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Developing new aviation management postgraduate program in responding to Industry 4.0: Key findings from multistages-multilevels market study

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Abstract. Most aviation related academic programs in Malaysia were designed centred around the aerospace engineering and aircraft engineering technologies. However, the emergence of Industry 4.0 demands aviation talents especially the non-management aviation practitioners such as aircraft engineers and other technical personnel to equip themselves with certain management-related skills. Hence, there is a pressing need for an advanced industry-driven and practitioners-based academic program in aviation management suits for various categories of aviation practitioners. The aims of this study are to explore the employability prospective of aviation managers (first stage); to examine the Industry 4.0-related management skills needed by aviation companies (second stage); and to analyse the personal development intention of individual practitioners (third stage). This study employed multistage-multilevel analysis on a single-case market study in a Malaysian aviation technical training university. Findings from this study are segregated into three levels. At the industry level, it is concluded that there is a brighter employability prospect of aviation managers at least until 2030. At the organizational level, there is an urgent need for the aviation professionals to upgrade themselves with managerial skills relevant to the Industry 4.0 such as data driven scenario planning, big data analysis, and collaborative decision making. At the individual practitioner's level, finding indicates that there is an increasing awareness among the individual aviation professional in particular the technical and engineering professional to engage in personal development in aviation management at postgraduate level. The key contribution of this case study is that, through multistages and multilevels analysis, it not only expands the robustness of the market study on new postgraduate program development but also able to incorporate the perspectives of different aviation stakeholders group i.e. the aviation industry, aviation organizations, and individual aviation talents. This multistage-multilevel model can facilitate university's policy makers to design future industry-based and practitioners-driven development program meant for industry practitioners.



1. Introduction

Aviation industry is one of the most important industries for Malaysia. It generates high value, high technology, and high income jobs [1], which is among the key element to achieve the status of developed nation by year 2020 [2]. This is why the government of Malaysia put greater emphasis and investment on the development of aviation talent through education and training. At this moment, most aviation related academic programs in Malaysia are purely centred around the aerospace engineering and aircraft engineering technologies. This is due to the fact that the vast components of Malaysian aviation industry represented by aircraft components' manufacturing sub-sector as well as maintenance, repair, & overhaul (MRO) sub-sector [3].

However, the introduction of new-generation aircraft especially by the duopoly aircraft manufacturers i.e. Airbus and Boeing adopting latest technology [4] has led to the increasing demand for new advanced skills development of the next generations of aviation human capital. Adding to that, the recent emergence of Industry 4.0 (IR 4.0) demands aviation talents including the non-management practitioners such as aircraft engineers and other technical aviation personnel to equip themselves with certain management-related skills.

Employing the stakeholders' theoretical perspective, this market study aims for four objectives. First, it investigates the future employability trend within the industry. Second, it investigates the emerging Industry 4.0-related managerial skills in aviation. Third, it examines the organizations' employment demand for IR 4.0-related management skills. And fourth, it analyzes the need for management advanced development among individual technical aviation practitioners. By addressing these four objectives, this study intends to create a more realistic and industry-driven basis for developing a postgraduate aviation management program.

Past literature in academic program development has put greater emphasis on providing the skills improvement intervention that can overcome the unemployment problem in the society [5]. The designs of academic program at that time were guided based on two competing schools of thought in educational theory i.e. cognitivism and behaviorism. Cognitivism approaches the education development more towards intellectual transfer of learning, whereas behaviorism focuses the cultivation of learning through stimulus and behavioral response of the learners [6].

However in recent years, the focus of an academic program has shifted from not just preparing the graduate for a single 'employment', but also retaining the graduates' 'employability' i.e. sustaining the graduates' industry-relevant career throughout their career tenure. The alumni of the academic program are now expected to become the future problem solvers, change agents, and transition managers that suit with the rapid changing nature of the industry [7].

As one of the strategic industry, aviation is known as the area with most rapid changing technology due to the advanced technology used by aircraft manufacturers, airlines operators, and aviation support services. The development of academic training program are mainly guided by internationally recognized aviation regulations such as Part 147 requirements for maintenance training organizations, or Part 145 requirements for maintenance repair organizations.

Nevertheless, the emergence of Industry 4.0 within the aviation industry has extended the focus of aviation academic programs into equipping the supply of aviation talent not only with aviation technical competency, but also with managerial skills involving multiple levels of direct and indirect stakeholders within the aviation industry. Present literature in academic program development especially in aviation education is lacking in providing the guide on how an industry-based and practitioners-driven academic program should be developed in a systematic way.

In order to have an industry- and practitioners-driven academic program that addresses the multiple stakeholders' needs, its development should be systematically done in stages involving multiple parties whose interest vested in it. These stages involve exploring employability at industry level, converging the industry employability with organizational employment at the companies' level, and confirming personal career need at the individual level. Based on that, the following multistages and multilevels market study was conceptualized as per depicted in Figure 1.

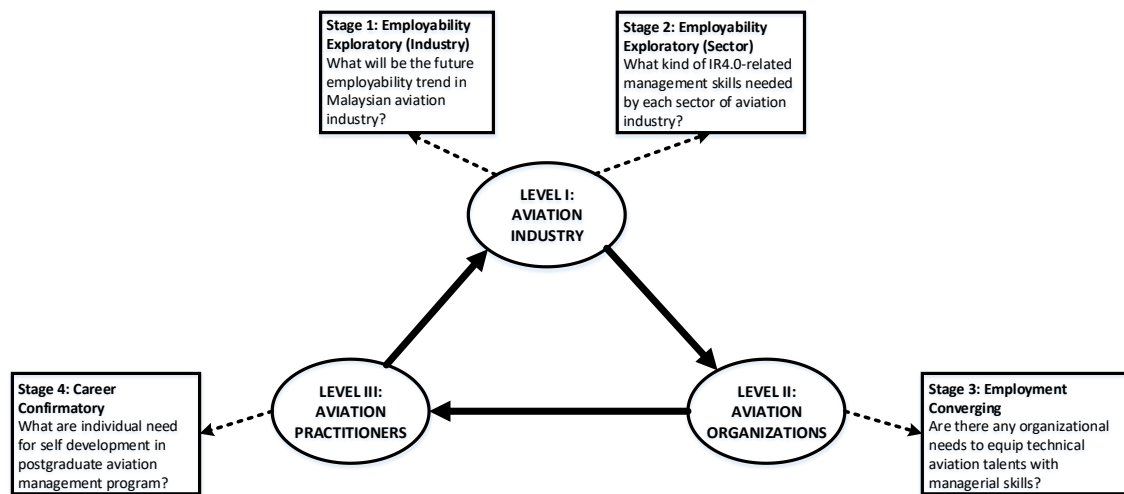


Figure 1: Conceptual framework of multistages and multilevels market study

The development of this conceptual framework is theoretically underpinned by the Stakeholders Theory. The Stakeholders Theory [8] stipulates that those ‘individual or group who is affected by or can affect the actions or outcomes of an organization are the organization’s stakeholder’. Applying this into the market study for aviation management postgraduate program development, the aviation industry, the aviation companies, and aviation practitioners are direct beneficiaries of the academic program. The involvement of industry stakeholders into the curriculum development has been found to be able to enhance the program quality of a higher education institution [9].

2. Methodology

The multistage data collection refers as the investigation which involves three or more stages of sequential and converging processes that requires multiple approaches of gathering information from the sources [10]. This study employed the multistage data collection in order to explore certain scenario pattern within the population, to explain the reason, and to confirm the reason [10].

The rationale of collecting data at different stages is due to the initial need to establish the industry employability sustainability first before assessing the employment in the individual organization and individual level consecutively. This pre-requisite consideration is based on the fact that in designing any new academic program, it should firstly contribute to the graduates’ employability with the industry [11]. Over past few years, there is a shift in trend among professional workforce to search for the ‘security of employability’ rather than the ‘security of employment’ [12]. Which mean that majority of talented individuals intentionally choose not to be loyal to a single organization, but rather loyal to his/her career. Therefore, the ‘employability’ should become the prerequisite to the ‘employment’ and ‘personal career development’ needs.

2.1. Stage 1/Level I: Exploring Employability Trend within Aviation Industry

This market study process started with the exploration of employability trend in Malaysian aviation industry (i.e. Level I). A content analysis data collection approach was used to analyze the number of aviation companies, number of aviation job titles created, number of aviation workforce, and number of managerial positions shortage in the industry. Data obtained from seven Malaysian aviation industry reports published by ministries, government agencies, and independent consultant were extracted and analyzed to establish the statistic on aviation manpower demand until the year 2030.

2.2. Stage 2/Level I: Explore the Industry 4.0 Managerial Skills Needs

Next stage involved the process of exploring categories of emergent Industry 4.0-related managerial skills in each sectors in Malaysian aviation industry (i.e. Level I). Employing thematic analysis

technique, information from eight published industry reports and eighteen journals articles on Industry 4.0 in aviation were extracted. The information were codified using Atlas.ti and relevant themes were identified to represent different categories of emerging new skills related to the application of Industry 4.0 in every aviation industry value chain.

2.3. Stage 3/Level II: Converge the Industry Employability with Organizational Employment

This stage 3 involved data collection at the organizational level (i.e. Level II). The process involved separate qualitative interview with three organizational leaders from two reputable aviation companies and an aviation regulatory agency in Malaysia. The first respondent is the Vice President (Engineering and Maintenance) of an airline, the second respondent is the Chairman of the Board of Directors of a MRO company, and the third respondent is the Principal Assistant Director (Air Traffic Management) of an aviation regulatory agency. Collected interview responses were then recorded, transcribed, and analyzed by three experienced qualitative researchers using Atlas.ti software.

2.4. Stage 4/Level III: Confirming Career Need for Personal Development

The last stage involved quantitative survey that was randomly administered online using Google Form to different groups of experienced and fresh aviation practitioners (i.e. Level III). Sampling frame were driven from university-industry networking records and bachelor of aviation management alumni database. One hundred participation invitations were sent, however only 55 responded which made 55 percent response rate. The details of the surveyed respondents are as per Table 1 below. Collected data were analyzed descriptively using SPSS.

Findings from all four stages above were then consolidated in a separate report and being presented, commented, and endorsed by a panel of experts consisted of three persons i.e. two academic experts from two higher education institutions and one expert from the aviation industry.

Table 1: Demographic profile of the surveyed respondents

Category	Sub-categories	Quantity	%
Organization types	MRO	8	15
	Operation	14	25
	Production	3	5
	Aviation Training	16	29
	Continuous Airworthiness	1	2
	Police Air Wing	1	2
	Business	4	7
	Customer Services	1	2
	Design & Certification	2	4
	IT	2	4
	Logistic	3	5
Job category	Managers	9	16
	Executives	12	22
	Engineers	4	7
	Pilot	1	2
	Instructors	4	7
	Officers	12	22
	Management Trainees	1	2
	Alumni & Students	11	20
	Not specified	1	2
Total Respondents		55	100

3. Results

3.1. Employability Trend in Malaysian Aviation Industry

The study reveals that there is a brighter employability prospect in Malaysian aviation industry until the year 2030. The industry witnessed a tremendous increase of the number of aviation companies i.e. from 50 (1998) to 266 (2017) companies. On top of that, the Malaysian aviation industry alone contributes to the creation of 483 aviation specific job titles. Concurrent to the increase of the number of aviation companies, the number of aviation workforce is also shown an upsurge i.e. from 6,800 (1998) to 21,200 (2017), and expected to increase further to 32,000 by 2030. Similarly, the aviation managerial positions had increased from 680 (1998) to 2,120 (2017) and anticipated to increase further to 3,200 by 2030.

3.2. Emerging Industry 4.0-Related Managerial Skills in Malaysian Aviation Industry

The study finds several emerging managerial skills that are related to the Industry 4.0 throughout the aviation industry value chain. Among identified Industry 4.0-related managerial skills are analytical thinking and decision making, innovative thinking, collaborative planning and decision making, scenario planning and visualization, big data management, and real-time data driven decision making.

3.3. Employment needs of management competencies for technical aviation practitioners

The interviews data with aviation companies' top leaders also shows that due to the cost factors, there is an urgent need for engineering and technical aviation practitioners to add on some management skills into their existing engineering and technical skills.

3.4. Individual practitioners' needs for academic development in aviation management at postgraduate level

The survey result indicates strong urge for advanced self-development among aviation practitioners. 93 percent of the respondents agreed that obtaining higher academic qualification significantly assist their vertical as well as horizontal career movement. In addition, the urge for personal development at postgraduate level are stronger among experienced aviation practitioners. The main reason behind this is that experienced practitioners realize that continuing education is also part of organizational needs.

Table 2 below summarizes in detailed the key findings of this market study at each stage and level.

Table 2: Study stages, data collection method, sources of data, and key findings

Stage (Level)/Objectives	Data Collection Method	Sources of data & Sample	Key Findings
Stage 1: Exploratory Stage [Prerequisite] <i>(Industry level)</i> To explore the employability prospect of aviation management postgraduate.	Content analysis	Aviation industry reports ($n_{\text{reports}} = 6$)	<ul style="list-style-type: none"> Malaysian aviation industry creates 483 aviation specific job titles in 6 sub-sectors. The highest is the Maintenance, Repairs & Overhaul (MRO) with 279 job titles. The number of aviation companies increases from 50 (1998) to 266 (2017). Number of aviation workforce increases from 6,800 (in 1998) to 21,200 (2017) and expected to increase to 32,000 by 2030. Number of managerial position in Malaysian aviation industry increases from 680 (actual 1998) and 2,120 (actual 2017) to 3,200 (expected 2030), creating shortage of 1,080 of aviation managers.
Stage 2: Exploratory stage	Thematic analysis	Aviation industry reports &	

<p><i>(Industrial sectors level)</i> To examine the organizational concern with regard to the emergence of Industry 4.0</p>		<p>academic literature on IR4.0 in Aviation (n_{reports}=8; n_{articles}=18)</p>	<ul style="list-style-type: none"> Emerging managerial skills related to Industry 4.0 throughout aviation value chain: <i>Aircraft Design & Certification</i>: Data mining; Analytical thinking <i>Aircraft Manufacturing</i>: Innovative thinking; Innovative analysis; Knowledge in efficiency & effectiveness; Collaborative decision making; Scenario planning; Visualization skill <i>Airport Operation</i>: Big Data management; Data driven analytical thinking; Collaborative decision making <i>Air Traffic Management</i>: Data driven analytical thinking; Fast data driven & collaborative decision making <i>MRO</i>: Real-time data driven decision making; Collaborative decision making <i>Aviation Training</i>: Creative thinking; Conceptual thinking
<p>Stage 3: Converging Stage <i>(Organizational level)</i> To examine the employment need on management skills for engineering & technical aviation jobs.</p>	Qualitative interview	<p>Leaders from Malaysian aviation companies (n_{leaders}=3)</p>	<ul style="list-style-type: none"> Technical aviation professional need to not only technically skilled but also possess managerial skills. E.g. Licensed Aircraft Engineer need to engage into managerial tasks e.g. planning for works & team and motivate them, planning and controlling of budget for manpower & maintenance projects (R1). With the increase in air traffic that include the UAVs and drones, the Air Traffic Controllers need to acquire analytical thinking and fast decision making skills (R2). Technical & engineering aviation personnel need to prepare themselves for career switching to management like in the case of Malaysia Airlines Berhad Chief Executive Officer who is a Pilot (R3).
<p>Stage 4: Confirmatory Stage (Individual level) To verify the individual need for advanced aviation management development</p>	Quantitative Survey	<p>Experienced (n_{experienced}=43) & fresh aviation practitioners (n_{fresh}=12)</p>	<ul style="list-style-type: none"> 93 percent of the respondents agreed obtaining postgraduate aviation management qualification assist both their lateral and vertical career movement. The urge for enhancing higher academic qualification at postgraduate level is stronger among experienced respondents since they begin to see continuing higher education is also part of organizational need.

4. Conclusion

Providing the opportunity for life-long learning is indeed a major responsibility of any higher education institutions. Yet, offering a customer centric academic program rather than providing 'no- frills' and

‘self-indulging’ academic program that will not meeting the industry and industry practitioners’ expectations and specific needs, is something that a university need to highly ensured. Based on that, this comprehensive market study for the new aviation management postgraduate program was conducted to examine the employability prospects, organizational and personal needs for personal development program, as well as the attractiveness elements of the prospective students. The findings clearly indicate that the prospective graduates of this proposed postgraduate program will have brighter employability changes in aviation industry. This is linked to the high shortage of managerial positions at various management categories that still exists for the next 10 years i.e. until 2030. The emergence of Industry 4.0 technology that encroaches into present aviation industry will also expand the need for certain specific skills related to management such as thinking skills, decision making skills, as well as leading various complex and cross-sectoral teams. The main contribution of this study lies on its methodology. By employing multistages and multilevels, various stakeholders’ needs can be appropriately addressed by the higher education institution. This process is important to ensure that each academic program can be self-sustained and continuously relevant in the eyes of the industry’s direct and indirect stakeholders.

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Declaration of Conflict of Interest

The author(s) declare no potential conflict of interest with regard to the publication of this research. The list of aviation industry reports and articles (as on Table 2) can be furnished separately upon formal request addressed directly to the corresponding author.

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