involvement/policy	3.90
Willingness to transfer	3.80
Innovation strategy	3.80
Reciprocity	3.80

4.2 Framework of Knowledge Transfer Factors

Figure 4 shows a framework of factors affecting knowledge transfer among non-management levels. The intersecting factors, considered important by both experts and members of non-management levels, include learning culture/learning organization, teamwork, collaboration, leadership and practices, motivation, openness, rewards/incentives, respect and appreciation, and problem solving.

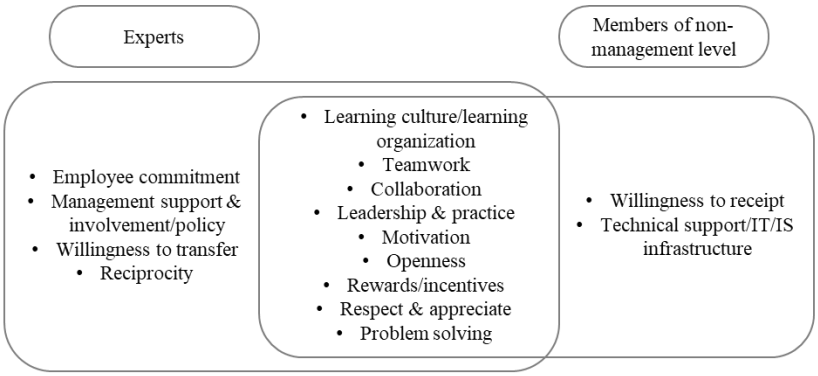

Figure 4: Framework of Factors Affecting Knowledge Transfer between Members of Non-Management Levels

4.3 KM Strategy Formulation

The knowledge management strategy was determined based on important factors that intersect between experts and members, as well as factors that do not intersect, which were considered based on journal reviews and discussions with experts. Table 5 presents several knowledge management strategies based on these reviews and discussions.

Table 5: Knowledge Management Strategy for Members of Non-Management Levels

Factors of Knowledge Transfer	Knowledge Management Strategy
Learning culture/learning organization; Employee commitment	Implement a performance management system
Teamwork; Collaboration; Respect and appreciate; Willingness to receipt; Willingness to transfer; Reciprocity	Mentoring program/pairing junior & senior Group discussion/brainstorming sessions Building networks of people
Leadership and practices	Provide knowledge agents
Motivation; Rewards/incentives	Making a reward system mechanism
Openness	After action review
Technical support/IT/IS infrastructure	Develop IT/IS infrastructure (intranet, portal, repository, shared network) Strategy centers on computer (people-to-documents, content management system)
Management support & involvement/policy	Create a knowledge management policy
Problem solving	Communities of practice
Learning culture/learning organization	Socialization of knowledge management to all levels
Teamwork; Collaboration; Problem solving	Training and assignment/involved in project

4.4 Priority of Strategy by TOPSIS

Five members of non-management levels were asked to assess the formulated strategies by giving a score of 1-5 (Likert scale). They evaluated how well these strategies, if implemented, may meet the criteria/important factors of knowledge transfer. This questionnaire was explained directly by the author to the respondents. The results of the strategy prioritization can be seen in Table 6.

Table 6: Priority of KM Strategy by TOPSIS

KM Strategy	Closeness Index	Ranking
Training & assignment/involved in project	0.5087	1
Making a reward system mechanism	0.5059	2
After action review	0.4806	3
Building networks of people	0.4793	4
Mentoring program/pairing junior & senior	0.4477	5
Implement a performance management system	0.4421	6
Group discussion/brainstorming sessions	0.4248	7
Provide knowledge agents	0.3849	8
Create a knowledge management policy	0.3847	9
Communities of practice	0.3764	10
Develop IT/IS infrastructure	0.2980	11
Socialization of knowledge management to all levels	0.2610	12
Strategy centers on computer	0.2467	13

4.5 Factors Analysis of Knowledge Transfer

In Table 3, it can be seen that learning culture/learning organization is the factor with the highest weight among others. Learning culture/learning organization is the main factor supporting knowledge management. This is confirmed by the experts' opinions, where Expert 2 stated that "*culture is important in everything, especially in knowledge management. Without a good learning culture in the organization, knowledge transfer will not be supported.*" Expert 1 also stated that "*culture is vital and the environment of the organization should support KM. If the culture of the organization is not in this direction and supporting KM, then it is unlikely that KM will flourish.*" The importance of these factors aligns with previous research, which indicates that a learning culture is crucial for the performance of knowledge transfer. Therefore, it is necessary for the company to build a good organizational atmosphere for knowledge transfer and innovation (Nan et al., 2013).

The factor with the lowest weight is technical support/IT/IS infrastructure. Expert 1 asserted in a statement that "*there needs to be some kind of IT system to support - but it is not hugely important.*" However, these factors are considered important by members of non-management levels. This can be explained by the fact that in this organization, members of non-management levels do not have access to IT/IS. This implies a need for members to gain access to IT/IS as a medium for knowledge transfer or access to knowledge, allowing their knowledge and skills to grow. As Expert 2 stated that "*it is important to support the implementation of knowledge management.*"

a) Analysis of Important Factors of Knowledge Transfer According to Experts and Members

In Figure 4, the important factors of knowledge transfer according to experts and members can be seen. Both groups agree that these factors are crucial for effective knowledge transfer. In other words, knowledge transfer between members of non-management levels will be successful if these criteria or factors are met. Based on the information obtained from experts, the important factors of knowledge transfer according to experts and members in Figure 4 can be explained as follows:

- Learning culture is crucial in an organization; without it, knowledge transfer cannot be effectively supported, thus hindering the flourishing of knowledge management in the organization.
- There is a need for a collaborative atmosphere among employees, as collaboration facilitates knowledge transfer between them. Additionally, teamwork is essential for complementing each other's strengths to achieve organizational goals. Interaction between individuals in collaboration and teamwork facilitates knowledge transfer.
- Leadership and practices play a vital role in an organization. In terms of knowledge transfer, having role models who share knowledge is crucial for encouraging other employees to follow suit. Effective leadership and practices motivate employees to actively participate in knowledge transfer.
- Motivation is the primary driver that prompts individuals to take action, including engaging in knowledge transfer. Rewards/incentives are particularly important factors that encourage this behavior. In other words, rewards/incentives are expected to promote knowledge transfer and innovation.
- Being open-minded is crucial in knowledge transfer. Knowledge transfer occurs effectively when individuals are open to new ideas and remain curious, especially in the face of rapid change.
- Respect and appreciation are fundamental in any social environment, including knowledge transfer. It is important to foster respect and appreciation between seniors and juniors or between knowledge recipients and sources, to create a good atmosphere for knowledge transfer.
- Problem-solving enhances knowledge transfer between individuals. Identifying the root causes of problems typically involves collaboration among several individuals. Therefore, problem-solving contributes to increasing knowledge and improving individuals' problem-solving abilities.

4.6 Analysis of Knowledge Management Strategy

From Table 6, it can be seen that the highest priority knowledge management strategy for members of non-management levels is training and assignment/involvement in projects. Members aim to enhance their competence, experience and tacit knowledge through specific project involvement. This is supported by the opinion of Expert 7, who noted that "*training and assignment will increase competence.*"

Establishing a reward system mechanism ranks as the second priority for knowledge management strategy among members of non-management levels. Members seek recognition for their contributions to knowledge transfer within the organization. This aligns with Expert 4's statement that "*awards can provide encouragement and pride for employees.*" However, Expert 1 cautioned that "*this is very tricky and best to avoid*," suggesting implementation depends on organizational policy regarding rewards, as mentioned during the knowledge transfer factor determination session by Expert 1, who stated that "*it (rewards/incentives) depends on the organization.*"

Further exploration reveals that knowledge management strategies such as training and assignment/involvement in projects, after-action reviews, building networks of people, mentoring programs/pairing juniors with seniors, group discussions/brainstorming sessions and communities of practice typically involve direct interaction where knowledge is closely tied to individuals. This approach is categorized as a personalization strategy (Hansen et al.,

1999). In essence, members of non-management levels prefer strategies aligned with personalization.

Developing IT/IS infrastructure ranks as the low priority for knowledge management strategy among members of non-management levels. Expert 1 commented that "*using what is already available is sufficient; no need for additional investment*," indicating a preference to focus on human resources rather than technological solutions. Developing IT/IS infrastructure and focusing on computer-centered strategies belong to the codification strategy. However, these strategies have become the lowest priority, as confirmed by Expert 1's statement that "*use what is already there and no need to do more*."

Creating a reward system mechanism, implementing a performance management system (e.g., including knowledge transfer in the key performance indicators of employees), providing knowledge agents and establishing a knowledge management policy are categorized as systemic strategies. 'Systemic' itself means affecting or connected with the whole of something. Therefore, a systemic strategy is defined as a strategy that influences individuals to actively contribute to knowledge transfer.

So, then the 13 formulated knowledge management strategies can be grouped into three categories. They are personalization strategy, systemic strategy and codification strategy, as presented in Table 7.

Table 7: Priority and Grouping of Knowledge Management Strategies

Knowledge Management Strategy	Ranking	Group of Strategy
Training & assignment/involved in project	1	Personalization Strategy
Making a reward system mechanism	2	Systemic Strategy
After action review	3	Personalization Strategy
Building networks of people	4	Personalization Strategy
Mentoring program/pairing junior & senior	5	Personalization Strategy
Implement a performance management system	6	Systemic Strategy
Group discussion/brainstorming sessions	7	Personalization Strategy
Provide knowledge agents	8	Systemic Strategy
Create a knowledge management policy	9	Systemic Strategy
Communities of practice	10	Personalization Strategy
Develop IT/IS infrastructure	11	Codification Strategy
Socialization of KM to all levels	12	Personalization Strategy
Strategy centers on computer	13	Codification Strategy

Knowledge management strategies discussed with experts and grouped into strategy groups are depicted in Figure 5.

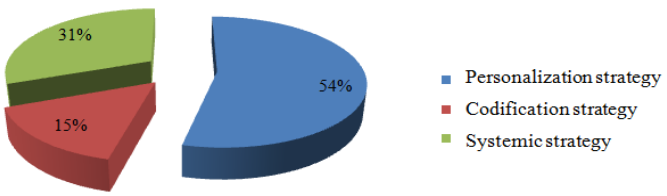

Figure 5: Knowledge Management Strategy for Members of Non-Management Levels

From Figure 5, it can be explained that the appropriate knowledge management strategy for members of non-management levels (in this case, heavy equipment maintenance workers) is personalization strategy. This is confirmed by Expert 1's statement that "*knowledge management should focus on humans, not machines.*" Personalization strategies allow members or employees to enhance their knowledge, competence, experience and skills. Meanwhile, systemic and codification strategies are implemented to support the personalization strategy.

5. Conclusion

This study identified the key factors supporting successful knowledge transfer among members of non-management levels. These factors include employee commitment, management support and involvement or policy, willingness to transfer, reciprocity, learning culture/learning organization, teamwork, collaboration, leadership and practice, motivation, openness, rewards/incentives, respect and appreciation, problem-solving, willingness to receive and technical support/IT/IS infrastructure.

From these factors, several knowledge management strategies were formulated and prioritized for members of non-management levels. The primary strategies identified are training and assignment/involvement in projects, implementation of a reward system mechanism and after-action reviews. The study confirmed that the most suitable knowledge management strategy for members of non-management levels is the personalization strategy, which leverages tacit knowledge for problem-solving activities in maintenance operations (Foguem & Noyes, 2013). Personalization strategy emerged as the predominant approach in knowledge management for the heavy equipment industry among non-management level workers, albeit requiring support from systemic and codification strategies.

Four internal experts, including one from the headquarters in Switzerland, were involved in this study. Future research should consider increased involvement of experts from headquarters for broader insights. Additionally, further research is recommended to explore the applicability of these strategies across different industries.

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