Exploratory and Confirmatory Factor Analysis of Future Skills of Thai Airline Ground Attendants

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Abstract

The COVID-19 pandemic disrupted almost all industries including the aviation ground services sector. This has led to accelerating use of various technologies and a need for developing new competencies and skills within this particular segment. This study aimed to examine the critical competencies required of future ground attendants in a post-pandemic era. For the purposes of this study, two methods of analyses, namely an 'Exploratory Factor Analysis' (EFA) and a 'Confirmatory Factor Analysis' (CFA), were deployed. A questionnaire was constructed as a research tool to collect data from 400 airline ground attendants in Thailand using a quota sampling method. The EFA results revealed a Kaiser-Meyer-Olkin (KMO) value of 0.947 and a significant Bartlett's Test of Sphericity (χ^2 = 9387.667, df = 595, $p < .001$), confirming the validity of the construct and the proposed components pertaining to the required future skills. Factor loadings exceeded 0.50, resulting in eight components from 35 indicators: 1) Decision-Making and Business (DB), 2) Digital Literacy (DL), 3) Cross-Cultural Competence (CC), 4) Team Communication (TC), 5) Creative Thinking (CT), 6) Problem-Solving Method (PSM), 7) Collaborative Skills (CS), and 8) Entrepreneurial Literacy (EL). The CFA results supported the model's goodness of fit (χ^2/df = 2.145, CFI = 0.931, TLI = 0.925, RMSEA = 0.054, SRMR = 0.048). Thus, this study offers new perspectives on the components of future skills for Thai airline ground attendants and guides the human resource department in developing training programs and adjusting job specifications. The findings also help the aviation sector to reskill and upskill employees to work effectively in a disruptive environment.

Keywords: Factor Analysis, Future Skills, Ground Attendants, COVID-19

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Introduction

The COVID-19 pandemic has significantly impacted the aviation industry, especially as it pertains to ground attendants, who are critical frontline staff, responsible for operational efficiency as well as for providing positive passengers' experiences (Thepchalerm & Ho, 2020). Since the pandemic, a number of measures and technologies have been deployed in order to enhance passengers' safety and hygiene. Examples of these initiatives include contactless self-check-in systems and the use of robots and artificial intelligence (AI) for various tasks (Chutiphongdech et al., 2023). However, the COVID-19 pandemic is not the only main factor driving the need for new skills in aviation ground services. Workforce competencies are also influenced by many factors such as global trends, globalization, rapid technological innovation, and changing labor market demands (Robinson, 2020).

Past studies identified key success factors for ground attendants in enhancing airline service quality and job performance, such as discipline and effective communication skills (Wattanacharoensil & Yoopetch, 2012). At present, there is a need for airline employees, including ground attendants, to develop digital competencies such as data management, customer interaction through digital platforms, and proficiency in technology-driven tools to improve operational efficiency and customer service in the working environment (Charernnit, 2023). In ground service jobs, there is a significant tendency to reduce personnel to essential roles only, as robots or AI have not yet replaced certain tasks (Javaid et al., 2021). In his research, Langnau (2022) warned that some workers may not be able to adapt to future skill requirements and consequently fail to be successful in the modern working environment.

Then, the concept of future skills is based on McClelland (1973) Iceberg Model, which identified three key components of competence: knowledge, skills, and attributes. For ground service jobs, these turn into observable workplace behaviors: knowledge shows as technical understanding of airline procedures and safety regulations; skills refer to proficient system operation and multilingual communication; and attributes include a service-oriented mindset and cultural sensitivity in daily operations (International Air Transport Association, 2021; SkillsFuture Singapore, 2018).

Moreover, the International Air Transport Association (IATA) Ground Operations Manual (IGOM) dictates the standardized competency requirements for ground crew operations which

focuses on a number of aspects, including technical proficiency and operational efficiency, passengers' safety, and effective communication skills (International Air Transport Association, 2024). However, working in the post-COVID-19 era requires more than just these skills. Ground attendants must develop required future competencies in order to perform competitively, while maintaining the highest quality of service and conforming to international aviation standards. The future work environments necessitate a new range of skillsets, also known as the "21st-century" skills. According to the World Economic Forum's report, titled "The Future of Jobs Report 2020", (World Economic Forum, 2020), future workplaces require strong analytical and critical thinking skills; they demand active learning and creativity along with complex problem-solving skills; as well, they call for strong leadership and technological competencies; and finally, future jobs mandate resilience and flexibility to ensure success in fast changing work environments. Hence, it is imperative that organizations plan for and develop future skills in their employees to maintain their competitiveness and succeed in the future (Lim, 2023).

Therefore, it could be said that the concept of working skills for airline ground attendants has been redefined. For aviation ground attendants, airline ground staff are increasingly required to develop competencies that combine these future skills with core IGOM competencies to meet changing work environments.

In Thailand, the 'future skills' have been a core component of the national strategy (the third strategy), where emphasis is being placed on the development and enhancement of human resource capabilities. As part of its National Education Plan (2017-2036), the Thai government acknowledges the importance of developing a human resources plan and allocates resources to materialize and shape the desired outcomes (Office of the Education Council, 2017). Additionally, a report by Office of the Education Council (2021) expresses the urgency and imperative nature of essential future skills required for the workforce in the age group of 15-59 years. This report advocates that training and education for this age group ought to be continuous and be done both formally and informally to ensure workforce readiness and the ability of workers to adapt to unpredictable circumstances. Some of these skills include: 1) Digital Literacy, 2) Problem-solving, 3) Business and Entrepreneurial Literacy, 4) Creative Thinking, 5) Collaborative Skills, and 6) Cross-cultural Competence. Despite the mandates and available required framework, there have been no specific guidelines pertaining to the future skills required for ground attendants.

Thus, this study attempts to identify and validate those required future skills that are critical to Thai ground attendants in the post-COVID-19 era. As mentioned earlier, this study was conducted with 400 Thai ground attendants working with Thai airlines at major airports in Bangkok and Chiang Mai. All participants had experienced working during the COVID-19 pandemic. The findings of this research could then be utilized to provide recommendations to airlines' to enhance ground attendants' competencies, as well as their re-skill and up-skill, so that they have the readiness to effectively handle disruptive and unforeseen environments.

Research Objectives

1) Identify the critical future skills required for Thai ground attendants in the post-COVID-19 era using an Exploratory Factor Analysis (EFA).

2) Confirm the validity and components of future skills using a Confirmatory Factor Analysis (CFA).

3) Provide recommendations regarding human resources development based on the validated future skills to enhance the competencies of Thai ground attendants.

Literature Review

Future Skills Concept

The concept of future skills is a relatively new idea developed in a disruptive working environment. This concept is adapted from the well-established theory of competence by David C. McClelland's Iceberg Model (McClelland, 1973), which describes competence as having both visible and hidden elements. The visible part includes knowledge such as technical information and regulations, and those skills developed through training and practice. The hidden part pertains to attributes such as motivation, attitudes, and self-concept that impact the behavior and performance at work. In aviation ground services, the visible parts are reflected in technical knowledge of airline procedures, safety standards, and digital systems, as well as operational and communication skills. The hidden parts are shown in attributes such as service-minded attitudes, cultural sensitivity, and the ability to remain calm under pressure (Wandelt & Wang, 2024). In the post-COVID-19 era, the concept of future skills provides a useful framework for identifying which

competencies are critical for resilience and recovery. Ground attendants continue to require the core IATA Ground Operations Manual (IGOM) competencies, but they must also adapt to rapid operational changes. For example, possessing digital literacy is essential for incorporating contactless technologies, such as digital ticketing and safety information systems (Bangani & Jokonya, 2022). Furthermore, Bremer and Maertens (2021) found German-speaking flight attendants exhibited strong customer service skills while lacking the required technology skills, which points to an urgent need for digital literacy training among staff. Finally, certain personality traits, also known as resilience skills, such as patience, contextual awareness, and adaptability are increasingly becoming critical in aviation work (Ropp & Belt, 2020).

In Thailand, the importance of future skills is emphasized in the National Education Plan (2017–2036), which underscores the critical nature of continuous skills development to prepare the workforce for unpredictable challenges (Office of the Education Council, 2017). Office of the Education Council 's report (2021) provides guidelines to promote future skills suitable for Thais across all age groups with the objective to enhance the quality of life of the workforce and prepare them for rapid changes or potential disruptions that may present themselves in the future. This report identifies the top 6 important future skills for the workforce aged 15-59 years as follows: 1) Digital Literacy, 2) Problem-solving, 3) Business and Entrepreneurial Literacy, 4) Creative Thinking, 5) Collaborative Skills, and 6) Cross-cultural Competence.

Digital Literacy (DL) refers to the knowledge and skills required to use digital technology, including software systems like AI and data analysis to effectively read, understand, and utilize information for work (Božić, 2023). During the pandemic, digital literacy became essential for ground attendants in working with contactless check-in and digital equipment in operations (Chutiphongdech et al., 2023). Moreover, digital literacy also supports other competencies, especially problem-solving, by providing quick access to accurate information to deal with passengers' inquiries and concerns. Problem-solving (PS) refers to a process that involves systematic observation and critical thinking to find an appropriate solution or way to reach the desired goal (Md, 2019). Ground attendants address unexpected operational issues, such as flight delays, overbooking, or lost baggage. ‘Adaptability skills’ are critical and have proven to be crucial in the post-pandemic context in the Aviation industry in order to respond to rapid changes that the industry experiences, and to maintain quality of service (Patala, 2022). Business and

Entrepreneurial Literacy (BEL) refers to the ability to manage, plan, and use resources effectively to keep operations running smoothly and achieve organizational goals (Scott, 2015). Business and Entrepreneurial Literacy skills are critical not only to help employees understand the company's operations, but they are also crucial during uncertain times. For instance, after Thai Airways underwent restructuring during the COVID-19 pandemic, many flight attendants had transitioned into new roles including online businesses, food delivery, or content creation (Charernnit & Treruttanaset, 2023). These skills are also important for helping them adapt and generate income during periods of unpaid leave. Creative Thinking (CT) is the ability to initiate new ideas, create innovative solutions, and improve processes by carefully evaluating information (Gafour & Gafour, 2020). Hariri et al. (2021) found that this skill is vital for preparing the workforce in the Aviation industry to tackle potential future challenges. In ground services, creative thinking leads to positive outcomes, especially when dealing with disorderly passengers (Abuan et al., 2023). Other critical competencies, such Collaborative Skills (CS), involve working well with others. These skills assist the ground crew to successfully negotiate and resolve conflicts, particularly considering the limited time and resources available to them during unforeseen and difficult encounters with passengers and perhaps with other staff. These skills help ground attendants to work efficiently, maintain service quality, and adapt to the fast pace of the aviation industry (Bell, 2010). Research has shown that cooperation is essential for both ground staff and cabin crew to keep operations safe and smooth (Wong & Neustaedter, 2017; Ziehe & Helfen, 2020). Collaboration is more important when combined with cross-cultural competence, as working in diverse teams requires understanding and respecting different cultural perspectives. Cross-cultural Competence (CC) is another critical skill that is critical for ground services staff. This skill relates to the ability to understand and adapt to different cultures, languages, and ways of working, while maintaining a strong emotional state and quickly adjusting to change (Khalil, 2021). In the Aviation industry, this skill is essential for serving passengers from around the world and meeting their different needs (AlShamsi et al., 2022). This skill also strengthens all other skills by improving communication, promoting teamwork, and ensuring that quality of service is maintained and is at par with international standards.

It is noteworthy to mention that existing literature on competencies and future skills required by the Aviation industry is not generally widespread. Moreover, the scope of "future

skills" can be rather broad and often difficult to pin down as these competencies comprise a blend of skills, knowledge, and attributes which vary among individuals across industries and work environments. In the Aviation industry, the quality of service provided by ground attendants significantly influences passengers' safety and overall satisfaction, which directly impacts travelers' future purchase decisions (Waramontri, 2021). As a result, considering the uncertainties pertaining to the recent pandemic and potential future disruptions, it is imperative to ensure that ground services staff has the competence and readiness to handle unforeseen circumstances, which can be made possible by skills development and essential training. The readiness and competence of the staff is crucial to the long-term survival of individual airlines and the Aviation industry as a whole. This study focused Future Skills based on both Office of the Education Council's (2021) report, which identified six key future skills for the workforce aged 15–59, the future skills concept, and evidence from aviation research to identify and validate the future skill components essential for Thai ground attendants. By applying Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA), the study not only identifies how future skills for ground attendants' group together but also confirms which skills are statistically reliable and relevant for ground attendant.

Ground Attendant Definition: An airline passenger service agent, assisting passengers in the terminal and responsible for check-in, luggage services, customer service, issuing boarding passes, informing passengers of flight details, and assisting with the air travel process before in-flight service.

Methodology

The close-end questionnaire with 35 questions was utilized for respondents to express their competencies regarding the necessary future skills for ground attendants. The questions were developed based on a review of future skills theories and concepts, the Thailand Professional Qualification Institute (TPQI) standards for the Aviation Profession (Ground Services and Terminal Support), and related research. The rating scale uses a 5-point Likert Scale from 5 to 1 (5 = Very High, 1 = Very Low). The questionnaire's validity and reliability were evaluated using the Index of Item-Objective Congruence (IOC) from three experts: A Human Resource Development expert, an Assistant Professor in Business Administration, and an Associate Professor

specializing in aviation and tourism, with an index of item-objective congruence (IOC) greater than 0.5 (Rovinelli & Hambleton, 1977). Moreover, the questionnaire's reliability was tested through a pre-test with a sample of 30 individuals from the non-actual sample, using Cronbach's Alpha-Coefficient method. A value above 0.7 indicated sufficient reliability and appropriateness for data collection. The reliability of the instrument was assessed with a Cronbach's coefficient alpha resulting in 0.985 (Cronbach, 1970), with a total of 35 items covering 6 dimensions for future skills, which were identified by Office of the Education Council (2021). 1) Digital Literacy (DL) 5 items 2) Problem-solving (PS) 6 items 3) Business and Entrepreneurial Literacy (BEL) 6 items 4) Creative Thinking (CT) 4 items 5) Collaborative Skills (CS) 8 items 6) Cross-cultural Competence (CC) 6 items.

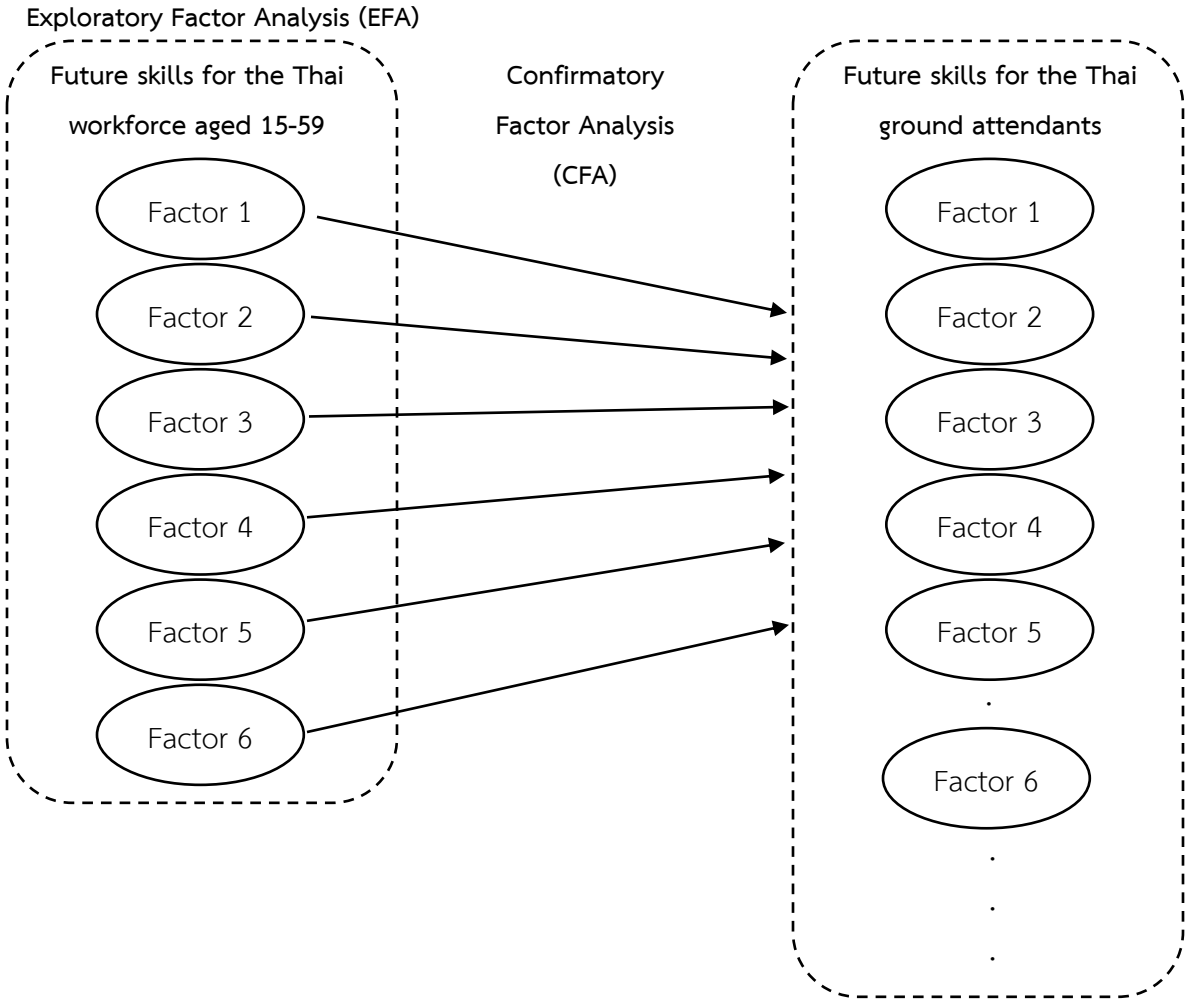

Figure 1: Conceptual model

At the time of this research in 2023, and during the COVID-19 recovery period, the total number of Thai airline ground attendants was unknown due to workforce shortages, making it difficult to determine the exact population size. Since the population was unknown, the sample size was calculated using Cochran's (1997) formula, requiring at least 384 respondents with a 5% margin of error, at a 95% confidence level. To ensure accuracy and suitability for factor analysis, the researcher decided to increase the sample size to 400, which according to Comrey and Lee's (1992) represents a "good" sample size. Due to the limited number of staff during May–June of 2023, the same dataset was also used for both Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). Van Prooijen and Van der Kloot (2001) support this method by pointing out that applying the same dataset for both analyses can be methodologically acceptable. Although this is a limitation, the model was carefully checked with several fit indices to reduce the chance of overfitting.

Online questionnaires were created using Google Forms and distributed to station managers of various Thai airlines at airports in Bangkok and Chiang Mai, because these airports areas have effectively utilized various technological innovations to provide the most efficient passenger services in Thailand. The questionnaire was approved for exemption by the Institutional Review Board of Chiang Mai Rajabhat University (Project Code: IRBCMRU 2022/217.23.09) in September 2022. Then, the data collection process was conducted. The sampling procedure combined quota sampling. In the process, a quota sampling method was employed to target 200 respondents from full-service airlines (such as Thai Airways, Thai Smile, and Bangkok Airways) and 200 respondents from low-cost airlines (including Thai AirAsia, Thai AirAsia X, Nok Air, Thai Lion Air, Thai Vietjet; as well as corporate outsourcing companies like Bangkok Flight Services - BFS). This method ensured proportional representation from both full-service and low-cost carriers, and it also prevented potential biases, due to the fact that these airline types have different service models and employee skills expectations, which could influence future skills requirements.

Upon collecting the data, a systematic process for analysis was followed. First, the responses to the questionnaire were reviewed through data editing to ensure accuracy and completeness. Subsequently, data coding was carried out to prepare the responses for computerized data processing. The analysis was then performed using statistical software.

Descriptive statistics were used to summarize the respondents' general information through frequency, percentage, mean, and standard deviation.

Inferential statistics included the use of Exploratory Factor Analysis (EFA) to identify distinct factors and only retain variables with factor loadings above 0.50 (Hair et al., 2010). Additional analyses comprised correlation coefficient analysis and Confirmatory Factor Analysis (CFA) using 'maximum likelihood estimation' (ML) to evaluate the structural validity of the research model by comparing the theoretical structural equation model with empirical data. The 'model fit' was assessed through the relative chi-square value (χ^2/df), with a criterion of less than three, along with several 'goodness-of-fit' indices. Specifically, the Goodness-of-Fit Index (GFI) and Adjusted Goodness-of-Fit Index (AGFI) were required to exceed 0.80 (Byrne, 2013), while the Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) were required to exceed 0.90 (Schumacker & Lomax, 2010). The evaluation also considered the Root Mean Square Residual (RMR) and Root Mean Square Error of Approximation (RMSEA), which are considered acceptable if below 0.08 (Hu & Bentler, 1995; Schreiber et al., 2006).

Results

As stated earlier, the analysis of the general information was conducted on a sample size of 400 respondents, which were selected using a quota sampling method. The sample consisted of 200 ground attendants from full-service airlines and 200 ground attendants of Thai national airlines in addition to outsourcing companies. The results revealed that the majority of the respondents were female, accounting for 59.0%. In terms of age, the most common age group was 31-40 years, accounting for 55.8%, followed by 21-30 years at 36.0%, and the least common age group was 41-50 years of age, accounting for 8.2%. Regarding education level, those with a Bachelor's degree accounted for the highest number of respondents at 86.0%, followed by those graduated with higher than a Bachelor's degree at 13.2%, and the lowest level was less than a Bachelor's degree at 0.8%, respectively. In terms of work experience, the largest group had 5-10 years of experience, accounting for 62.5%, followed by less than 5 years at 30.0%, and the least common had more than 10 years of experience, accounting for 7.5%. As for the organization or airline, the most common organization was Thai Airways, accounting for 24.2% of the respondents,

followed by Thai AirAsia at 20.8%, and the least proportion was the category for outsourcing companies, accounting for 0.8%.

The Exploratory Factor Analysis (EFA)

In this analysis, the relationships among observed variables were examined to identify future skills competencies among Thai ground attendants, and also to determine the patterns of such correlations among the variables. Variables with the highest correlations were grouped together into future skills components, with original observed variables retained in the factor with the strongest correlations. For the purposes of 'Exploratory Factor Analysis and to ensure that the data set was indeed appropriate for factor extraction, preliminary assumptions (sample adequacy, KMO, and Bartlett's test) and analytical feasibility elements (factor loadings and multi-collinearity were examined. In the process, only variables with factor loadings equal to or greater than 0.50 were selected. The details of the analysis are as follows:

The Kaiser-Meyer-Olkin (KMO) statistic had a value of 0.947, which is greater than 0.50, indicating that the data was highly suitable for factor analysis according to the research objectives. Additionally, Bartlett's Test of Sphericity showed a statistically significant Approx. Chi-Square value of 9387.667 with a P-value <0.001, which is less than 0.05. This suggested a significant relationship among variables and indicated that the data was appropriate for further factor analysis and extraction (Watkins, 2018).

Then, the data were analyzed by Exploratory Factor Analysis to extract the components using principal component analysis and varimax orthogonal method.

From Table 1 it is illustrated that all indicators had a mean value ranging from moderate to high ($\overline{\mathbf{X}}$= 3.20 to 3.94) and a standard deviation between 0.71 and 1.03. The results of the factor analysis, after conducting Varimax rotation, revealed the grouping of variables into 8 factors of future skills, as all 8 factors had an eigenvalue greater than 1, as follows.

Factor 1 is labeled Cross-cultural Competence (CC). There are five indicators with factor loadings that range from 0.645 to 0.756, this factor explained 11.238% of the variance

Factor 2 is labeled Digital Literacy (DL). There are five indicators with factor loadings that range from 0.698 to 0.810, this factor explained 10.866% of the variance

Factor 3 comprises observed variables extracted from Problem-solving (PS) and Business and Entrepreneurial Literacy (BEL), labeled Decision-making and Business (DB). There are six indicators with factor loadings that range from 0.594 to 0.738, this factor explained 10.623% of the variance

Factor 4 comprises observed variables extracted from Collaborative Skills (CS) 4 variables Considering the questions related to teamwork communication competency, this factor is labeled Team Communication (TC). There are four indicators with factor loadings that range from 0.723 to 0.799, this factor explained 8.913% of the variance

Factor 5 is labeled Creative Thinking (CT). There are four indicators with factor loadings that range from 0.691 to 0.725, this factor explained 8.320% of the variance

Factor 6 comprises observed variables derived from Problem-solving (PS) 3 variables and Cross-cultural Competence (CC) 1 variable. Considering the questions related to problem-solving methods, this factor is labeled Problem-solving Method (PSM). There are four indicators with factor loadings that range from 0.578 to 0.831, this factor explained 8.107% of the variance

Factor 7 comprises observed variables derived from Collaborative Skills (CS) 4 variables. Considering the questions related to collaborative work. Therefore, this factor is labeled Collaborative Skills (CS). There are four indicators with factor loadings that range from 0.669 to 0.763, this factor explained 7.874% of the variance

Factor 8 comprises observed variables derived from Business and Entrepreneurial Literacy (BEL) 3 variables. Considering the questions related to entrepreneurship, this factor is labeled Entrepreneurial Literacy (EL). There are three indicators with factor loadings that range from 0.740 to 0.817, this factor explained 6.108% of the variance

After conducting an exploratory factor analysis (EFA), it was found that the future skills of Ground attendants presented the relationships among the observed variables could be constructed with the same components, resulting in a total of eight skills components for ground attendants after the COVID-19 pandemic, as follows: 1) Cross-cultural Competence (CC), 2) Digital Literacy (DL), 3) Decision-making and Business (DB), 4) Team Communication (TC), 5) Creative Thinking (CT), 6) Problem-solving Method (PSM), 7) Collaborative Skills (CS) and, 8) Entrepreneurial Literacy (EL)

Table 1: Descriptive Statistics, Factor Loadings, Eigenvalues, and Percentage of Variances for Future Skills after varimax rotation

Factor	Variable	Item	$\bar{X}$	SD	Eigen value	% of Variance	Factor Loadings
1	CC1	Socialize to build relationships and a professional network.	3.52	0.93	3.933	11.238	0.645
	CC2	Continuously adapt to workplace changes.	3.54	0.93			0.756
	CC3	Accept cultural differences.	3.55	0.91			0.751
	CC4	Collaborate with diverse cultures.	3.58	0.86			0.741
	CC5	Manage emotions and adapt to diverse cultural perspectives.	3.67	0.88			0.696
2	DL1	Using computers and digital devices.	3.75	0.85	3.803	10.866	0.810
	DL2	Using digital communication tools for work purposes, such as Zoom.	3.77	0.93			0.699
	DL3	Use basic Microsoft Office for work like Word, Excel, and PowerPoint.	3.62	0.84			0.698
	DL4	Using technology to provide accurate flight information to passengers.	3.66	0.87			0.785
	DL5	Use with technology devices (collaborate work with AI).	3.65	0.92			0.750
3	PS4	Staying calm and fair when making decisions to solve problems at work.	3.53	1.03	3.718	10.623	0.729
	PS5	Identify work-related problems by asking the right questions.	3.42	0.96			0.738
	PS6	Gather information to make informed decisions and solve problems effectively.	3.55	0.98			0.700
	BEL1	Have a basic understanding of business operations.	3.33	1.02			0.653
	BEL2	Have transferable business skills that can generate additional income.	3.20	0.98			0.594
	BEL3	Have knowledge about accessing funding sources such as credit loans options.	3.34	0.92			0.601
4	CS1	Adapt and listen to the opinions of your colleagues.	3.42	0.99	3.120	8.913	0.798
	CS2	Analyze the behavior, emotions, thoughts, and feelings of others.	3.44	0.92			0.723
	CS3	Motivate and inspire teamwork to achieve shared goals.	3.42	0.88			0.747
	CS4	Refuse colleagues in risky situations and warn them to avoid risks or change behaviors in the right direction.	3.41	0.92			0.799

Table 1: Descriptive Statistics, Factor Loadings, Eigenvalues, and Percentage of Variances for Future Skills after varimax rotation (continued)

Factor	Variable	Item	$\bar{X}$	SD	Eigen value	% of Variance	Factor Loadings
5	CT1	Initiate and create new ideas to improve your work.	3.80	0.82	2.912	8.320	0.718
	CT2	Possess out-of-the-box thinking skills to solve problems and enhance efficiency.	3.76	0.75			0.691
	CT3	Think creatively to develop innovative solutions.	3.94	0.71			0.725
	CT4	Can be open-minded, accept, and embrace the outcomes of changes resulting from creative perspectives.	3.87	0.84			0.723
6	CC6	Have the skill to identify and address the diverse identities of passengers.	3.77	0.80	2.837	8.107	0.831
	PS1	Pay close attention to details and are interested in solving work-related problems.	3.88	0.89			0.725
	PS2	Possesses presentation skills to propose problem-solving methods and improve work quality.	3.88	0.85			0.794
	PS3	Have interpretation skills to ensure mutual understanding in problem-solving.	3.74	0.77			0.578
7	CS5	Can work under pressure.	3.67	0.87	2.756	7.874	0.701
	CS6	Collaborate and assist your colleagues well.	3.64	0.88			0.698
	CS7	Have the ability to coordinate with others effectively.	3.52	0.85			0.763
	CS8	Can work efficiently with others to achieve common work goals.	3.67	0.86			0.669
8	BEL4	Lead and guide others towards achieving goals.	3.65	0.80	2.138	6.108	0.741
	BEL5	Manage resources effectively in the workplace.	3.71	0.84			0.817
	BEL6	Manage risks effectively and adapt to changing situations.	3.69	0.85			0.740

The Confirmatory factor analysis: testing the measurement models (CFA)

Among the available quantitative methods, the CFA was carried out to verify the construct validity of the instrument developed (Hoyle, 2012). The main advantage of CFA in construct validity research was that directly comparing alternative models of relationships among constructs was possible and achievable (Whitely, 1983). With the extensive use of CFA, the validity of the construct can be assessed by the AMOS program. Through CFA, the questionnaire can be revised as a better instrument based on the outcome generated from the construct validity. Therefore, after the EFA analysis, the confirmatory factor analysis (CFA) to verify the factorial validity of the

Future Skills. The models were compared using χ^2/df, GFI, AGFI, CFI, TLI, RMR and RMSEA. Table 2 presented the model specifications for CFA.

Table 2: Model fit statistics for each hypothesized factor model

Parameter	Accepted values	Coefficient	Interpret
χ^2/df	< 3	2.145	Passed
GFI	≥ 0.80	0.848	Passed
AGFI	≥ 0.80	0.827	Passed
TLI	≥ 0.90	0.925	Passed
CFI	≥ 0.90	0.931	Passed
RMR	< 0.08	0.048	Passed
RMSEA	< 0.08	0.054	Passed

Table 3 presented the 2nd order of the competence model showed a statistical significance of .001 for all latent variables among future skills competency of Thai Ground Attendants. Standardized results concerning the model are presented in Figure 2.

Table 3: Second-order confirmatory factor analysis between observed variables and future skills competency

Factors	b	S.E.	t-test	R^2
Cross-cultural Competence (CC)	0.853***	-	-	0.199
Digital Literacy (DL)	0.687***	0.093	10.417	0.727
Decision-making and Business (DB)	0.870***	0.121	12.189	0.456
Team Communication (TC)	0.657***	0.102	9.76	0.508

Table 3: Second-order confirmatory factor analysis between observed variables and future skills competency (continued)

Factors	b	S.E.	t-test	R^2
Creative Thinking (CT)	0.712***	0.087	9.785	0.432
Problem-solving Method (PSM)	0.675***	0.094	10.104	0.756
Collaborative Skills (CS)	0.852***	0.101	11.755	0.473
Entrepreneurial Literacy (EL)	0.446***	0.063	6.06	0.728

*** p<0.001

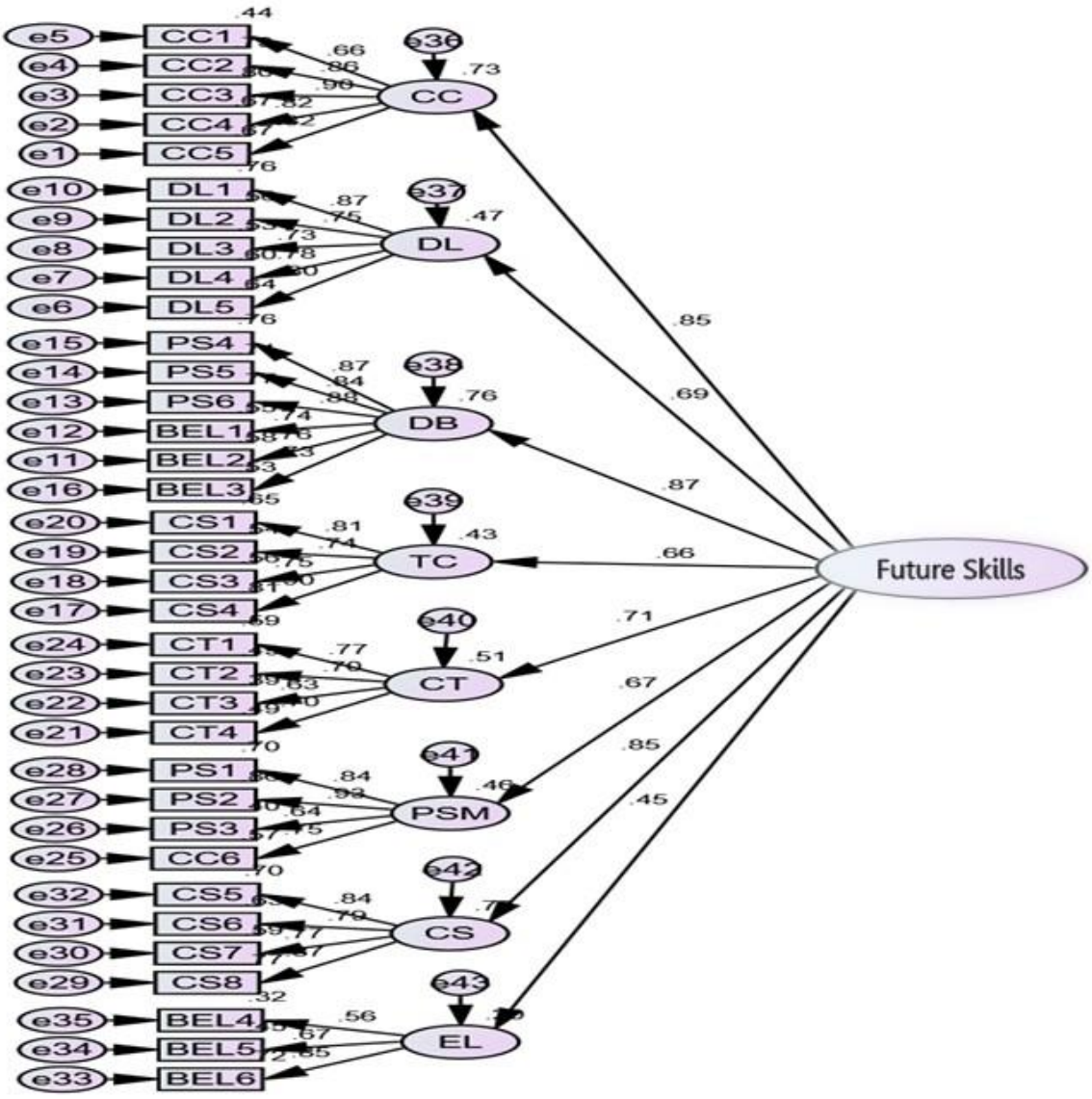

Figure 2: A second-order measurement model for Future Skills of Thai Ground Attendants in the Post-COVID Era

Reliability of the Model

Once the CFA was finished, the instrument of model for Future Skills Competency of Thai Ground Attendants in the Post-COVID era was confirmed in 35 items from eight factors. Then the reliability of the model instrument was considered. Reliability refers to the stability and consistency of the scores obtained (Fraenkel et al. 2011). In the current study, the internal consistency test (Cronbach's Alpha), construct reliability (CR) and AVE were calculated. The value

of Cronbach's Alpha is higher than 0.70. Also, CR should be more than 0.60 and AVE must be over 0.50 (Fornell, & Larcker, 1981; Hair et al., 2010). Table 4 shown the Cronbach's Alpha, CR, and AVE for the subconstructs of Future Skills Competency of Thai Ground Attendants in the Post-COVID Era.

Table 4: Reliability Analysis for Future Skills Competency of Thai Ground Attendants in the Post-COVID Era

Factor	No. of Items	Cronbach's Alpha	CR	AVE
Cross-cultural Competence (CC)	5	0.903	0.779	0.946
Digital Literacy (DL)	5	0.888	0.770	0.946
Decision-making and Business (DB)	6	0.916	0.808	0.946
Team Communication (TC)	4	0.875	0.873	0.634
Creative Thinking (CT)	4	0.793	0.793	0.509
Problem-solving Method (PSM)	4	0.867	0.871	0.633
Collaborative Skills (CS)	4	0.891	0.890	0.670
Entrepreneurial Literacy (EL)	3	0.739	0.746	0.502

As is shown in Table **4**, the Cronbach's Alpha of each sub-construct exceeded the desirable standard of 0.70**:** Cross-cultural Competence (CC), α = 0.903; Digital Literacy (DL), α = 0.888; Decision-Sub-Construct making and Business (DB), α = 0.916; Team Communication (TC), α = 0.875; Creative Thinking (CT), α = 0.793; Problem-solving Method (PSM), α = 0.867; Collaborative Skills (CS), α = 0.891 and Entrepreneurial Literacy (EL), α = 0.739**.** Meanwhile, all the CR values for the Factor of Thai Ground Attendants in the Post-COVID Era exceeded the desirable standard of 0.60, which indicated high internal consistency. Moreover, the AVE for the eight latent variables exceeded the common cut-off value of 0.50, demonstrating that this research had acceptable discriminant validity.

Discussion and Conclusion

This research offers new perspectives on the components of future skills for Thai ground attendants in the post-COVID era. The factor analysis identified 8 components comprising 35 items. The CFA indicated that the developed model was well-aligned with the collected data, exhibiting good fit criteria. All statistical measures used to assess the model fit were within acceptable ranges, demonstrating that the developed model has strong structural validity and it could be effectively applied in practice.

Component 1 Cross-Cultural Competence (CC)

This component included five key internal variables: building relationships and professional networks, adapting to workplace changes, accepting cultural differences, collaborating with diverse cultures, and managing emotions across cultural contexts. The majority of respondents had more than ten years of work experience, that possibly improved their skills for effective diversity management and interpersonal adaptability. Ground attendants with cross-cultural competence can work smoothly in a diverse environment and the ability to build relationships and a professional working environment was crucial for career success. This component revealed internal variables in accordance with Thakur et al. (2025), who noted that managing cultural diversity and developing cross-cultural competence are essential for effective collaboration and relationship-building in diverse workplace environments. Adaptability, quick acceptance of change, and emotional control were also critical skills for ground attendants. This notion is aligned with the proposal in similar literature stating that adaptability at an individual and organizational level is indeed critical for strong performance in complex environments such as aviation (Burke et al., 2006). Furthermore, in the aviation industry, where interactions with passengers from diverse cultural backgrounds were common, this was supported by a case study of Saudi Arabian Airlines, which found that multicultural awareness and effective communication significantly impacted teamwork effectiveness and safety (Metscher et al., 2009). Therefore, cross-cultural competence was crucial for adjusting in complex work environments, accepting various ideas, and understanding different cultural perspectives (Weng, 2015).

Component 2 Digital Literacy (DL)

Digital Literacy comprised the ability to use computers, digital devices, communication tools for work purposes, Microsoft Office applications, technology for providing flight information, and AI-assisted collaboration tools. These components were emphasized as significant for ground attendants. Kantawan and Satararuji (2022) stated that digital literacy was a combination of media and technology literacy. The COVID-19 pandemic accelerated automation trends due to passengers' preferences for contactless experiences, making ground attendants' jobs more digital. For instance, the use of Zoom application does not directly involve passenger services, yet after COVID-19 workers increasingly used it for work-related tasks. For example, at Chiang Mai International Airport, ground attendants use Zoom for operational meetings with head offices in Bangkok or airline hubs in other countries. These meetings help staff to share updates, solve problems in real time, and coordinate flight information, helping to ensure smooth passenger service. The aviation industry is rapidly changing with technologies that demand digital literacy skills such as AI, data management, and advanced training tools. According to Abu Talib et al. (2025), digital literacy is an important factor for efficiency at workplace, especially in roles like operations and data analysis, and for adapting to future aviation work. In this particular research, the majority of the respondents were aged 31–40 (55.8%) who mainly belong to the ‘millennial generation’ (Gen Y). This generation has a strong familiarity with digital technologies, although not as much as the next generations, yet they are technology savvy and have experienced the rapid expansion of digital technology. According to Deloitte (2022), while this age group had strong levels of internet use, they may have lagged behind the younger generation. Airlines' human resource teams needed to implement effective digital literacy training programs tailored to their workforce. As a result, ground staff were compelled to acquire digital literacy skills to adapt effectively to work in this changing environment. Digital literacy was important for hospitality employee retention and productivity, especially during crises (Kumar, 2021).

Component 3 Decision-making and Business (DB)

This component involves remaining calm and fair in decision-making, identifying problems through effective questioning, collecting relevant information, and by understanding business operations. Effective decision making and business skills are also critical in case of changes in

employment status (redundancies or crises) to allow individuals to have a better understanding of their transferable skills and types of opportunities that might be aligned with their interests and skillsets. Furthermore, decision making and business literacy are crucial especially during crises and unforeseen circumstances to allow accessing funding options to support livelihood and financial stability during these tumultuous times, such as pandemics. Ground attendants need to manage tasks such as unexpected flight changes which require good decision-making skills, as their decisions directly impact the safety of passengers, customer's satisfaction, and operational efficiency, was supported by research from Raguž et al. (2007), which emphasized that decision-making skills were essential for finding optimal solutions and achieving business success in the hospitality industry. Furthermore, the integration of decision-making and business skills within this component reflected the importance of business knowledge that helped ground attendants generate income during periods of insufficient earnings, such as unpaid leave. This aligned with the study by Charernnit and Treruttanaset (2023), which found that Thai Airways flight attendants shifted to business-related careers during COVID-19, recognizing that business skills are indeed important for airline staff. Compared with the IATA Ground Operations Manual (IGOM), which mainly focuses on ground attendants' roles in safety and standard work procedures, this study proposes that Decision-Making and Business (DB) skills are also very important during a crisis. These skills help ground attendants not only follow safety and operational rules but also think strategically, keep business running, and find ways to maintain their own income during periods of disruption.

Component 4 Team Communication (TC)

TC encompassed listening and adapting to colleagues' opinions, analyzing behaviors and emotions, motivating teams, and guiding colleagues away from risks. The respondents' experience in high-pressure work environments contributed to possessing these skills. Teamwork and communication skills are core competencies in the aviation industry, and especially critical for ground attendants who use such skills on a daily basis. Santos et al. (2014) emphasized that effective communication was not only essential for technical tasks but also for developing teamwork and ensuring aviation safety. Therefore, effective team communication was an important skill in high-risk industries such as aviation (DiazGranados et al., 2023).

Component 5 Creative Thinking (CT)

Creative Thinking (CT) comprised the following skills: initiating new ideas, out-of-the-box problem-solving, developing innovative solutions, and embracing change. The aviation industry demands adaptive creativity to address unexpected situations, such as passenger disruptions or delays. This was supported by research that recommended aircrew training emphasize creative problem-solving skills in emergency situations (Muñoz-Marrón et al., 2018). According to Abuan et al. (2023), creative thinking was one of the perceived competencies of ground staff in dealing with unruly passenger behavior at Manila International Airport. Therefore, possessing creative thinking skills are essential for ground staff. This idea is also supported by Kalyanamitr (2021), who studied the necessary skills for the post-COVID-19 era and identified creative and innovative thinking skills as necessary for post pandemic environments. For instance, creativity is particularly valuable when encountering unexpected challenges, enhancing quality of service, or when adapting to rapidly changing operational environments, such as those at international airports.

Component 6 Problem-solving Method (PSM)

Problem-solving Method (PSM) requires the following skills: identifying passengers' needs, paying attention to detail, presenting solutions, and ensuring mutual understanding. This component is also reiterated in the World Economic Forum's report (2020), "Future of Jobs Report", stating that problem-solving skills are essential for adapting to a disrupted work environment. Problem-solving skills among airline employees are crucial and directly contribute to strong operational success and enhanced customer satisfaction (Cahyo et al., 2020). Failoni and Dane (2023) also contest that problem-solving skills are critical to effective operation in aviation. Good problem-solving methods enabled employees to identify solutions, establish effective procedures, and manage unexpected issues, ensuring smooth operations (Gomes Júnior & Schramm, 2021).

Component 7 Collaborative Skills (CS)

Collaborative Skills (CS) consisted of internal variables, including: the ability to work under pressure, effective collaboration and assistance to colleagues, strong coordination skills, and efficiency in achieving common work goals. This is consistent with Bell (2010) explained that essential workplace skills include working well in a team, negotiating effectively, resolving conflicts, and adjusting to situations where time and resources are limited, while also staying calm under pressure to manage stress and keep the team motivated toward shared goals. Ground attendants often work in teams or collaborate with colleagues from different departments to ensure smooth operations. Collaboration was crucial in developing innovation and creating value in the aviation business (Pereira et al., 2021).

Component 8 Entrepreneurial Literacy (EL)

Entrepreneurial Literacy (EL) comprised three key areas: leading teams, managing workplace resources, and handling risks in changing situations. Ground staff with entrepreneurial literacy understood the business aspects of their roles, enabling them to contribute to the airline's success. This was supported by Syed et al. (2019), expressed that the development of an entrepreneurial mindset was important for the next generation of aviation professionals to manage talent and lead in the growing aviation industry. Additionally, as it is stated by Ndofirepi (2020), “entrepreneurial literacy” influences self-leadership; in other words, how psychological factors drive entrepreneurial behaviors. This suggests that possessing such skills could help ground attendants think more strategically, take initiative, make decisions, and take advantage of career opportunities that present themselves along the way.

The research results reveal new perspectives, including components such decision-making and business skills, which are essential for survival of the workforce, allowing them to make decisions or access funding sources to generate income during unpaid periods. It is reasonable to conclude that these results indeed correlate with Office of the Education Council’s recommendations to promote integrated learning in both formal (Job-related skills) and informal (non-job-related skills) settings. The above-mentioned report also highlights the importance of

lifelong and self-directed learning in order to sustain existing jobs or during transition to new jobs, especially in uncertain work environments and during uncertain times.

Managerial Implications

The findings of this study identify eight future skill components for Thai ground attendants in the post-COVID-19 era. The results of this study can assist airline HR departments in developing competency-based questionnaires and serve as a guideline for ground attendants to improve their skills for professional growth and to perform effectively in a rapidly changing aviation environment. For managerial applications, airlines and relevant stakeholders should integrate these skills into industry standards or staff handbooks (e.g., IATA IGOM).

Human resource departments should consider and prioritize these future skills in job descriptions, recruitment criteria, and training programs, while training departments should integrate all eight future skills into structured courses for both new and existing staff to support. Among these, the second-order CFA results highlight Decision-Making and Business (DB) (β = 0.870), Cross-Cultural Competence (CC) (β = 0.853), and Collaborative Skills (CS) (β = 0.852) as the strongest predictors of competency. Training courses should prioritize these three skills. Example training courses include: Critical thinking and Decision-making Workshop, Seminar on Cross-Cultural Communication and Effective Collaboration and Teamwork Workshop.

Implications for Future Research

For future research, it is recommended to use qualitative methods, such as in-depth interviews, and study skill needs in different airline service models by comparing full-service and low-cost airlines.

Research Limitations

This study was conducted during May–June 2023, in the early post-COVID-19 period, across three airport locations, with a limited budget. Therefore, the findings may not fully represent the entire population, and access restrictions further limit the sample size.

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