ASSESSING THE PERSON-JOB FIT IN THE EUROPEAN UNION AVIATION INDUSTRIES USING A COMPETENCY GAP ASSESSMENT FRAMEWORK

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ABSTRACT

Over the last few decades, the European Union's aviation industries have experienced a dwindling of their long-standing capacity to attract and retain the most promising students , to the benefit of other industries (such as automakers). A misalignment or gap between the competencies needed at work and those earned at school is just one of the several potential causes already identified. We argue that such a gap may be eroding the person-job fit, namely: the difference between the perceived applicant-job fit and the actual employee-job fit, thus contributing to making these industries less attractive.

The purpose of the research was to evaluate the person-job fit, along two dimensions: perceived applicant-job and actual employee-job fit in the European Union aviation sector. Competency was the component used to operationalize the measurement of the person-job fit. A competency gap assessment framework, which has already been tested in other research contexts, estimated the gaps between the competencies for adequately performing the job tasks and those acquired by higher education students. A total of 88 competencies, divided into four domains of activity (airlines, airports, air navigation service providers and manufacturers), were taken into consideration.

The methodological approach included two large-scale surveys: one of aviation employees with the purpose of assessing the relevancy of the competencies, and another of higher-education students, with the purpose of assessing the respective level of proficiency.

The results evidenced a high actual person-job fit but a low perceived person-job fit in the aeronautical or aerospace engineering programs, and a low actual person-job fit and perceived person-job fit in the remaining ones. Results suggest that students' attraction to pursuing a career in aviation may be negatively affected but, if starting out in a manufacturing industry, they are likely to perform above their initial expectations.

Keywords: competency gap, air transport, aviation, higher education institutions, engineering, industry.

INTRODUCTION

The aviation sector has undergone profound changes over the last couple of decades. In addition to the worldwide liberalization of the air transport markets *(1)*, other external developments have impacted the sector, including the economic and financial market turmoil, growing environmental awareness, steady growth in demand, a progressive increase in fuel costs or significant technological developments *(2)*. Job markets have also undergone unprecedented evolution. Globalization and other phenomena brought unprecedented freedoms to societies and markets worldwide. Accordingly, it is no surprise that employee mobility is increasing not only in geographical terms but also across industries and markets. Whilst such dynamics created novel recruitment opportunities, they also brought with them significant problems for industries in terms of retaining their best employees *(3, 4)*.

Today, the workforce constitutes a key resource for maintaining the competitiveness of human-capital-intensive industries, such as in aviation. In this regard, the capacity to attract and retain the most promising applicants is fundamental to sustaining a competitive edge. However, this is becoming increasingly difficult, and some authors already classify the current dynamics and developments taking place in the labor markets as a "war for talent" *(5)*. In the European Union (EU), the increasing difficulty the aviation industries are experiencing in attracting outstanding applicants and retaining the best employees is currently a primary concern for the European Commission and national governments *(6)*. The main reasons for this phenomenon are documented elsewhere *(7–9)* and summarized herein:

1. *Growing competency gap* – job competencies, driven by developments in international markets and worldwide societies, are evolving at a faster rate than the degree course curricula, which also have to deal with the slower pace and longer decision making processes of many Higher Education Institutions (HEIs);
2. *Progressive loss of interest in scientific or technical careers* – traditionally reputable and socially relevant, these careers are progressively losing ground to others that are more fashionable and, eventually, better paid in domains such as financing and banking, management and entrepreneurship, marketing and public relationss;
3. *Progressive loss of prestige of the aviation industries* – the long-standing respect for aviation (i.e., aeronautics, aerospace, air traffic control and airports) is on the decline;
4. *Progressive loss of interest in mathematics, physics and other natural science-related disciplines* – media and social networking platforms are diverting (young) people's attention towards new and trendy fields away from the traditional disciplines;
5. *Inferior positioning of technical careers vis-à-vis management careers* – in many industries, including aviation, top positions are available for those who choose a management career path, which incentivizes those that follow a technical track career to career shifts.

In this paper, we argue that these factors are contributing to the erosion of the Person-Job fit (P-J fit) in the EU aviation sector.

The concept of P-J fit is a class of the broader concept of Person-Environment fit (P-E fit). The P-E fit refers to the level of matching between the individual characteristics of a person and the characteristics of his/her living environment, which includes the work environment *(10–12)*. Inherently, the P-J fit is defined as the level of matching between the characteristics of a person and the characteristics of a job or the job's tasks *(13)*. These concepts imply reciprocity in both directions. As such, the P-J fit can be conceptualized in two different ways: i) as the level of compatibility between a person's abilities and the requirements of a job or job tasks – demands-abilities fit; and ii) to which extent a job fulfills a person's needs and ambitions – needs-supplies fit *(14)*.

A further division of the P-J fit concept was established depending on whether the person is a prospective applicant – perceived applicant-job fit – or an employee – actual employee-job fit. The findings have however been mixed. Studies concerning perceived applicant-job fit have seldom found statistically significant relationships *(15, 16)*. In contrast, studies looking at actual employee-job fit have found significant statistical evidence supporting a positive relationship between the level of fit and the performance *(17, 18)*.

The study of the P-J fit has proved valuable in clarifying the decision making process, as well as attitudes and behaviors of applicants during the recruitment process and, consequently, in improving organizations' selection procedures *(13, 17, 19)*.

The measurement of the P-J fit requires the evaluation of two discrete entities – person and job – across a same set of commensurable components. So far, no universal taxonomy (e.g.: needs, ambition, preferences, goals, etc.) has been agreed upon and some authors argue that is very likely that this will ever happen *(20)*. Firstly, the fundamental properties of a person or a job for establishing the fit remain unknown. Secondly, the very contextual conditions (e.g.: cultural conditions, labor regulations, etc.) seem to play an important role in the relevance of the components *(21)*. Nonetheless, the Knowledge[1], Skills[2] and Abilities[3] (KSAs) components are commonly used in the operationalization of the P-J fit (together with many other different components), particularly as far as demands-abilities fit is concerned *(13)*. Typical assessment procedure consists in listing the set of necessary KSAs for adequate performance of a job's tasks and evaluating the degree to which the person (applicant or employee) fulfills them. The level of fulfillment correponds to the level of fit.

In this paper we used the competency component to measure the P-J fit in the EU aviation industries. The relevant literature is populated with definitions on the concept of competency *(22–24)*. However, thus far no consensus has been reached. Morgeson et al. *(25)* identified three types of definitions: the first type includes knowledge, skills and abilities; the second includes knowledge, skills, abilities, motivations, beliefs, values and interest; and the third type includes motive, trait, skill and social role. The reasons for such diversity are discussed elsewhere in detail *(26–28)*, but may be ascribed to different epistemological assumptions, cultural differences or, even, differences in the context of the study (or nature of the object of analysis). A common element to these and other definitions is the comprehensive or holistic nature of competency as it seems to embrace other concepts. This nature provides higher flexibility in the definition of taxonomies tailored to each organization. However, it offers a lower level of detail which may reduce accuracy or lead to lower quality results than other components *(25)*.

For the purpose of this study, we adopted Woodruffe's *(29)* definition of competency as referring to a person's capability of doing a given (job) task well. The person's competency is built over time and several factors influence its development, namely: ability, knowledge, understanding, skill, action, experience and motivation *(30)*. The utilization of competencies to describe job tasks in aviation industries is, as in other industries *(25)*, an established practice. Detailed lists of competencies per domain of activity are available.

A Competency Gap Assessment Framework (CGAF) was deployed to assess eventual competency gaps between the person's competencies and the aviation industries' needs. Two types of gaps have been taken into consideration. The first is a gap between the competencies that

[1] We define knowledge as the "inferred capability which makes possible the successful performance of a class of tasks that could not be performed before [a] learning [process] was undertaken" *(47 pp 355)*. In turn, the learning process can be understood as capacity of an individual, given a set of stimulus, to acquire the capability to solve a given class of tasks.

[2] We define skill as "goal-directed, well-organized behavior that is acquired through practice and performed with economy of effort"*(48 pp 18)*.

[3] We define ability as the relatively stable and enduring psychological characteristics (e.g. numerical ability, spatial ability) which are, considered to vary or differ across individuals, that defy efforts to change *(49 pp 75-76) cited in (13)*.

students perceive as being relevant for working and those they actually acquire while studying. The second is a gap between the competencies that are relevant to adequately performing a jobs' tasks, and those that students and employees actually acquire or acquired while studying. The first gap denotes a low match level between the applicant's perceived and actual competencies and, therefore, a low perceived applicant-job fit. The second gap denotes a low match level between the employee's abilities and the job requirements and, therefore, a low actual employee-job fit.

There is literature on the problem of competency gaps available *(31–34)*, but it is somewhat limited. A number of authors have proposed frameworks and tools to evaluate the gap *(35–37)*, while others have taken a different approach, assuming the existence of the gap and developing methods and tools to improve the relevancy of the courses and thus fill the gap *(36)*. Studies analyzing the competency gaps in the transportation sector are scarce and the few available have mainly focused on the railway sector. Fracchia and Macário *(38)* identified the educational offer in the rail sector (higher education level), and conducted a survey of the rail industries with the aim of identifying their training needs. The study was carried out in the context of the was the EU. They concluded that EU rail industries were primarily looking for undergraduate and post-graduate employees in the following areas: train control, positioning and communication, signaling, control command and interlocking. The demand for doctorate employees was limited to very specific areas, such as risk analysis, noise or vibrations. Later, Lautala *(39)* conducted a study aiming at understanding the quantitative and qualitative demands for university graduates by the rail sector in the United States. The author concluded that the railindustries placed greater emphasis on problem-solving competencies than on technical competencies. Recently, Reis and Macário *(40)* assessed the competency gap between the requirements of the EU rail industry and the competencies taught in railways-related higher education courses. The results show a relevant gap, as the industry's central requirements lie in environment-related competencies but no railways-related education offer was identified.

The purpose of the research presented in this paper was to evaluate the P-J fit in the EU aviation industries across two dimensions: perceived and actual P-J fit. Competency was the component used in the operationalization of the P-J fit. The assessment of the competency gap between aviation industry employees and higher education students in the European Union provided information about the level of fit. Educational programs were divided in two groups: Aero-related Engineering Programs and All Educational Programs. Aero-related Engineering Programs include aerospace engineering and aeronautical engineering. The relevancy and proximity of these two programs to the aviation industries justifies an independent study. All Educational Programs include all higher education programs. In terms of scope, the research focused on the key domains of activity of the aviation industries, being: airports, airlines, Air Navigation Service Providers (ANSP) and manufacturers.

This paper is organized in five sections. The following section presents the framework for analysis of the competency gap. The third section describes the methodological approach. In the fourth section we present the main results. And the final section presents the main outcomes of the research.

COMPETENCY GAP ASSESSMENT FRAMEWORK

The CGAF is grounded in the concept of quality and the principles of Total Quality Management (TQM).

TQM principles gained in popularity in business management in the 1990s. By this time, globalization and other phenomena were profoundly impacting and changing global market dynamics. Among other things, competition heightened at both the domestic and international levels and the interests of the economic agents (e.g.: customers, suppliers, or governments) became increasingly complex and volatile. Traditional management principles proved insufficient amidst such turmoil, and industry managers started looking for alternative solutions. TQM emerged as “a systems approach to management that aims to continuously increase value to customers by designing and continuously improving organizational processes and systems” *(41 pp 25)*.

The concept of quality has evolved over time, in parallel with business and management principles *(42)*. Quality is currently seen as a complex concept that encompasses several dimensions. Juran *(43 pp 2.1-2-2)* defined quality both as “those features of products which meet customer needs and thereby provide customer satisfaction” and the “freedom from deficiencies – freedom from errors that require doing the work over again (rework) or that results in field failures, customer dissatisfaction, customer claims, and so on”. Consequently, the value of quality is not absolute but rather depends on the agent (e.g.: roles, goals, desires, background, etc.) that is evaluating it. In this regard, in a customer-provider situation, which corresponds to most business activities, Macário *(44)* identified four dimensions of quality as follows (Figure 1):

- Expected Quality (Q_E) – This is the level of quality which implicitly or explicitly is required by the customer. This level of quality is understood as a composition made up of a number of criteria. Qualitative analysis of customer profiles and preferences can assess the contributions of these criteria.
- Targeted Quality (Q_T) – This is the level of quality which the service provider is aiming to provide to the customers as a consequence of his understanding of the customer expectations and of the capabilities of the productive side of the system.
- Delivered Quality (Q_D) – This is the level of quality effectively achieved in the provision of the products or services by the different components of the system, although it is not necessarily the image that corresponds to what the customer sees. Delivered quality must be measured also from the customer viewpoint and not only from the supply side perspective, i.e., it should be assessed against the customer’s criteria.
- Perceived Quality (Q_P) – This is the level of quality as perceived by the customer. It is influenced by several factors, such as the customer’s personal experience of the service or associated or similar services, information received about the service from the provider or other sources, non-service elements (e.g. convenience, etc.), or even personal environment and needs.

FIGURE 1 AROUND HERE

We can group these concepts into two different categories: one represents the service provider perspective – Q_T and Q_D – and the other represents the customer perspective – Q_E and Q_P. The relationship between these four concepts is of paramount relevance to defining an industry’s level of quality and, ultimately, its competitive positioning. Possible misalignments evidence drops in quality or quality gaps. A quality gap can be identified in each pair of quality concepts (Figure 1).

- Satisfaction Gap – Deviations between QE and QP occur when the attributes of the product or service acquired do not match the customer’s initial expectations. A QE inferior to QP results in customer dissatisfaction; while the inverse results in customer satisfaction. This gap can result from the customer’s accumulated knowledge of the service delivered and from personal or reported experiences with the service in question or with similar ones, and from personal backgrounds and environments, which create an expectation in regard to the service provided.

- Market Misreading Gap – Deviations between Q_E and Q_T occur when the provider is unable to read and identify the attributes of the product or service that the customer expects to acquire. This gap can be caused by problems at the observation or decision level. In the former case, this means a lack of, or poor effectiveness of, the mechanisms for observation and study of the customers' perceptions and needs. In the latter, it will be either the malfunctioning of the strategic or tactical level of decision or the non-existence of one of these levels.
- Performance Gap – Deviations between Q_T and Q_D occur when the planned attributes of the product or service do not match with the properties of the product or service actually produced and delivered. This corresponds to any situation of underperformance related with the provision of services. This performance gap is either a measure of the effectiveness of one (or more) of the various providers in achieving their own targets or of the effectiveness in dividing targeted quality through the different service components.
- Delivery Gap – Deviation between the Q_P and Q_D occur when the properties of the product or services acquired by the customer do not match the properties that the supplier says it delivers. This disturbance can result from a misalignment of customer expectations in relation to the product or service provided, or the provider's inability to communicate the actual properties.

The quality gap concept was then adapted to the context of the research presented in this paper, that is, HEI-industry interaction. The interaction between HEIs and industries reveals a high degree of similarity with the service-provider relationship. Students are the object of transaction between HEIs and industries. HEIs are *producers* of students that are meant to be *acquired* by industries. HEIs compete among themselves to attract the most promising and capable undergraduate students. An increasingly relevant factor in attractings students has to do with the employability the teaching programs offer. HEIs thus seek to design and adapt their curricula and programs to the industries' current and future needs. The purpose is to provide students with the necessary competencies to conveniently perform the industries' job tasks, i.e., with higher person-organization fit and P-J fit. The four quality concepts (Figure 1) can thus now be reinterpreted from the perspective of the HEI-industry interaction as follows:

- Q_E refers to the *industries'* expectations and needs in terms of competencies;
- Q_T refers to the *HEIs'* objectives and aims to teach a portfolio of competencies;
- Q_D refers to the *students'* actual portfolio of competencies;
- Q_P refers to the *employees'* actual needs in terms of competencies;

By rearranging these four agents according to the quality gap concept (Figure 1), we were able to define the CGAF (Figure 2) *(40)*. The CGAF conceptualizes the sources of the competency gaps in the HEI-industry interaction. The CGAF classifies the agents along two dimensions as follows:

- Dimension one: demand (Industry and Employee) and supply (HEI and Students) of competencies;
- Dimension two: expectation (Industry and HEI) and delivery (Employees and Students) of competencies.

The CGAF considers that a total of four competency gaps may emerge between each pair of agents (as presented in Figure 2):

- *Gap 1* – gap between the competencies of a student and those needed to conveniently perform the job tasks. This was the gap analyzed in this research work;
- *Gap 2* – gap between the competencies that an industry needs and those that a HEI actually teaches to their students. This gap may result from either an incorrect assessment of the industry needs or the inability on the part of the industries to convey their needs;
- *Gap 3* – gap between the competencies that an industry needs and the ones owned by the employee. This gap may result from deficiencies in the recruitment process or uncertainties about the competencies actually needed.
- *Gap 4* – gap between the competencies that the HEI expects to develop in their students and those actually acquired by the students. This gap is related with inadequate learning or studying practices.

FIGURE 2 AROUND HERE

METHODOLOGICAL APPROACH

The research methodology was structured into four steps as follows:

- Step 1 – Identification of the competencies in aviation industries;
- Step 2 – Survey of employees;
- Step 3 – Survey of students;
- Step 4 – Assessment of the competency gaps.

Each step is presented briefly in the following.

Step 1 – Competencies in aviation industries

The research focused on four domains of aviation activity, which are: airlines, airports, ANSP and manufacturers. The purpose of Step 1 was to identify the competencies in these four domains. We used a comprehensive list proposed and validated by Kupfer et al. *(45)*. This list identifies a total of 88 competencies, clustered in 19 groups or aggregated-competencies. See Table 1 in Appendix I.

Step 2 – Surveys of employees

The objective of this step was to evaluate the relevancy of every competency for conveniently performing the job tasks in each domain of activity. The research focused on employees with a higher education background[4] and currently working in an aviation industry. A four-level scale with the following valuation was used: 1) Not Relevant, 2) Low Relevancy, 3) Relevant and 4) Very Relevant.

Respondents were asked two questions: i) to evaluate the relevancy of the competencies in their current work and ii) to evaluate their level of proficiency in the competencies upon completing their higher education studies.

The survey was built online (platform provided by the SurveyMonkey[5]) for easier and simpler access and dissemination. It was available during five months from October 2012 to March 2013. Multiple channels were used to disseminate the survey, such as the authors' mailing lists and those of research associates, announcements in professional associations' newsletters and publication through the authors' social networks. Tailored surveys were developed for each domain of activity. A detailed description of the survey, including the list of industries contacted, is available in *(46)*. The survey obtained a total of 153 valid responses, from a total of 19 European

[4] All (1st, 2nd and 3rd) Bologna Levels, corresponding to a total of 3 to 9 years of higher education *(50)*.
[5] Available at: www.surveymonkey.com (accessed on 1st December 2012).

Union countries. The distribution of the respondents throughout the four domains of activity is as follows:

- Airports: 25,
- Airlines: 17,
- Air Traffic Management: 17,
- Manufacturers: 28,
- Others (e.g.: consultants, government entities, associations, regulatory boards): 66.

Respondents from other domains of activity were excluded from the analysis.

The education level of the employees is as follows:

- Doctoral degree (Bologna 3rd Level): 32;
- Master's degree (Bologna 2nd Level): 107;
- Bachelor degree (Bologna 1st Level of): 14.

The education background is as follows:

- Aerospace or Aeronautical Engineering: 69;
- Mechanical Engineering: 18;
- Civil Engineering: 11;
- Other Engineering: 24;
- Other Non-Engineering: 31.

Step 3 – Survey of students

The objective of this step was to evaluate the competencies of the higher education students. The survey used the same four-level scale as the previous survey in order to allow for a direct comparison. Respondents were again asked two questions: i) to self-assess their level of proficiency on each competency; and ii) to estimate the expected relevancy of each competency in the labor market. The survey was also made available online on the same web platform during eight weeks between October and November 2012. Again, multiple channels were used to disseminate the survey, mainly: university student offices and student associations. A detailed description of the survey, including a list of respondents, can be found in *(46)*. The survey obtained a total of 174 valid responses, from 19 countries divided into the following educational programs:

- Aerospace or Aeronautical Engineering: 88;
- Mechanical Engineering: 7;
- Civil Engineering: 10;
- Other Engineering: 37;
- Other Non-engineering: 32.

Step 4 – Gap Assessment

The purpose of this last step was to assess the competency gaps (Gap 1 of Figure 2). The available literature on the assessment of competency gaps follows a qualitative approach based on simple statistical descriptors *(40, 45)*. In addition, a thorough search of the literature yielded no source suggesting a formulation to evaluate the gap. Considering that the amount of responses was insufficient to deploy a purely quantitative analysis, we adopted a mixed approach based on qualitative and quantitative analysis. We considered that a competency gap would likely occur when the deviation of valuations between agents (employees and students) was above half of a level (out of four in the Likert scale). In mathematical notation, we have:

$$Competence\ Gap\ if\ |V_{Ei} - V_{Si}| \geq 0.5$$

$$V_{Ei} - average\ valuation\ of\ competency\ i\ given\ by\ Employees;$$

$$V_{Si} - average\ valuation\ of\ competency\ i\ given\ by\ Students$$

FIGURE 3 AROUND HERE

We complemented this quantitative analysis with a qualitative analysis, using lexicographical visualization of the results, and interviews with key experts. Figure 3 presents the canvas deployed to assess the competency gaps. The green zone represents a No Gap Zone, as the difference in valuations is below half of one level. Conversely, results located outside this zone are in a Gap Zone since they have a difference in valuation above half of one level. The higher the difference the higher is the likelihood of a competency gap. In addition, we were able to identify two types of competency gaps, corresponding to the two Gap Zones. Gap Zone 1 indicates an overvaluation by the students, whereas Gap Zone 2 indicates an overvaluation by the employees.

FIGURE 4 AROUND HERE

Respondents were classified according to their domain of activity and education background. The domains of activity are airline, airport, ANSP and manufacturer. The education backgrounds are Aero-related Engineering Programs and All Educational Programs. The Aero-related Engineering Programs include aerospace and aeronautical engineering programs. The All Educational Programs include all programs.

Competency Gap 1 was divided into three other Gaps (Figure 4) as follows:

- *Gap 1.1* establishes the interaction between the students' perceived level of proficiency (supply) and employees' perceived actual relevancy (demand) of the competencies;
- *Gap 1.2* establishes the interaction between the perceived level of proficiency (supply) and perceived relevancy (demand) of the competencies for the employees (Gap 1.2E) and Students (Gap 1.2S).

Other interactions could be established between the agents, but were excluded from this paper since they do not impact the P-J fit.

Gap 1.1 and Gaps 1.2 were both used in the assessment of the P-J fit exercise. Gap 1.1 and Gap 1.2E provided information about the actual employee-job fit. They both refer to the difficulties students may face, upon getting a job, to adequately accomplish their respective job tasks. It is probable that they are not aware of them at the outset. Gap 1.2S was used to assess the perceived applicant-job fit. It refers to deviations in students' perceptions as to the relevancy and level of proficiency of each competency. Significant deviations may denote that students perceive a lack of, or an insufficient proficiency in, competencies to apply for a career in the aviation sector.

RESULTS AND ASSESSMENT OF THE COMPETENCY GAPS

The results of the competency gap assessment are presented below using the lexicographical representation of Figure 3. The results are listed in Appendix II.

Actual employee-job fit (Gap 1.1 and Gap 1.2E)

Figure 5 presents the results for Gap 1.1. As explained above, we considered two groups: All Educational Programs (in red) and Aero-related (aeronautical or aerospace) Programs (in blue). The former group manifests a wide gap, evidencing a low level of alignment between the employees' perception of relevancy and the students' perception of proficiency. Conversely, the

Aero-related Engineering Programs group exhibits lower or no gaps (most notably in the airline domain of activity), revealing a high level of alignment between employees and students. Also, all gaps result from an undervaluation by students vis-à-vis employees. This may denote uncertainty on the part of students as to their competencies and proficiency levels.

Turning to Gap1.2E, the two groups (All Educational Programs and Aero-related Engineering Programs) are presented in Figure 6. Both groups exhibit a similar behavior. Firstly, manufacturer-related competencies do not reveal a gap. Secondly, the remaining competencies exhibit smaller gaps. Thirdly, all gaps result from an undervaluation of Self-assessment vis-à-vis Relevancy. The results show that employees have a negative perception of their proficiency levels for competencies at graduation. This perception is rather aligned with students, since the proficiency level was also ranked low in this group.

The results reveal that, as far as the Aero-related Engineering Programs group is concerned, the actual employee-job fit is considerable since a considerable number of competencies does not exhibit gaps and the remaining ones exhibit a smaller gaps. The All Educational Programs group reveals a lower actual employee-job fit, as the competency gaps are visible, particularly in Gap 1.1.

FIGURE 5 AROUND HERE
FIGURE 6 AROUND HERE

Perceived applicant-job fit (Gap 1.2S)

Figure 7 presents the results for Gap 1.2S relating to the All Educational Programs and the Aero-related Engineering Programs. Both groups exhibit wide gaps in all four domains of activity. Also, all gaps result from an undervaluation of Self-assessment vis-à-vis Relevancy. Results suggest that students have a low perception as to their proficiency level in the competencies. The impacts on the perceived applicant job fit are immediate: both groups show a reduced fit since the gaps are wide and result from an undervaluation of the applicants' proficiency levels.

FIGURE 7 AROUND HERE

CONCLUSIONS

The aviation industries have been reporting growing difficulties in attracting and retaining the most promising engineering students. This paper reports the findings of a study aimed at assessing the competency gaps between the EU aviation sector – divided into four domains of activity: airlines, airports, ANSP and manufacturing industries – and higher education students. We argue that competency gaps are likely to reduce the P-J fit, both in terms of perceived applicant-job fit and actual employee-job fit, which may contribute to explaining the gradual loss of attractiveness experienced by these industries.

The paper presents a CGAF that is a comprehensive framework designed to assess the competency gaps in any industry (Figure 2). The CGAF identifies four types of agents, which are: industries, HEIs, employees and students. The CGAF organizes the agents in a square, along two dimensions, and establishes a gap along each edge. The object of study was the Competency Gap 1 (Figure 2) between higher education students and employees working in aviation industries. Competency Gap 1 was further divided into three elementary gaps:

- Gap 1.1 establishes the interaction between the students' perceived level of proficiency (supply) and employees' perceived actual relevancy (demand) of the competencies;

- Gap 1.2 establishes the interaction between the perceived level of proficiency (supply) and perceived relevancy (demand) of the competencies for the employees (Gap 1.2E) and Students (Gap 1.2S).

The assessment of the competency gaps provided information for evaluating the P-J fit. Gap 1.1 and Gap 1.2E influence the actual employee-job fit. They both refer to the difficulties students are likely to face, upon getting a job, in adequately accomplishing their job tasks. On the other hand, Gap 1.2S influences the perceived applicant-job fit since it refers to the difference in students' perception between the competency needs and the competencies actually developed.

The main results are:

- Gap 1.1 - Few to no gaps in the Aero-related Engineering Programs group, and significant gaps in the All-educational Programs group;
- Gap 1.2E - Few to no gaps in both groups;
- Gap 1.2S – Significant competencies gaps in both groups.

The identification of a gap in a given domain of activity may denote a students' ill-preparedness, due to an insufficient level of proficiency or lack of competencies to start working in that domain of activity. Results suggest that Aero-related engineering students (aerospace or aeronautical engineering students) are probably better prepared to start working in an aviation job than students from other course backgrounds. These results are in line with the expectations, since the curricula for these engineering programs are tailored to the aviation sector (first and foremost the manufacturers), while other engineering programs have a different scope. Furthermore, results suggest that students may feel apprehensive about starting to work in the aviation industries, as they all perceive that their proficiency levels are lower than those required by the competencies' relevancy. Ultimately, this can delay entry into the labor market (students may pursue further studies), reduce the standards for accepting a job or drive graduate towards other sectors.

The implications of the P-J fit are immediate: high actual employee-job fit and a low perceived applicant-job fit in the Aero-related (aeronautical or aerospace engineering) Programs, and a low actual employee-job fit and perceived applicant-job fit in the remaining Programs.

The results also have policy implications, since actions are required to reduce the competency gaps. HEIs and industries must strengthen the education component of their interactions. Actions must be developed to promote mobility for industry professionals, as well as professors, lecturers and students. The former could participate in supervising or monitoring committees for dissertations/theses or academic works, in events (e.g.: seminars) or, even, in classes; while the latter could engage in visiting periods, internships or on-the-job working experiences. In addition to this, industries should improve their visibility among students. Actions should be developed to help students understand the needs and expectations of the aviation industries. Examples of such actions could be open days held by industries and student participation in job fairs.

It is important to note that the conclusions of the research are conditioned by the limited availability of data. Firstly, the relatively low level of response to both surveys hampered the ability to conduct statistical or other analyses. Secondly, the high rate of responses from the aero-related programs could skew the findings. At any rate, considering the scarcity of research into and knowledge on the aviation sector in relation to this important topic, the research has provided important results and brought significant advancements. The likely existence of misalignments within the EU aviation sector has been revealed. The CGAF proved to be a value tool in assessing the competency gaps and evaluating the P-J fit. Also, competency proved to be an appropriate component for operationalization of the P-J fit.

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APPENDIX I – LIST OF COMPETENCIES

Table 1 – List of competencies

AIRLINE RELATED			
Competency	Constituent	Competency	Constituent
1. Cockpit Crew	1.1. Planning of the flight	3. Equipment maintenance	3.1. Maintenance and reparation of airframe
	1.2. On board instrument control		3.2 Maintenance and reparation of power plant
	1.3. General and radio navigation & communication		3.3 Reparation of on board instruments
	1.4 Understanding air law & operational procedures		3.4 Maintenance and reparation of navigation and radio communications equipment
	1.5 Management of technical aspects		3.5 Maintenance and repair of auxiliary systems
2. Planning & Control	2.1 Coordination of maintenance		
	2.2 Planning and coordination of operations		
	2.3 Flight dispatching		
	2.4 Determination and provision of meteorological circumstances		
	2.5 Ramp planning		
	2.6. Safety management		
AIRPORT RELATED			
Competency	Constituent	Competency	Constituent
4. Design	4.1. Design of airside infrastructure	9. Maintenance	9.1. Airside maintenance
	4.2. Design of building and terminal		9.2. Terminal maintenance
	4.3. Design of landside access	10. Environmental Control	10.1. Noise control
5. Building & Construction	5.1. Building & construction of airside infrastructure		10.2. Emission control
	5.2. Building & construction of building and terminal		10.3. Waste maintenance
	5.3. Building & construction of landside access		10.4 Wildlife control
6. Planning	6.1. Master planning	11. Security	11.1. Security concerning passengers
	6.2. Land use planning		11.2. Security concerning cargo
7. Handling	7.1. Handling of passengers		11.3. Security concerning employees
	7.2. Handling of freight		11.4. Prevention of intrusion / unauthorized access
	7.3. Handling of air vehicles		
8. Emergency Planning	8.1. Rescue and fire fighting		
	8.2. Obstacles removal		
AIR TRAFFIC MANAGEMENT RELATED			
Competency	Constituent	Competency	Constituent
12. Area Control	12.1. Supervision of Area Control Centre operations	15. Operations	15.1. Provision of flight information to VFR traffic
	12.2. En route aircraft control		15.2. Planning and coordination of network capacity
	12.3. Planning & coordination en route air traffic		16.1. Design, development and evaluation of ATC procedures

13. Approach Control	13.1. Supervision & planning approach operations	16. Air Traffic Management (ATM)	16.2. Design, development and sustainment of ATC systems, product and tools
	13.2. Provision of terminal radar approach control		16.3. Management of safety of ATC operations
14. Tower Control	14.1. Supervision of tower operations		16.4. Management of air traffic capacity and efficiency
	14.2. On the ground aircraft movements control		16.5. Management of interaction of operational controllers with operational environment
	14.3. Aircraft landing & taking-off control		
MANUFACTURER RELATED			
Competency	Constituent	Competency	Constituent
17. Research & Development	17.1. Failure assessment and recognition	19. Engineering	19.1. Aircraft operability and design maturity integration
	17.2. Avionics, electronic and electrical systems & EMC		19.2. Design
	17.3. Customer service		19.3. Failure assessment and recognition
	17.4. Fluid mechanics and acoustics		19.4. Stress and structures analysis
	17.5. Propulsion and powerplant		19.5. Materials and processes
	17.6. RAMS, human factors & operability		19.6. Systems engineering and architecture
	17.7. Software design & IT		19.7. Airworthiness and certification
	17.8. Structural design		19.8. Architecture, integration and in-service support
	17.9. Test engineering		19.9. Systems & electronics engineering
	17.10. Services solutions		19.10. Structural & general engineering
	17.11. Quality engineering		19.11. Flight physics
	17.12. Production rigs		19.12. Configuration management
18. Operations	18.1. Airline operations appreciation		19.13 Composites design and stress
	18.2. Components and aircraft architecture		19.14. Supply management
	18.3. Manufacturing engineering		19.15. Lean experts & supply chain quality field engineering
	18.4. Maintenance		19.16. Electrical design/integration
	18.5. RAMS, human factors & operability		
	18.6. Governance		
	18.7. Risk management		
	18.8. Composites manufacturing and assembly		

APPENDIX II – GAP ASSESSMENT

Table 2 – Surveys' results and Gaps' Calculations

		EMPLOYEES				STUDENTS				GAP 1.1		GAP 1.2E		GAP 1.2s	
		All Educational Backgrounds		Aero Educational Background		All Educational Backgrounds		Aero Educational Background		All Educational Backgrounds	Aero Educational Background	All Educational Backgrounds	Aero Educational Background	All Educational Backgrounds	Aero Educational Background
		Relevancy	Self-Assess	Relevancy	Self-Assess	Relevancy	Self-Assess	Relevancy	Self-Assess						
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)-(1)	(8)-(3)	(2)-(1)	(4)-(3)	(6)-(5)	(8)-(7)
Airline	Cockpit Crew	2,22	1,50	2,28	1,19	3,30	1,81	3,30	1,97	-0,41	-0,31	-0,72	-1,09	-1,49	-1,34
	Technics & Engineering	2,02	1,27	1,91	1,31	3,36	1,45	3,26	1,59	-0,57	-0,31	-0,76	-0,60	-1,91	-1,67
	Planning, Control & ICT	2,24	1,56	2,23	1,31	3,43	1,71	3,47	1,79	-0,53	-0,44	-0,68	-0,92	-1,72	-1,68
Airport	Infrastructure Design	2,60	1,62	1,88	1,06	3,41	1,76	3,48	1,79	-0,84	-0,09	-0,98	-0,82	-1,64	-1,69
	Building & Construction	2,14	1,36	1,93	1,07	3,23	1,42	3,38	1,42	-0,72	-0,51	-0,78	-0,87	-1,81	-1,96
	Infrastructure planning	2,72	1,68	2,00	1,18	3,38	1,66	3,44	1,69	-1,06	-0,31	-1,04	-0,81	-1,73	-1,75
	Operations Handling	2,58	1,60	2,60	1,33	3,41	1,76	3,44	1,77	-0,83	-0,83	-0,98	-1,27	-1,66	-1,67
	Emergency Planning	2,35	1,58	2,25	1,30	3,35	1,66	3,43	1,71	-0,69	-0,54	-0,76	-0,95	-1,69	-1,72
	Maintenance	2,17	1,42	1,80	1,40	3,34	1,50	3,36	1,64	-0,67	-0,17	-0,75	-0,40	-1,84	-1,73
	Environmental control	2,37	1,78	2,20	1,50	3,40	1,72	3,44	1,86	-0,66	-0,34	-0,59	-0,70	-1,69	-1,58
	Security	2,29	1,44	1,86	1,05	3,51	1,68	3,50	1,86	-0,61	0,01	-0,85	-0,81	-1,84	-1,64
ANSP	Area Control	2,31	1,54	2,52	1,74	3,45	1,49	3,39	1,54	-0,82	-0,99	-0,77	-0,79	-1,96	-1,85
	Approach Control	2,32	1,71	2,36	1,75	3,56	1,55	3,55	1,62	-0,77	-0,75	-0,62	-0,61	-2,01	-1,93
	Tower Control	2,34	1,72	2,48	1,78	3,47	1,57	3,47	1,63	-0,77	-0,84	-0,62	-0,70	-1,90	-1,84
	Other ATC operations	2,22	1,69	2,15	1,71	3,37	1,59	3,34	1,50	-0,62	-0,65	-0,53	-0,44	-1,77	-1,84
	ATM	2,49	1,75	2,51	1,79	3,38	1,58	3,39	1,60	-0,91	-0,91	-0,73	-0,72	-1,80	-1,79
Manufacturers	Research & Technology	2,29	1,90	2,31	2,40	3,44	1,84	3,46	2,14	-0,45	-0,17	-0,39	0,09	-1,60	-1,32
	Operations	2,18	1,81	2,88	3,08	3,45	1,79	3,44	2,09	-0,39	-0,78	-0,37	0,20	-1,66	-1,35
	Engineering	2,28	1,86	2,55	2,50	3,43	1,94	3,41	2,33	-0,34	-0,23	-0,43	-0,05	-1,48	-1,09

LIST OF TABLES (IN APPENDIX)

LIST OF FIGURES

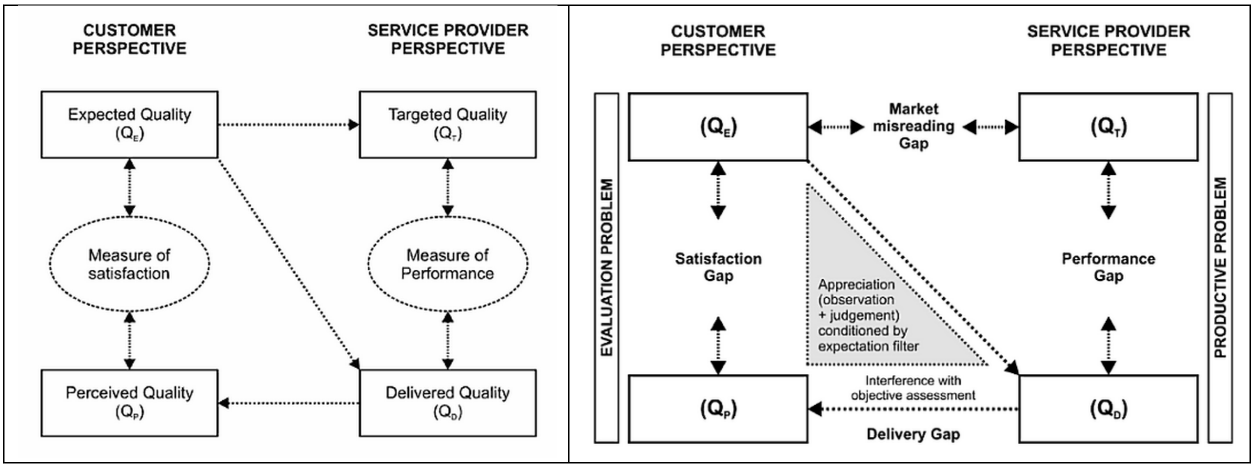

Figure 1 - Fundamental components of quality (left) and respective gaps (right) (source: 44)

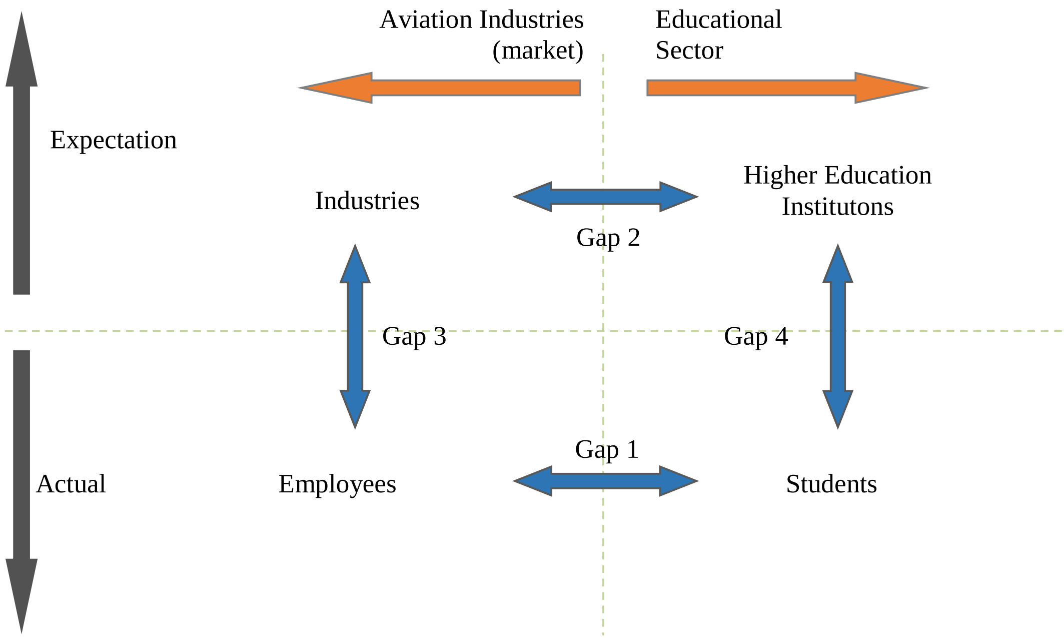

Figure 2 - Competencies Gaps Framework (source: *(40)***)**

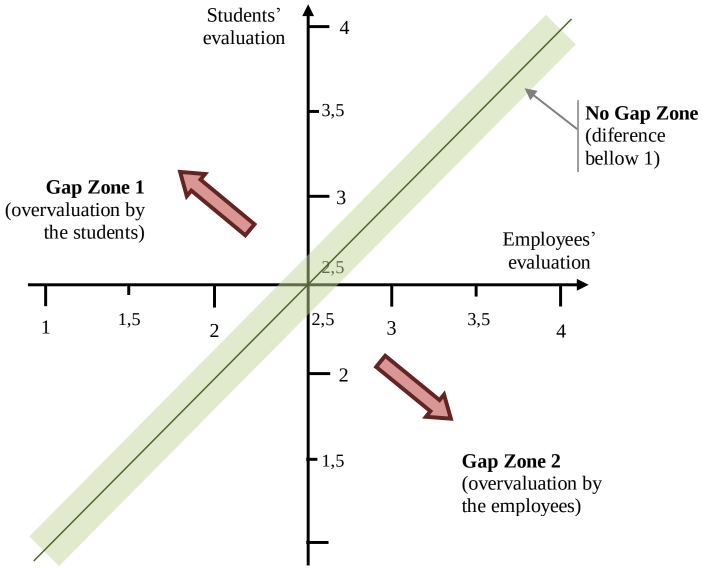

Figure 3 – Lexicographical representation of the competency gaps

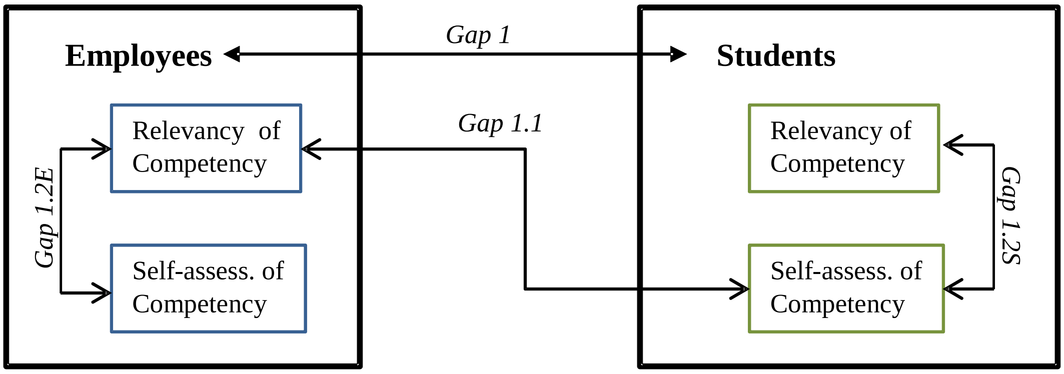

Figure 4 – Survey connections in the Gap Assessment Framework

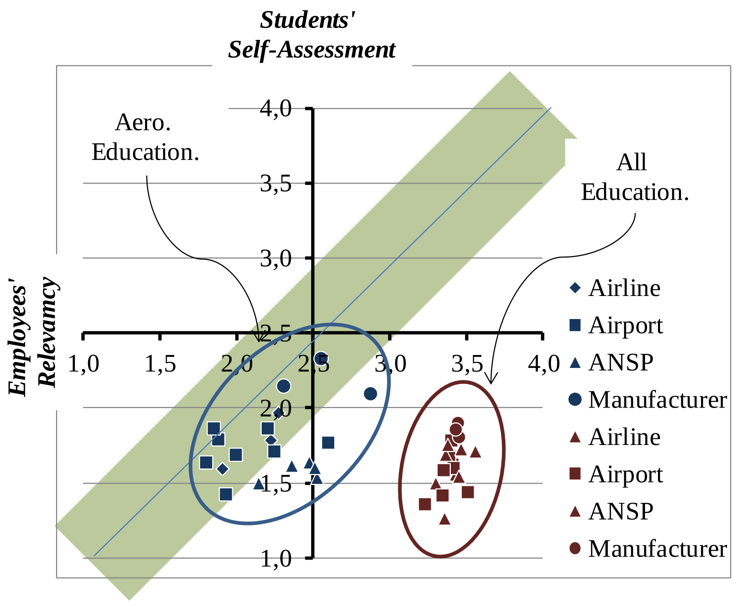

Figure 5 – Gap 1.1 (aero-related and all educational backgrounds)

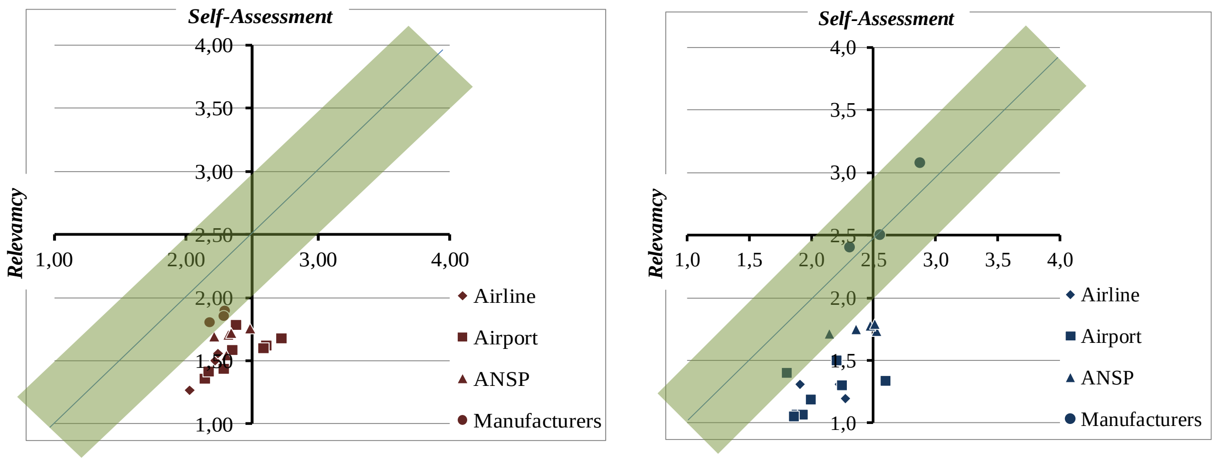

Figure 6 - Gap 1.2E - all educational backgrounds (left) and aero-related educational background (right)

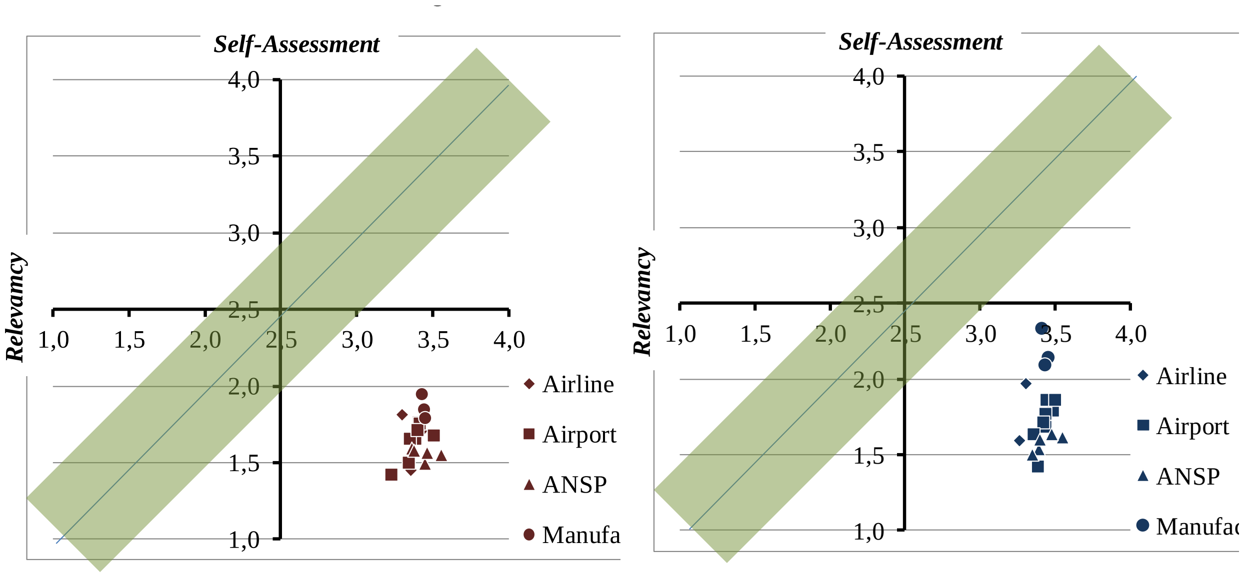

Figure 7 - Gap 1.2S - all educational backgrounds (left) and aero-related educational background (right)