

Worker knowledge sharing in logistics services: case of a Brazilian aircraft manufacturer

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RESUMO

Objetivo - O objetivo deste artigo é avaliar fatores de compartilhamento de conhecimento do trabalhador no serviço logístico de um fabricante de aeronaves.

Estudo / metodologia / abordagem - A metodologia proposta é suportada por uma abordagem quali-quantitativa para examinar como as organizações podem desenvolver contextos favoráveis para explorar a resiliência, e a relação de compartilhamento de conhecimento entre os trabalhadores da área de Logística de um fabricante brasileiro de aeronaves. A proposta deste estudo apresenta uma fase quantitativa que envolve uma classificação dos diferentes fatores influenciando o compartilhamento de conhecimento em termos de sua importância relativa entre si, usando o *Analytic Hierarchy Process with Incomplete Pairwise Comparison (AHP-IPC)*. A fase qualitativa é baseada em entrevistas locais, conversas informais e observações in loco.

Resultados - Os resultados gerais indicaram que a Compreensão da Instrução de Trabalho e o Registro na Instrução de Trabalho foram percebidos como os processos mais importantes entre os trabalhadores logísticos, seguido da Conversa entre os Trabalhadores. Com base na análise qualitativa das fases foi possível observar que os fatores como: Incentivo, Instrução de Trabalho, Zero Defeito e Treinamento foram considerados mais relevantes.

Limitações / implicações da pesquisa - Este estudo limitou-se ao departamento de logística de uma fabricante brasileira de aeronaves e seus trabalhadores de logística.

Implicações práticas - Os resultados contribuem para orientar gestores a apoiar o compartilhamento de conhecimento por meio de comunicação, colaboração entre os trabalhadores da empresa.

Originalidade / valor - Este é o primeiro estudo em um departamento de Logística de uma fabricante de aeronaves brasileira aplicando a metodologia da proposta baseada em questionários a fim de captar a percepção dos trabalhadores sobre compartilhamento de conhecimento no chão de fábrica e é muito relevante devido à complexidade da área de logística de um fabricante de aeronaves.

Palavras-chave: Compartilhamento de Conhecimento, Logística, Fabricante de Aeronaves.

ABSTRACT

Purpose - This paper assesses factors that enable tacit knowledge sharing among logistic workers at Brazilian aircraft manufacturer.

Design/methodology/approach - The proposal methodology is supported by a mixed methods approach to examine how organizations can develop favorable contexts to explore knowledge sharing relations among workers in the Logistics area of a Brazilian aircraft manufacturer. The proposal has a qualitative phase based on local interviews, informal conversations and on-site observations. The quantitative phase entails a ranking of the different factors that support knowledge sharing in terms of their relative importance to each other, using the *Analytic Hierarchy Process with Incomplete Pairwise Comparison (AHP-IPC)*.

Findings - Our overall results indicated that Understanding of Work Instruction and Registration in Work Instruction were perceived as the most important processes among the logistic workers, followed by Conversation among Workers. Based on the qualitative phase analysis it was possible to observe that the factors Incentive, Work Instruction, Zero Defect and Training were considered relevant.

Research limitations/implications - This study was limited to the logistics department of a Brazilian aircraft manufacturer and its logistic workers.

Practical implications - The findings contribute to support managers to deal knowledge sharing through efficient communication, collaboration and thrust among workers in the company.

Originality/value - This is the first study in a Logistics department of a Brazilian aircraft manufacturer applying the proposal methodology based on questionnaires in order to capture the workers perception of the resilience and knowledge sharing in the shop floor and it is very relevant due the complexity of the operation in a logistic area of an aircraft manufacturer.

Keywords: Knowledge Sharing, Logistic, Aircraft Manufacturer, Brazil.

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1. INTRODUCTION

This paper assesses factors that enable tacit knowledge sharing among logistic workers at Brazilian aircraft manufacturer.

Knowledge Sharing is the process of creating and exchanging knowledge among people which implies collaboration and synergy of individuals working together to achieve common goals (VAN DEN HOOFF; DE RIDDER, 2004). Tacit knowledge influences organizational performance (ABBARIKI; SNELL; EASTERBY-SMITH, 2016). Workers' tacit knowledge sharing improves knowledge creation (JAYASINGAM *et al.*, 2010), and organizations have applied management practices to facilitate knowledge sharing (PENG, 2013).

The literature indicates research opportunities related to tacit knowledge, and its influence on organizational culture and human resources (MUNIZ Jr., WINTERSBERGER, HONG, 2021; MUNIZ Jr., RIBEIRO AND PRADHAN, 2021; RODRIGUEZ, MUNYON, MUNIZ Jr., 2021). Despite the acknowledgement of the importance of workers' knowledge on the shop floor, both the knowledge management and operations management literature have devoted limited attention to blue collars. Studies on knowledge sharing tend to overwhelmingly focus on symbolic workers (DYER; NOBEOKA, 2008), as collaborative work of project teams (CONSTANZO; TZOUMPA, 2008). The perspective of workers on knowledge management, a much under-represented group in the existing literature (MUNIZ JR., WINTERSBERGER., HONG, 2021.), and a better understanding of worker knowledge sharing in the logistic area represents a research opportunity. The research question is: How enablers factors impact logistic worker knowledge sharing?

Ranking factors based on worker judgment about their relative importance (assessment) is a case of decision by multi-criteria method because it supports a wide range of factors related to knowledge, work, and production (see Figure 1). The AHP-IPC is a multiple criteria decision-making method that uses hierarchical structures to represent a decision problem and then develops priorities for the alternatives based on the decision-maker's judgments (SAATY, 1980). The application of the AHP method is effective for ranking factors based on the relative importance of each factor to one another (SUBRAMANIAN., RAMANATHAN, 2012)

This study apply the method Incomplete Pairwise Comparisons based on the Analytical Hierarchical Process (AHP-IPC, HARKER, 1987) to data analysis, which was validated in previous studies (see details in FUNO *et al.*, 2013; MUNIZ *et al.*, 2019; MUNIZ *et al.*, 2021).

KUMAR, SINGH and HALEEM (2014) identified some knowledge sharing barriers such as pressure for conformity, employee turnover, language, rapid firm growth, knowledge management strategies and enablers as team-members knowledge variety, incentive and reward, problem solving behavior, Training and education, Resources, organizational infrastructure, Organizational culture.

The complexity for an aircraft logistic worker such as material handling to different plants and aircraft configurations, and longer cycle-time is supported by worker's tacit knowledge sharing. Operational complexity influences production performance (SALOMON; SIMON; MUNIZ Jr., 2016).

The area of logistics has received considerable attention in prior decades and its relationship with areas such as Education (NOVAIS; SILVA; MUNIZ Jr., 2017); logistics supplier selection (TRAMARICO *et al.*, 2012), logistics risks (FUNO *et al.*, 2013), RFID application (CASTRO *et al.*, 2021), Safety and Knowledge Management in logistic (MUNIZ Jr. *et al.*, 2017) indicate a fertile area to this study based on its multidisciplinary.

This research contributes to guiding supportive ways to provide employees interaction and management action, which contribute to practical and theoretical perspective.

This paper is structured considering a literature review to present knowledge sharing in section 2. Methodology has been discussed in Section 3 with profiles of respondents. Findings discussions have been presented in Section 4. Conclusions of the study have been drawn in Section 5.

2. THEORETICAL FOUNDATION

Knowledge Management (KM) is the systematic, formal and deliberate acting in order to capture, preserve, share, and (re) use the tacit and explicit knowledge, created and used by employees during routine tasks and improvement of production processes in order to generate results measurable for the organization and for the people (MUNIZ Jr., TRZESNIAK; BATISTA Jr., 2009). Knowledge is a blend of information and experience that results in

innovation. It is also regarded as organizational culture, skills, reputation, intuition that influences human behavior (HALL; ANDRIANI, 2003).

KM is recognized as an important approach, which has a great impact on organizational performance by effectively managing the intellectual assets within an organization (BARAL; KIFOR; BONDREA 2014).

Therefore, it is believed that there is a very powerful interaction and synergy between People and Process disciplines, which indicates this issue as research opportunities. KM includes technological and people-based frameworks development:

- Technological-based (information systems): based on the importance of data, emphasizes information technology, denominated computational paradigm;
- People-based (Management): based on the importance of communication and tacit knowledge, emphasizing people, denominated organic paradigm.

We adopt the SECI model (Table 1, NONAKA, 1994) entailing the dimensions of socialization, externalization, combination, and internalization, which are considered critical enabling factors to support knowledge sharing. The SECI model has become accepted and applied to empirical studies in many contexts such as the automotive sector (MUNIZ Jr., WINTERSBERGER; HONG, 2021). Nonaka’s model was validated with the practices adopted by Japanese middle managers (NONAKA, 1994).

TABLE 1 - Knowledge conversion process – SECI

From	To	Tacit	Explicit
Tacit	Socialization (Dialogue)		Externalization (Write)
Explicit	Internalization (Study/Read)		Combination (Summarize)

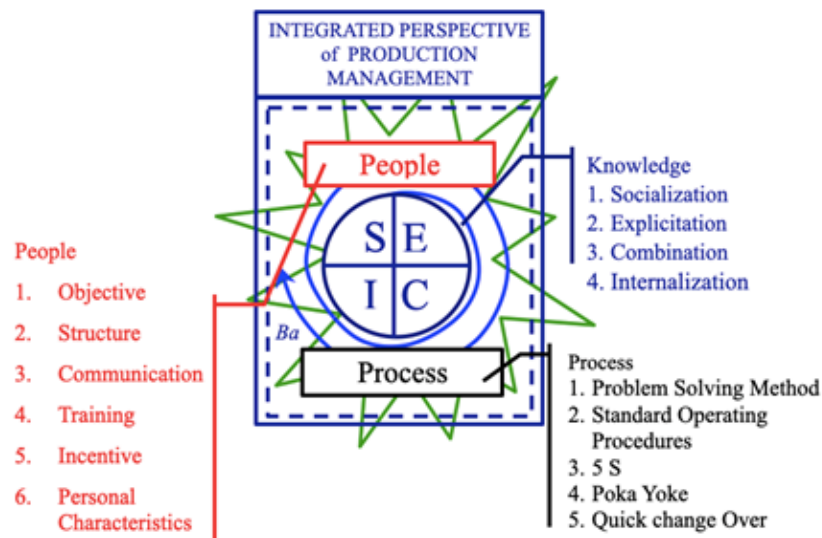
Source: Adapted from NONAKA, 1994.

Knowledge has been acknowledged to be an important component of production management systems. However, there has been a perception that only explicit knowledge can be effectively managed, captured and kept updated (NONAKA, 1994). There is an understanding that tacit knowledge exists, is important, and needs to be formally included in a model of production management system, especially to model shop floor environments.

Nonaka and von Krogh (2009) shows that better results are achieved by actions that are focused on tacit knowledge sharing and people integration.

Traditionally, production management models are composed of two dimensions, namely the technical dimension and the social dimension. The technical dimension refers to production organization, which is hereafter called the Process including all activities, types and physical arrangement of equipment and the flows of material that result in services and goods. The social dimension refers to work organization, which is hereafter called the People. Knowledge should be considered as a third dimension (MUNIZ Jr. *et al.*, 2010a,b; MUNIZ Jr., RIBEIRO; PRADHAN, 2021;). Figure 1 shows the integrated approach related to People, Process and Knowledge factors to support better worker knowledge sharing on the shop floor (MUNIZ Jr. *et al.*, 2019; MUNIZ Jr. *et al.*, 2021).

FIGURE 1 - Knowledge-based Integrated Production Management Model



Source: Muniz Jr. et al. (2010a,b).

Process factors contribute to the control and improvement of the daily activities of workers, and include problem solving methods, standard operating procedure (written procedures), 5Ss, poka yoke and quick changeover, which have been demonstrably found to enable the workers to use and share their knowledge alongside their increasing levels of engagement. The use of the Process factors enhances the learning of operators by systematically seeking improvements in the production context based on lean manufacturing (MUNIZ Jr., WINTERSBERGER; HONG, 2021). These factors focus on tools which

contribute toward the control and improvement of the daily activities of production workers, for example: Problem Solving Methods (GARVIN, 1993); Standard Operating Procedure (OHNO, 2019); 5S (OHNO, 2019); Poka Yoke (OHNO, 2019) and Quick Changeover (MCINTOSH *et al.* 2000.). The use of P-factors enhances operators' learning by systematically seeking improvement in the production environment. In this work, Lean manufacturing and mass production considerations were central in the selection of factors.

People factors include items such as: objectives (KOZLOWSKI *et al.*, 2001.), structure, communication (WORLEY; DOOLEN, 2006), training (NONAKA, 1994; DARRAH, 1995), incentives (KOZLOWSKI *et al.*, 2001). The People factors relevant to supporting KM must consider the interaction between the operators and the organization, sharing of measurable objectives, work and communication structure, and training and incentives. Two work organization models were considered in selecting these factors: the semi-autonomous models and the enriched model. The selected factors must enhance people's involvement in achieving organization objectives by the creation, retrieval, share, and use of knowledge. The selected factors cover various aspects in production: "who can help to do what?", material and time resources availability, communication among group members and between the group and the other people in the organization, required training by the various activities, and by the operation of the production machinery and incentives.

3. METHODOLOGICAL PROCEDURES

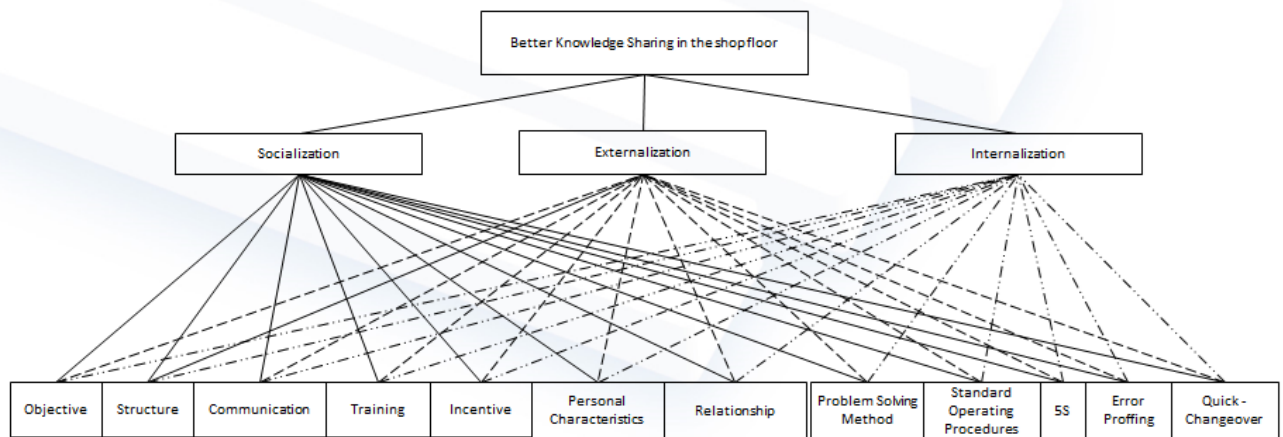
The literature background was based on web of science papers (2004-2021) and highlights Knowledge Sharing and the enablers factors assessed. We applied the guidelines to literature review of empirical papers (NAKANOMUNIZ Jr., 2018).

The methodology is based on the quali-quantitative method approach to assess factors to facilitate the assessment of the relation between knowledge sharing among logistic workers at Brazilian Aircraft manufacturer. The aeronautical logistics area in the plant researched has a strong dependence on the worker's tacit knowledge considering operational complexity to handle large parts variety to produce different aircraft configurations, and it is by high technology information systems used in the logistic service.

The quantitative phase compares worker judgment about factors that enable knowledge sharing in terms of their relative importance among these factors, using Analytic Hierarchy Process with Incomplete Pairwise Comparison (AHP-IPC, see Appendix).

Figure 2 represents the AHP structure to support our assessment of the factors in the Logistics area in the aeronautical industry, which include worker knowledge sharing as the goal:

FIGURE 2 - Application of AHP to Logistic Service Study



Source: (MUNIZ Jr., WINTERSBERGER; HONG, 2021).

The method included interviews, informal conversations and on-site observations. The research relies on the use of questionnaires (see MUNIZ Jr., WINTERSBER and HONG, 2021) and observations in the company production plant in order to enhance the validity and reliability of the research outcome. A total of 72 questionnaires were applied including operators (61), management (9) and technical support staff (2).

The interviewees received personal instruction from the first and second author about how to fill up the questionnaire. The objective of the questionnaires carried out is to define the criteria and alternatives that lead to a better Knowledge Sharing among the Workers in the logistics area of an aerospace company. The AHP-IPC questionnaire used in the research as exemplified in Figure 3:

FIGURE 3 – Example of the questionnaire used in the research (MUNIZ *et al.*, 2021)

Written records of standard operating procedures	9	7	5	3	1	3	5	7	9	Dialogue among workers
Dialogue among workers	9	7	5	3	1	3	5	7	9	Study of standard operating procedures

Source: The authors.

In order for there to be better sharing of workers' knowledge, indicate the relative importance for the alternatives below: 1) same importance; 3) low importance; 5) middle importance; 7) high importance; and 9) extreme importance.

It also performed a focus group session (1.5 h) with logistics leaders to discuss the quantitative result. The update occurred with the inclusion of the result of the interview conducted with the 3 supervisors of the Logistics area (qualitative phase). Due to some company constraints to arrange the interview with the workers, it was decided to have the interview with the staff team only.

Context of study

Brazil is considered an emerging economy and has a diverse industry. Brazil is also the largest national economy in Latin America. Brazil has a mixed economy with abundant natural resources. Brazil's diversified economy includes agriculture, industry, and a wide range of services. Brazil entered an ongoing recession in 2014 and the number of unemployed people reached 14 million people between 2017 and 2018. Thus, knowledge sharing becomes relevant for the organizations.

The aerospace industry is a competitive sector and allows us to understand the worker knowledge sharing in complex assembly and longer cycle-time. The Brazilian aerospace industry is strongly positioned.

Technology innovation, high level technology products, complexity in its process, and high expense in development projects are characteristics of the aerospace industry. Aerospace is a competitive market, which undergoes profound changes with the entry of new players, especially in the regional and executive jets market. The company researched is a Brazilian worldwide company, which designs, develops, manufactures and markets aircraft and

systems, and customer services. One of the world's main aircraft manufacturers, this Brazilian company takes part of a complex supply chain, with 90% of its suppliers located outside the country (FUNO *et al.*, 2011).

It is important to highlight that the aeronautical industry is managed by international rules and requirements from airworthiness authorities such as FAA (Federal Aviation Administration), EASA (European Aviation Safety Agency) ANAC (Agencia Nacional de Aviação Civil), and other international civil aviation organization such as ICAO, IATA, etc.

4. RESULTS AND DISCUSSIONS

Externalization (register in standard operating procedures) and Internalization (Read/study of standard operating procedures) were judged equal by workers logistics interviewees with both 34.28% of relative importance, and closer Socialization (Conversation among Operators) with 31.44% of relative importance, what differs from previous study that highlight Socialization as the main mode of knowledge conversion among worker as relevant (NAKANO, MUNIZ Jr., BATISTA Jr., 2013; MUNIZ Jr. *et al.*, 2021).

The Logistic workers want formal procedures to support their decision besides their memory or tacit knowledge. It can be explained by the safety management system (SMS) and safety culture in the aeronautical industry with dedicated and specific requirements and rules applied for manufacturing, design and production systems in order to ensure a safety operation around the world.

Table 2 presents details about the factors related to each mode of knowledge conversion. Incentives were considered the most important to knowledge sharing in the modes of Socialization (18,69%), and Internalization (14,09%).

TABLE 2 –Results for each alternative in each criterion

Alternatives	Socialization (conversation)	Externalization (registration/write)	Internalization (understanding/read)
Objective	10,58%	7,15%	6,23%
Structure	7,39%	10,15%	11,64%
Communication	3,10%	7,03%	9,04%
Training	6,80%	10,30%	13,08%
Personal Characteristics	1,82%	2,58%	3,63%
Relationship	4,03%	4,53%	8,73%
Problem solving method	5,40%	8,12%	5,47%
Work Instruction / Standard Operating Procedure (SOP)	13,09%	13,63%	8,11%
5S	6,24%	5,80%	4,38%
Zero Defect	14,57%	10,92%	7,33%
Quick Change	8,30%	6,62%	8,26%
Incentives	18,69%	13,17%	14,09%

Source: The authors.

The Standard Operating Procedure is relevant to support Conversation among Workers (Socialization) and Registration in the Work Instruction (Externalization). It brings confidence to worker decision making process safety. However, it is mentioned that the logistic worker prefers to have something "written" when performing their tasks based on informal conversation.

In the analysis of the results, in order to have a better Conversation among the Workers (Table 2), it is also important the Objective of the team (10.58%), so that the exposed subjects are based around the same objectives.

The Internalization to understanding of Standard Operating Procedure (Table 2), Training was opted as the second most important alternative among workers. Therefore, it is always necessary that the company keep training focused on procedures in a specific area.

Analyzing the alternatives in the criteria for the Conversation between Workers and Registration in the Work Instruction (Table 2), we can observe that Zero Defect is one of the most important (14.57% and 10.92%, respectively), leading to a conclusion that the operators consider that means used to avoid errors in their activity are essential since they are based on previous practices and so they are more confident in the information.

Incentive (15,22%), work instruction (11,57%), zero defect (10,84%) and training (10,15%) were considered the most important factors or alternatives for the knowledge sharing in the Logistics Area. Based on these results a question was raised concerning the high score obtained for the alternative incentive. This question was better discussed and understood in the interview with the supervisors.

Incentive was the most relevant factor with 15,22% in the global ranking among workers and according to the opinion of the supervisors, the incentive is related to the exchange of experience among workers to solve problems in the logistics area, and incentive is also related to opportunities of new ideas for the logistics process. Another point related to incentive according to the supervisors is the solution proposal for solving problems, and motivation to give suggestions. These are the points observed by supervisors to answer the question a) above regarding the incentive alternative. such as, Time Availability (CLEVELAND; ELLIS, 2015), Incentive (NAKANO, MUNIZ Jr.; BATISTA Jr., 2013), Roles and Responsibilities (BHAMU; SANGWAN, 2014), when implementing the Lean philosophy in an organization.

Zero defects/Error Proofing had 10,84% in the factor global ranking among workers and according to supervisors, it shows the relevance of the conversation among shop floor logistics workers to exchange experience of some problem that occurred in order to eliminate defects or even some failures in the process. Considering the complexity of the activity, the zero defect culture is part of the aeronautics industry and the percentage score obtained in the survey reflects this culture. These are the main points raised by supervisors to answer the question b) raised above concerning the zero-defect alternative.

Training had 10,15% in the factor global ranking and it also shows according to supervisors that sharing the learning or knowledge in practice is part of the training.

It is also important to note that the alternatives "Personal characteristics" and "Relationship" are the least important for Knowledge Sharing (Figure 2). This reinforces the fact that for Knowledge Sharing, individual characteristics should not be taken into account for each employee, but in a more comprehensive way, thus favoring the diversity of the workers.

In the qualitative phase (company interview), the supervisors raised some considerations to better understand the factors or alternatives that had a relevant score in the survey. These considerations were the following:

- Incentive is regarding the exchange of experience to solve problems, incentive to give ideas, propose solutions, and suggestions.
- Zero defect: Conversations to share experience of some problem that occurred in order to eliminate defects / failures that occurred during the process, zero defect culture is part of the aeronautics industry.
- Training: Sharing the learning or knowledge in practice is part of the training.

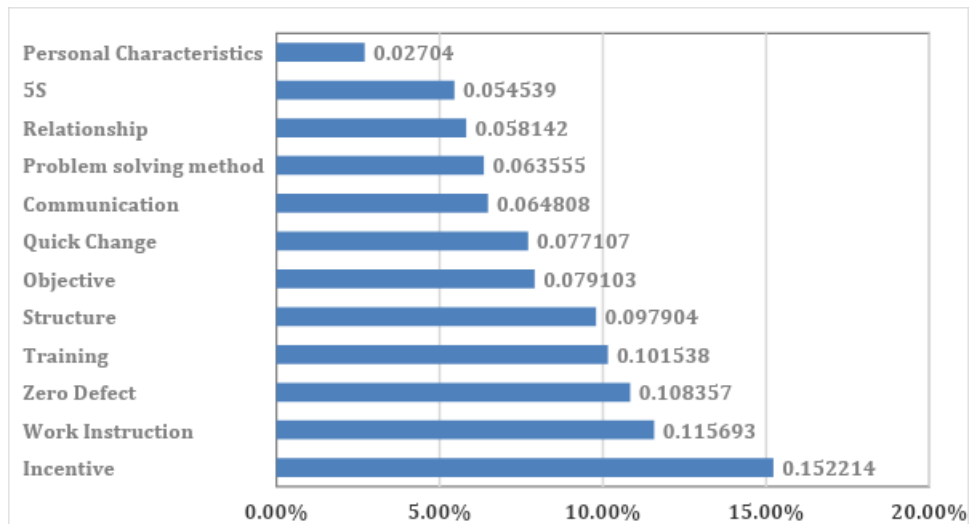
6. CONCLUSION

Considering the complexity of a logistic process for an aircraft manufacturer such as the multi-site operations, the different configurations of an aircraft and the costs involved in this process is very important to support knowledge sharing among the logistics workers in order to avoid mistakes and to reduce the costs of this complex operation.

The more relevant enablers (Figure 4) that contribute to knowledge sharing among the logistic workers in a Brazilian aircraft manufacturer were:

- ✓ Criterion: Registry in the Work Instruction (Standard Operating Procedure) and Understanding of the Working Instruction.
- ✓ Alternatives: Incentive, Work Instruction, Zero Defect and Training.

FIGURE 4 – Factors Global Ranking



Source: The authors.

Considering that some of the enablers factors to support knowledge sharing are the same ranked for a resilience management by Adini *et al* (2017), such as collaboration, planning, procedures, training, infrastructure, communication and evaluation, we consider a research opportunity to discuss the relation between Resilience and Knowledge sharing. Organizational resilience is a company's reactive capacity to resist an external event, and anticipate events to open new development pathways.

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Appendix A: Analytic Hierarchy Process (AHP)

The Analytic Hierarchy Process (AHP) is a structured technique of multi-criteria decision analysis for organizing and analyzing complex decisions. Developed in the 1970s by Thomas L. Saaty, the method decomposes decision problems into a hierarchy of sub-problems and, after that, compares qualitative or quantitative data to each other, with respect to their impact on an element above them in the hierarchy tree (SAATY, 1980).

Nascimento, Muniz Jr. and Rocha (2016) indicated judgments inserted in the comparison's matrices are often based on the fundamental scale of absolute numbers (SAATY, 1980). That is, a linear scale from 1 to 9. Value 1, from that scale, is used when it is judged that both objects have the same priority. One implication of the use of the fundamental scale is that the comparison matrix will be a positive reciprocal matrix. That is $a_{ij}=1/a_{ji}$ and $a_{ij}>0, \forall i, j=1, 2, \dots, n$. Therefore, x , the number of comparisons required to fulfill a comparison matrix can be obtained by Equation 1.

$$X = n(n - 1)/2 \quad (1)$$

A limitation in applying the AHP is the time required to complete all possible pairwise comparisons. A large number of comparisons is a concern when using a questionnaire based on AHP. Incomplete pairwise comparisons (IPC) is an algorithm developed to reduce the number of comparisons allowing the group to focus on the debate and decrease time used to fill a comparison matrix (HARKER, 1987). Harker (1987) explains that the two advantages that the AHP has over other multi-criteria methods are the ease of use and the ability to handle inconsistencies in judgments. Nevertheless, the author states the capability to handle such inconsistencies, based on the redundancy within the method, is also a drawback because of the amount of work required to make all of the necessary pairwise comparisons.

The questionnaire follows the example of Figure A, in order to collect employee judgment about relative importance of factors to support better sharing of workers' knowledge.

FIGURE A - Question example for the interviewee compare two different Criteria

Written records of standard operating procedures	9	7	5	3	1	3	5	7	9	Dialogue among workers
Dialogue among workers	9	7	5	3	1	3	5	7	9	Study of standard operating procedures

Saaty’s 5-point scale (1991): (1) same importance; (3) low importance; (5) middle importance; (7) high importance; and (9) extreme importance. Figure A shows an example of the questions used.

The judgments were collected anonymously from blue and white collars of the logistic area. The data were aggregated with Aggregation of Individual Priorities – AIP, and the findings were discussed with a sample of these executives to assess the adherence with their industrial experience (Forman and Peniwati, 1998). By reducing the number of comparisons, from x to $n - 1$, a greater involvement of the respondents was expected. As a matter of fact, the response was 55.7% of the population.

The Analytic Hierarchy Structure (Table B) presents the results calculated from the blue and white collars judgments to support better worker knowledge sharing based on knowledge conversion process (NONAKA, 1994). The results were aggregated based on Forman and Peniwati (1998): the aggregation of individual priorities (AIP). That is, priorities from each executive were aggregated by arithmetic mean.

AIP was the appropriate approach to treat the data collected because of the broad research characteristics including number of functions researched, and size of the population. More importantly, because of the use of direct judgments (first diagonal) in aggregating the priorities (AIP), and not the aggregation of estimated values of judgments based on geometric mean (AIJ), there is a greater significance to the results.

In each individual judgment, from the adapted Saaty fundamental scale, it was possible to create a reciprocal matrix of 3x3 value judgments (Table A), for the judgment of the Criteria and another three matrices 12x12, for the judgment of Alternatives.

The comparison of the factors in each matrix is made from the elements horizontally with the elements vertically. Regarding the Criteria (Table B), the analysis and classification of Interviewee 1 - II allows to conclude that Socialization - Dialogue is of extreme

importance (value 9 in the matrix) in comparison to Externalization - Write in order to have a better sharing of worker knowledge (2nd column and 1st line of the matrix). Then, the geometric mean of the matrix (5th column of the table) as well as the arithmetic sum of each column (5th row of the table) is calculated, which makes it possible to calculate the relative priorities of each factor in its normalized form (6th column of the table). The verification of the consistency of the results was also performed and, as discussed in the description of the AHP-IPC method, we obtained the respective values of $\lambda = 3$ and the Consistency Index (CI) equal to 0.

TABLE B - Example of Incomplete Pairwise Comparison calculus

Interviewee A	Dialogue among workers	Write Standard Operating Procedures	Study Standard Operating Procedures	Geometric Average	Priority
Dialogue among workers	1	9	81	9,00	89%
Write Standard Operating Procedures	1/9	1	9	1,00	10%
Study Standard Operating Procedures	0	1/9	1	0,11	1%
TOTAL	1	10	91	10	

As highlighted in the matrices (Table A), the gray values correspond to the responses to parity comparisons acquired during the survey. The other values above the main diagonal were deduced according to the method used, and the values entered below the main diagonal correspond to the reciprocal (inverse) values of those above the main diagonal.

For the other judgments regarding Alternatives in relation to the three Criteria, the same decisions were made, and also = $\lambda = 12$ and $CI = 0$.

Focus groups validated the findings and the research instrument. Data was analyzed to rank factors using manager's judgments (experts). The advantage of this approach is that inconsistency is not possible which is quite useful when dealing with survey studies.