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Think first job! Preferences and expectations of engineering students in a French 'Grande Ecole'

Cecile N. Gerwel Proches[a], Nathalie Chelin[b] and Siegfried Rouvrais[b]

[a]Graduate School of Business and Leadership, University of KwaZulu-Natal, Durban, South Africa; [b]IMT Atlantique, Télécom Bretagne, Université Bretagne Loire, Brest, France

ABSTRACT
A career in engineering may be appealing owing to the prospect of a good salary and a dynamic work environment. There may, however, be challenges for students wishing to enter their first job. In engineering education, career preparation courses may be included so as to prepare students adequately for their first job, future careers, and to reinforce career decision-making skills. This study explored the first-job preferences and expectations of engineering students at a generalist French 'Grande Ecole' before their compulsory internship. The study ultimately provided insight into ways in which future engineers may best be equipped for their first jobs. A qualitative research study was employed, using four focus groups to collect data, which was analysed thematically. Key findings indicate the resolute importance that engineering students place on having a challenging job, teamwork, independence, opportunities for development, and a participative style of being managed. The research findings may be of value in order to renew an engineering curriculum with better alignment between students' expectations and industry needs.

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1. Introduction

The engineering sector offers stable, long-term jobs, dynamic work environments, and good salary conditions. In spite of such a favourable context, graduate students are, however, not always adequately prepared to enter the workplace (Ramadi, Ramadi, and Nasr 2016; Llorens et al. 2013; Rodrigues 2001); and their conceptions may not correspond to the offers of real professional practices. Research has also illustrated the importance of analysing engineering students' perceptions of their future careers (Dias 2011; Gokuladas 2010; Specking, Kirkwood, and Yang 2015; Kinnunen et al. 2016; Jones et al. 2010; Ngambeki, Dalrymple, and Evangelou 2009). As argued by Baytiyeh and Naja (2011), much care should be taken in deciding on a job that leads to sustainable professional and personal growth and financial well-being. It is thus essential to gain insight into the way in which students view their future workplace, and how they expect to enter their first job, in order better to prepare them for effective and efficient operations within organisations. To anticipate increased job satisfaction, it is therefore crucial to identify student expectations of and preferences for their first jobs, so as better to align career preparation courses in the formal engineering curricula therewith. Innovative engineering education ensures that graduates are adequately prepared and are able to contribute to the practice, responding to dynamic contexts (Finkel 2013).

This research was conducted at a 'Grande Ecole' or graduate school in France. The French engineering system may be considered intricate from an outside perspective (Paul and Murdoch 2000). The

CONTACT Cecile N. Gerwel Proches gerwel@ukzn.ac.za
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system has, however, been commended (Béraud 2000; Florman 1997). It typically takes five years to complete the engineering diploma, which is at the Master's level. To enter 'Grandes Ecoles', students have to complete preparatory classes which take two to three years and are considered very demanding (Béraud 2000; Didier 1999; Paul and Murdoch 2000). Students then enter the highly selective 'Grandes Ecoles', for three years, internship included. However, French engineering students may, in most cases, be considered emerging adults (Arnett 2000). This may include having to deal with issues of identity, becoming responsible, making decisions, and finding a place in the working world in line with one's own attributes (Arnett 2000). Caldas Nicácio et al. (2016) refer to Dubar's work (1998), which focuses on how intertwined are professional identity with professional training.

The French accreditation body (French Commission des Titres d'Ingénieur (CTI) (cited in Centrale Marseille n.d.) outlines the following when delineating the job of an engineer:

> The basic role of the engineer is to resolve often very complex technological and concrete problems in the conceptualization, realisation and operation of products, systems and services. This ability is based on a body of technical knowledge, on the one hand, and awareness of economic, social and human issues, on the other, together with a solid training in engineering science.

From the perspective of engineering education, it is important that teaching and learning activities be offered in the engineering curriculum, to address industry expectations, as well as for the purpose of quality enhancement (Finkel 2013; Lemaître et al. 2006). The aim of this research was to gain insight into the views of engineering students at a graduate engineering school (so-called Grande Ecole in France) prior to their first industry experience (compulsory internship in French accredited programmes). This corresponding research, held in 2016, was also conducted to inform the career-counselling course manager to enable the institution to gain more objective insight into the professional and personal needs of their students. This was considered essential in order, ultimately, to develop more cutting-edge, relevant, integrated, and improved programme courses.

In line with the significance of 'engaging future engineers', this study was motivated in part by the need to examine concerns of authors such as Adams et al. (2011, 49) in addressing: 'issues of who becomes an engineer, what it means to be an engineer, and how to design an engineering education to prepare aspiring future professionals'. This study was, furthermore, undertaken to address a very real concern of authors, such as Florman (1997), who emphasised that, even with the best of curricula, students may not appreciate such a curriculum. Thus, academics, and possibly even industry, may be under the impression that there is a solid and impressive curriculum relied on for training future engineers. However, this may not be perceived as such by those on the receiving end. Such an outcome becomes more pertinent when one considers the impact of sending out well-prepared graduates into the workplace.

'Grandes Ecoles' have a significant relationship with industry through internships, but there may be a gap between the expectations of industry and the perceptions that students hold of their first job. There could be negative consequences for job performance, satisfaction, and motivation levels, if students are not adequately prepared for their first job, hold unreasonable expectations, or have a mismatch in terms of skills and competencies. The study therefore sought, ultimately, to address the following question: How can the 'Grande Ecole' under study best equip its future engineers for their first jobs pathway? This is significant, particularly in light of the CTI vision of preparing engineering graduates to adapt to the working world, to make a contribution, and, fundamentally, to assume responsibility for their development and professional choices. For such, the goals of the research were to (G1) determine the perceptions that students have of engineers; (G2) identify the motivating factors that contribute to the selection of the first job; (G3) determine the challenges that students anticipate in their first job; and (G4) assess whether the curriculum sufficiently prepares engineering students for their future careers.

The following section presents a review, from an educational perspective, of the literature pertaining to the engineering profession. The methodological approach that was followed in the study is then outlined, with details being provided about the study context, data collection and analysis.

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The results are then presented, followed by a discussion thereof, which links the results with previous research. The study concludes by summarising key findings, proposing suggestions for revising the curricula or career courses, and providing suggestions for future research and transferability of the method for use in other institutional contexts.

2. Purpose of study: understanding the engineering profession and identifying requisite skills

In a similar fashion to the ABET 'a to k' student outcomes defined in the US, or to the European learning areas for Master's degree programmes defined by the ENAEE, the CTI defines, in its 2016 version, 14 programme outcomes (aka graduate attributes) which describe the knowledge, understanding, skills, and abilities which an accredited engineering degree programme must enable a graduate to demonstrate:

- to integrate into professional life, to fit into an organisation, to breathe life into the organisation, and make it evolve (litt. 'la capacité à s'insérer dans la vie professionnelle, à s'intégrer dans une organisation, à l'animer et à la faire évoluer') (criterion number 11) and
- the ability to know oneself, to self-assess, to manage one's own competencies (particularly in the perspective of lifelong learning), and to operate one's own professional choices (litt. 'la capacité à se connaitre, à s'autoévaluer, à gérer ses compétences (notamment dans une perspective de formation tout au long de la vie), à opérer ses choix professionnels') (criterion number 14).

These outcomes are directly linked to the French generic profile of an engineer, as defined by the CTI (2016):

> Engineers must have a broad view of their field, be both operational and capable of remaining so. They must be able to change specialties and cultural and technical environments, and to evolve in company hierarchy or in another firm, being conscious of their personal equilibrium and of the well-being of society.

Technical expertise is considered critical in the French engineering profession; and this is linked to the creation of new products, project management, and technology (Didier 1999; Wang and Verzat 2011). Lower-level technicians primarily focus on implementation in line with procedures and guiding principles. There is thus a difference between technicians and engineers (Didier 1999). Engineering in France, according to Lemaître (2017), is quite different from other European countries. Engineering schools have smaller student numbers, focus on the practical, and are quite unlike typical universities (Lemaître 2017), therefore seen as unique. These students typically have a good command of the basic sciences, but are also expected to be industrial managers, and able to grasp social and humanistic issues in engineering (Lemaître 2017; Béraud 2000). Graduates are generally categorised as those who will work as technical engineers and those who are perceived to be global engineers. The latter have had international exposure, can work in intercultural contexts, have a fairly good command of English, and usually enter large corporate companies, often at managerial level (Lemaître 2017). This relates to the strict hierarchy as found in France, which is detected in the distinction between the cadre and non-cadres, and consequently, technician and engineer (Béraud 2000). It has thus been highlighted that French graduate engineers from 'Grandes Ecoles' often proceed to managerial jobs (Lemaître 2017; Béraud 2000; Wang and Verzat 2011). French engineering education is recognised for its humanistic approach, with a wide education base, including a focus on social dimensions and personal development (Lemaître 2003; Béraud 2000).

An engineering career in France is influenced by age, as well as the institution at which the individual studied (Leyva and Apalaches 2002). This is supported by Béraud (2000, 371), who stated that 'an engineering diploma of a "Grande Ecole" is directly linked to high social prestige'. Didier (1999, 474) emphasises that, when referring to an engineer in France, reference is made to both 'a job and a title'. Engineers are highly respected in France and come with great social standing (Didier 1999; Lemaître 2017; Béraud 2000). Didier (1999) also emphasises the importance that is placed on

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the institution at which the engineer graduated. Previous research has elaborated on the importance of the French graduate schools which have contributed to the prestige of the profession, but also continue to produce an elitist system (Lemaître 2017; Kloot and Rouvrais 2017; Rouvrais et al. 2006; Lundgreen 1990; Béraud 2000; Paul and Murdoch 2000).

Employers are aware of the prestige that is held by the various top French engineering schools, and salaries are often positioned accordingly (Béraud 2000). On professional acceptance, young graduates very quickly and easily are integrated into the working world, both in France and abroad. More specifically, in France, IESF surveys (IESF 2016a) recall the diversity of engineering professional paths, and the transformation amplifications around entrepreneurship and counselling. The balance between work and personal life is increasingly being included in self-realisation; and the use of communication technologies in the working activities contributes to this situation.

2.1. Factors affecting career choices of engineering students

Wnek and Williamson (2010) emphasised the importance of comprehending the requirements of students in undergraduate engineering education, with the aim of moulding students, who will then be able to have meaningful careers in a competitive world. It can, however, be challenging to choose a career (Dias 2011). Furthermore, engineering students may not have a clear idea of the working world, or of what their careers will entail (Rouvrais and Chelin 2010; Berglund and Heintz 2014; IESF 2016b). It is critical to gain insight into the perceptions of engineering students so that engineering schools impart correct knowledge to both industry and students (Specking, Kirkwood, and Yang 2015; Jones et al. 2010). Similarly, the research of Kinnunen et al. (2016) in computer science education also stressed the importance of examining the career expectations of students in order better to equip them.

There are a variety of factors that impact the career choices of students. The work of Woolnough et al. (1997, 118) accentuated motivating factors already at school level, which included a scientific home background, ability, personality, and 'messages that the student receives about the status, salary and job satisfaction that society accords to careers in science and engineering'. Dias (2011, 374), in her research on Portuguese engineering students' reasons and motivations for considering engineering career choices, found that there were internal influences such as 'social status, intelligence, gender, competences, values and interests'. There were also external influences that played a role in career aspirations; these included peer groups and social identity (Dias 2011). Identity and professional meaning develop as students transform from learner to engineering practitioner, and in so doing become responsible for their future (Rouvrais and Chelin 2010).

It is important that the curriculum be aligned with the requirements of industry (Jian et al. 2010; Alpay 2013; Hartmann and Jahren 2015; Llorens et al. 2013). Industry expectations of engineers, for instance, point to a focus on skills such as time management, communication, and accountability (Ramadi, Ramadi, and Nasr 2016). As noted by Stiwne and Jungert (2010), improving the chances of students' finding work is one of the aims of the Bologna process in higher education in Europe. Baytiyeh and Naja (2011) argued that engineering graduates, in facing college-to-work transition, were expected to be responsible, to handle pressure, to engage with their superiors, and to connect with diverse persons.

The following section describes the underpinnings of the qualitative research study conducted in 2016 to impact an engineering curriculum and its teaching and learning activities around career decision-making in a French 'Grande Ecole'.

3. Methodology

3.1. Research paradigm

The study followed the interpretivist approach, which often entails the inductive approach through the use of methods such as focus groups and interviews to explore multiple realities, subjective

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experiences, meanings, and in-depth understandings (Du Plooy-Cilliers, Davis, and Bezuidenhout 2014; Fox, Martin, and Green 2007; Vivar et al. 2007; Iqbal 2007; Creswell 2009). The emphasis in qualitative research shifts to words, rather than statistics, as it is challenging to 'measure and quantify these experiences and meanings' (Fox, Martin, and Green 2007; Du Plooy-Cilliers, Davis, and Bezuidenhout 2014, 173).

Qualitative research is aligned with the constructivist perspective which acknowledges that knowledge is socially constructed and that people hold multiple realities (Golafshani 2003; Bowen 2008). As Fossey et al. (2002) emphasise, qualitative research is not concerned with employing statistics or engaging in quantitative analysis, but rather is concerned with how and why people interact and behave the way that they do.

3.2. Institutional context

The research was conducted in the natural setting of participants. This, according to Creswell (2009), is typical of qualitative research, in which researchers gather information at which the issues or problems are being experienced. IMT Atlantique is a public, higher-educational institution, under the aegis of the French Ministry for Industry. In 2016, two engineering degrees were on offer at Brest campus:

- a medium-sized, full-time generalist programme (FIG), with approximately 650 students over the three years of the curriculum, which imparts a wide spectrum of knowledge, skills, and competences. The selection of most students is based on a highly selective two-year preparatory class pre-admission system with a national-level competitive examination. Graduates from this programme often move into respected expert or managerial positions in national or international companies or in the national hierarchy of the French civil service. In this programme, a career orientation course of 63 hours has, since 2003, been included in the three-year curriculum (Rouvrais and Chelin 2010);
- a small-sized specialised apprenticeship programme (FIP), with approximately 120 students. With less French traditional prestige, Master's level graduates from this programme often move into technical-expert positions in IT companies in the national arena.

The Master of Engineering ('Diplôme d'Ingénieur') from IMT Atlantique allows the students to best express their skills and talents and to develop competences in line with their professional projects. The two programmes are accredited by the French CTI. The programmes are also awarded the EUR-ACE label by the European Network of Accreditation of Engineering Education.

3.3. Data collection

Non-probability sampling is often used in qualitative research and is determined by the judgment of the researcher. The study drew on purposive sampling which involves intentional selection of 'the elements that we wish to include in our sample' (Du Plooy-Cilliers, Davis, and Bezuidenhout 2014, 142), in order to assist in comprehending the research problem and question (Creswell 2009), and thus in answering the four aforementioned goals of this study. Qualitative research generally involves a smaller sample size, the aim being to collect rich data (Vivar et al. 2007), the emphasis not on representativeness (Caldwell, Henshaw, and Taylor 2005).

Focus groups were employed. These focus groups were led by a researcher who was not from the institution, and who facilitated the interaction by drawing on predetermined, open questions, and themes, allowing participants to express their opinions and views (Du Plooy-Cilliers, Davis, and Bezuidenhout 2014; Creswell 2009). Focus groups may be advantageous in generating debates and in facilitating learning, allowing for participants to engage one another on matters, and to stimulate sincere discussions (Du Plooy-Cilliers, Davis, and Bezuidenhout 2014; Ehigie and Ehigie 2005). Focus groups

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also bring to light multiple perspectives that may exist on a given topic, enabling the researcher to gain clarity on certain aspects (Du Plooy-Cilliers, Davis, and Bezuidenhout 2014; Vivar et al. 2007). The benefits of focus groups as a way of collecting qualitative data, relate to the time taken to collect data, interaction between participants, emerging conversations, and also to giving the researcher insight into both verbal and non-verbal communication (Dilshad and Latif 2013; Smithson 2000). There are, however, limitations which have been noted by previous researchers (Dilshad and Latif 2013; Smithson 2000) such as having some respondents more vocal than others, and certain participants who might simply agree with the rest. The research objectives were not thought to create any difficulties for respondents to discuss as a group, therefore focus groups were selected to draw on the interaction that would occur (Morgan 1996).

As highlighted by Du Plooy-Cilliers, Davis, and Bezuidenhout (2014), researchers should contemplate the number of sessions to conduct. Three to four focus groups could be considered sufficient to deal with the research question and problem (Du Plooy-Cilliers, Davis, and Bezuidenhout 2014). For this study, four focus groups were thus held between 15 and 30 September 2016. All FIG and FIP participants were second-year students (2A, thus already at Bachelor level), who were requested to share their perceptions ahead of the compulsory internship in French engineering education for FIG participants. Participants were invited by email to participate in the study on a voluntary basis. The overall FIG 2A class in 2016 was composed of 175 students (36 being female), whereas the FIP2A comprised 45 students (10 being female, inducing a smaller focus group for homogeneity of the study). The focus group sessions lasted, on average, 45 minutes to an hour, and were mainly conducted in English.

Students were first informed of the purpose of the study and requested to complete an informed consent form which outlined the purpose of the study. Participants had to confirm that they were volunteering to participate in the study, that their names would be kept confidential, and that they could withdraw from the study at any time, should they so wish. As suggested by Du Plooy-Cilliers, Davis, and Bezuidenhout (2014) and Vivar et al. (2007), participants were reassured on matters of confidentiality and ethics, and their names were not used in writing up findings. The researcher tried to establish rapport with the participants, attempting to remain neutral, owing to her non-institutional position. The focus groups were aimed at stimulating discussions and open conversations (Salkind 2012). The researcher also made an effort to encourage reserved participants to speak, and to ensure that certain participants did not dominate discussions (Salkind 2012). Participants were also informed that there were no right or wrong responses to the questions that were posed to them (Ehigie and Ehigie 2005). Participants agreed to the researcher's use of a digital recorder to record the dialogue. Notes were also taken during the focus group sessions.

As focus groups are considered a form of interviewing (Vivar et al. 2007), open-ended questions were used to allow for participants to outline their views. Focus groups are valuable in that they are a fairly flexible technique (Barbour 2005). The researcher often encouraged participants to elaborate, where necessary (Du Plooy-Cilliers, Davis, and Bezuidenhout 2014). Probing was also employed. The focus groups centred on the following questions and themes as outlined in Figure 1.

Table 1 outlines the details of the respondents who participated in the four focus group sessions, a total of 22 participants who were involved in the study. Most participants were male, which is in line with the engineering field and the student gender balance at IMT Atlantique. Non-French students also participated (approx. 40% at IMT Atlantique engineering studies). Students were, on average, 22 years of age. Three of the focus groups were conducted with the generalist FIG2A cohort. The focus group 3 cohort was conducted with FIP students. Data saturation was reached when it became evident that nothing new was observed (Bowen 2008).

3.4. Data analysis

As recommended by Anderson (cited in Dilshad and Latif 2013), this research was written up by presenting the analysis of the focus group data through summarising the participants' views and

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- What is your definition of an engineer?
  - What are your perceptions of the role of an Engineer?
  - Will it be easy to change or do a different job, considering that you are an Engineer?
  - Do you have an idea about your first job?
- What are the reasons / why?
- What do you not want in your first job?
- What do you want / expect from your first job?
  - Name one thing that it is important for your first job?
  - When you choose your first job, what will the first criteria be?
  - What values do you consider important in your first job?
  - Is it important that the company values are aligned with your personal values?
  - In your opinion, what would your motivation be for wanting to stay in a company or leave?
  - How do you see your professional career evolving / changing over time?
  - Until now, you may not have actively made decisions about your life.
- Is it difficult for you to make decisions?
- Do you need coaching or assistance to help you decide?
  - Is it necessary for the School to help you to prepare for your first job? Please elaborate.
  - What are the main difficulties that you currently experience?
  - Would you like to add anything?

Figure 1. Interview schedule for focus groups.

including actual quotations. The focus groups were also conducted by ensuring consistency with the study objectives (Dilshad and Latif 2013). It is important to note that the findings offered as themes, which emerged from the analysis of the focus group data, present an interpretation of the opinions and experiences that were expressed (Smithson 2000).

Data analysis was primarily conducted by searching for themes and patterns, and was essentially iterative in nature, while being focused on data reduction and interpretation (Du Plooy-Cilliers, Davis, and Bezuidenhout 2014; Iqbal 2007; Henning, van Rensburg, and Smit 2004). As reflected by Ryan and Bernard (2003, 103), themes arose through a combination of inductive data analysis as well as consideration of theory and mostly involved looking for 'repetitions, similarities and differences, and transitions'. Qualitative research presents narratives and does not focus on presenting frequencies (Henning, van Rensburg, and Smit 2004). In line with the inductive approach, findings arose as themes were identified through detailed data analysis (Iqbal 2007).

The analytical process unfolded as described by Thorne (2000, 69), who makes reference to constant comparative analysis, whereby researchers essentially compare various interviews and accounts in order to 'generate knowledge about common patterns and themes within human experience'. It is suggested that quotations from respondents be included to lend support to findings (Noble and Smith 2015; Vicsek 2010).

To ensure credibility and trustworthiness of the data, as suggested by Bowen (2008), emphasis was placed on describing the experiences and in-depth opinions of participants, using rich descriptions, as opposed to ensuring objective measurement (Fossey et al. 2002). The researchers also worked together as a team to give thought to themes that arose during the process of analysis, thus ensuring

Table 1. Details of focus group participants.

		Gender		Nationality	
	No. of participants	Males	Females	French	Other
Focus group 1 (15 September 2016)	8	5	3	7	1 = non-EU foreign
Focus group 2 (22 September 2016)	4	3	1	0	4 = non-EU foreign
Focus group 3 (22 September 2016)	5	2	3	3	1 = non-EU foreign 1 = EU foreign
Focus group 4 (29 September 2016)	4	3	1	4	0
TOTAL	21 (17 FIG, 4 FIP)	13	8	14	7

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credibility (Noble and Smith 2015; Shenton 2004; Rajedran 2001). The research is also strengthened when the researchers provide a rich description of the study context (Shenton 2004), which has been reflected in the paper. The themes are presented in the following section.

4. Results

4.1. Skills and attributes of an engineer

Participants highlighted that an engineer must be able to learn new things and be in a position to discover solutions to help solve problems. Engineers should also be adaptive and creative, being able to draw on their imagination in understanding how things work. This was important in bringing about new insights into a job, and being able to stay up to date with new developments in their field. The capacity to learn quickly was considered important, as well as having the ability to envisage the future. Engineers were, furthermore, described as entrepreneurs, managers, leaders, technical specialists, a link between science and technology, and as those who made the world different. For example, the following student quotes show alignments with the CTI vision of the French engineer:

> An engineer must have a large pallet of skills (FG1).
> An engineer is someone who needs to adapt himself to problems.
> He has to solve problems … (FG3)
> I think an engineer should be flexible and have that ability to work
> in different situations and different companies … (FG2)

First-job options that were mentioned by respondents included project management, research and development, quantitative finance, signal processing, IT programming, and employment requiring strategy, consulting, security, networks, defence, or working for the army, being part of a start-up developing new projects, the technical field, audiovisual work, or work as a research engineer, in pure research, management, launching something, and being a generalist by creating and selling a product. Some indicated that they had a better idea of what they did not want to do, which was often described as technical. For example, the following student quotes show alignment with the generalist approach of engineering education in French 'Grandes Ecoles':

> I don't know what I'm going to do but I know what I'm not going to do …
> not a technical engineer. (FG1)
> In my first job, I would like to have fun. (FG4)
> I don't want to spend my life in front of a computer, I want to have social contact,
> I want to meet people. (FG3)
> I think sometimes the engineer like to be a manager … (FG1)

Some students pointed to the changing nature of jobs, while others preferred stability:

> I like the job where I can change. I don't like to do the same thing all the time. (FG1)
> … for me I don't want to change every five years, when I find the way I like …
> I'd like to continue this way … to be better and better … (FG1)

Certain students stated that it was important to gain experience before choosing a career path, while others expressed that there may not be opportunities to do so. It was argued that engineers could easily change employer. The importance of starting in the technical line to gain different skills was articulated but so was being able to manage various projects. The personality aspects of being in engineering also came to the fore. Some students argued that contact with people was essential, and that being a good listener and being open-minded were critical aspects. The role of ethics in a job was also prominently reflected – it was mentioned that it is important to believe in a product. Participants also alluded to self-mastery, it being essential to drive one's own development by being proactive in understanding one's competencies.

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Participants also emphasised the misconceptions that people tend to have about the job of an engineer. These included thinking that engineers are 'nerds', who perform complicated tasks, are mystical, play on computers, or are able to fix anything. There appeared to be frustration that people were not really able to visualise the work of an engineer:

> People exaggerate it a bit … like an engineer is a Mr Fix-it! (FG2)
> We are just nerds in the face of society … (FG3)

4.2. Motivating factors for the first job

It was interesting to note that most respondents did not place particular emphasis on money and location as critical factors in deciding on the first job. It was argued that students did not have much influence in determining their first salary, as salaries were often standardised, and linked to the universities that they attended. This was probably similar for location, which may not be easy to achieve in a first job. Others considered a balanced life more desirable than a large wage, while some differed from that view.

The majority of participants conveyed that it was important to have a job in a dynamic environment that afforded them opportunities for variety, and which was free from monotonous tasks, presenting them with learning opportunities. There was a strong desire to be in a job that allowed for a great degree of flexibility. The importance of having a good and inspiring project was accentuated by many respondents:

> Something challenging to help utilise what we learnt here … (FG2)
> A job that would allow me to improve myself everyday …
> and the possibility to make choices … (FG4)
> Pleasure … The job must be enjoying for us. It is quite important. (FG1)

Being able to work in a team was an aspect that seemed to resound across all the focus groups. Respondents articulated that it was critical for them to work with talented people from whom they could learn, and who could provide them with new insights. Some commented that a bad or uninteresting team could be a reason for leaving an organisation. Integral to good teamwork was the desire for good integration and communication between team members, the manager, and the client.

Participants stressed the importance of being able to be exposed to diverse people in their jobs in order to gain wider perspectives; however, this also depended on available opportunities. Many were comfortable with the idea of working abroad for a few years. These students argued that it was imperative to learn about different techniques and methods which could be brought back home. It was also conjectured that they would need to learn more English were they to live abroad. Others, while expressing the desire to be based abroad, did mention that it could be difficult to achieve this in a first job. The opportunity that the curriculum presented for students to spend a semester abroad was viewed positively. A stable environment and consistency appeared to be essential for other participants.

Participants alluded to the need for a management style that was more participative and encouraging of their growth, and which made them wish to achieve. Some argued that they hoped for a good manager who would serve as a mentor. Mention was also made of the desire not to have a manager or leader, but rather, for all employees to be on the same level:

> I prefer to work in a team where there is a not a leader … not giving instruction … (FG2)

The role of values in the workplace was highlighted. Some participants argued that it was less important in a first job that there be alignment between personal and company values, while others considered it important to adapt. Some indicated that it was not important, as they were not going to be in the same job for the rest of their working lives, while others argued that they were not really interested in company values. Mutual respect was considered important for some, while others

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commented that personal values actually do not matter when one belongs to a company. Ethics emerged prominently, with some students maintaining that they did not wish to be in an unethical and political environment, nor in a company that only cared about profit and not people, nor in one which was dishonest or unscrupulous.

Managing professional and personal aspects in terms of family life was mentioned. Others responded that the decision of work and location would possibly be based on family (present and future). Immediate family was important for some female participants, in that each decision made had to be based on its effect on the family. Others, however, remarked that their families would wish them to do whatever pleased them:

> In our 20s we are free to go wherever we want to … but later on when we think about having a family, that will be the point where the difficulties show up … (FG3)

4.3. Potential challenges in the first job

Being able to adapt to work was reported as a possible challenge. Mention was made of the potential challenge of being the new blood, as it was perceived that experience in the workplace is greatly valued. The leadership style of the direct line manager could also present as a challenge:

> Some bosses can go hard with their employees …
> often the superior bosses are acting really … with some employees … (FG4)

Potential discrimination in the workplace as a result of culture, religion, or country of origin was addressed as a possible difficulty for certain participants. Mention was made of clients who could potentially be troublesome, and who could change their minds. The fit with colleagues and work environment was also considered significant by some participants, as well as having work-life balance and enjoying work. A potential hurdle for some wishing to work abroad was not being able to speak a foreign language, or working in another country, which many appeared to take as a given.

> It's scary … in another country we don't know … (FG3)

4.4. Role of the curriculum in preparing engineering students for their future career

Participants suggested that the institution bring in previous students and promote networking especially in respect of former students:

> A previous student who is already working …
> just to give some advice, to be in contact regularly … (FG1)

It was also reflected that exposure to various persons such as teachers, researchers, administrators, and former students, could assist in career planning. Access to the names and details of former students could be valuable:

> People who can give us real advice because they did exactly the same thing
> and had the same questions. (FG1)

A suggestion was made that a conference be held at the institution which could involve actual engineers from various fields in companies who could expose students to real-world engineering, articulating what it is like to work in a team; and how companies actually operate, so as to address any illusions or fears that students had about the working world. The project that students had to conduct was considered critical in preparing students for the workplace. The diverse nature of the curriculum was appreciated as it exposed students to many options. Some students were concerned about personality fit with the job, suggesting that personality tests could assist in this respect.

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Some students argued that the transition from preparatory school (preparatory classes for access to the 'Grandes Ecoles') to the institution was somewhat problematic, while others had not experienced any obstacles. Differences in responses to the questions may have been detected between students who were in the FIP vs. FIG degrees. Some responded that difficulties were greater with preparatory school, whereas other maintained that coming from university and not preparatory school initially presented challenges:

> In Preparatory you sit and there everything … come to you … (FG1)
> I did not feel this gap … if I want something, I just ask … (FG1)

Some students stated that present concerns centred on money, certain courses, making decisions, deciding on areas of specialisation, preparing for the semester abroad, and being placed in companies. Effective decision-making was also referred to, with some arguing that it was important to plan and reflect. Others reflected that it was difficult to make decisions, and that they often had to consult others for advice.

5. Discussion

The researcher who primarily conducted the focus groups is not based at the institution. Students could thus have felt more comfortable with an external researcher, as this ensured the neutrality both of the researcher and the participants. Some participants could, however, have felt guarded, and possibly unable to fully express themselves in front of their classmates. Nevertheless, the results that were presented are aligned with the four research goals. Results also show alignment with the generalist, humanist approach of engineering education in French 'Grandes Ecoles', and with the CTI vision of the French engineer, together with its core graduate attributes.

The main findings of the research denoted that engineering students place importance on being in a job that is challenging, dynamic, flexible, and which offers independence. The results also revealed the need for students wishing to work in a team. There was a desire in participants for opportunities for development in their first job and to not be over-managed. Participants outlined diverse understandings of their perception of the engineers, and multiple career paths were identified. The results highlighted the importance of having students exposed to industry and former students. Potential challenges were identified by participants. The results are now presented in detail according to the goals of the study; and previous research is drawn on for comparison.

The first goal (G1) of the study attempted to determine the perceptions that students have of engineers. Participants believed that an engineer was a problem-solver who exhibited creativity and flexibility, and who had to be able to learn quickly and stay abreast of new developments. Engineering graduates should be able to function effectively in multidisciplinary environments, often driven by project, teamwork, solving problems, being customer oriented, able to learn, proactive, able to make compromises, and possessing people skills (McInerney et al. 2006; Dias 2011; Finkel 2013; Llorens et al. 2013; Baytiyeh and Naja 2011; Hartmann and Jahren 2015; Nguyen 1998). Gourvès-Hayward and Morace (2011) highlighted international, national, regional and disciplinary differences between students' representations of the realities behind the career of engineer, in terms of education and training, function, experience, or social status.

The findings pointed to various options which engineering students considered upon completion of their education. This corresponds with the view of Finkel (2013), that engineering offers multiple professional paths. These were mainly centred on entrepreneurial and management or leadership careers, while the technical route was largely considered undesirable. This finding is similar to the research of Kinnunen et al. (2016, 15), who observed that 'while many students expect to study, and are mostly interested in, technical aspects of CS, they also at the same time expect/wish to be working in their own company and/or as managers'.

The ability to move between jobs was considered appealing as was found in the research of McInerney et al. (2006). Essential skills emerged, such as communication, listening, and being adaptable.

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Engineers must be able to work in dynamic environments which demand more than technical competence; they are expected to be skilled in communication, problem-solving, and management abilities (Nguyen 1998). It is important that engineers be creative and flexible, that they show leadership, take responsibility, are accountable, respectful, empathetic, principled, and able to lead from wherever they are (Wnek and Williamson 2010; Llorens et al. 2013). The study pointed to certain misconceptions or stereotypes, such as being a 'nerd' that were often attributed to holding a career in engineering.

The second goal (G2) of the study was aimed at identifying motivating factors that contribute to the way in which engineering students select their first job. The results highlighted that participants were especially drawn to a challenging environment, along with its flexibility, and in which they would be developed. These descriptions reflect the nature of Generation Y, which is the category into which students in this sample would fall. The study findings also correspond with the research of Cavas et al. (2011) that averred that independence is an important factor for engineering students. Kinnunen et al. (2016) also found that computer science students, in their research, desired challenging jobs. Salary and the location of the job were rarely reported as significant factors in deciding on employment.

The desire to work in a team came through very strongly. This corresponds with similar findings in previous research regarding the importance of teamwork in the engineering profession (Ngambeki, Dalrymple, and Evangelou 2009; Baytiyeh and Naja 2011). Participants were also comfortable with the idea of working with diverse people; they understood the need for engineers to communicate effectively.

The results revealed that students felt very strongly about having managers lead them in a participative style as opposed to an authoritarian and directive style. Some in this research considered a shared leadership style on a team to be the best approach to being managed or even a more hands-off approach. While participants in this study were largely prepared to assume leadership roles, it is, however, important to note, as asserted by Hartmann and Jahren (2015), that consideration be given to precisely the industry expectations regarding the leadership roles that entry-level engineers will play.

Varying views were expressed apropos of the role of values in the workplace, with some students responding that personal values were not important; that it was important to be adaptable, whereas others indicated that they would leave a company if there were misalignment. The notion of work-life balance was accentuated: this appeared to be a factor that could be essential later on in their careers.

The third goal (G3) of the research examined the potential difficulties that students may anticipate in their first job. The results revealed that possible stereotypes regarding the engineering profession prove challenging. The following could be considered major potential challenges, based on descriptions of students relating to the ideal work environment: lack of a challenging job or project, having an authoritarian manager, routine, not being developed professionally, working in isolation, and personality-job mismatch. Baytiyeh and Naja (2011) advanced that engineers have to be self-confident, responsible, self-learners, and able to cope in a challenging, competitive environment. Other less significant challenges relate to the role that immediate family and future family could play in the career. Other challenges, for some, related to having to adapt to a foreign country, or having to learn a foreign language.

Differences in individual, personal, make-up (which could possibly be linked to a distinction between FIP vs. FIG) that may serve as potential barriers in the workplace, were observed. These included low levels of self-confidence, maturity, decision-making ability, and identity with the future career. Further hurdles could apply to being reactive, and being unaware of the roles, stereotypes, and illusions concerning future work. Dias (2011) found that factors such as social status, cultural background, self-esteem, values, and interests, were of relevance in career aspirations. The impact of attendance at preparatory school is one area that could also account for these differences. Students may also face stumbling blocks in the workplace if they lack prior work experience, which

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they could have obtained through volunteering, or exposure to the workplace through internships, projects, and the curriculum itself.

The final goal (G4) of the research was to assess whether the curriculum was preparing engineering students adequately for their future careers (details of the in-house 63-hours career orientation course may be found in Rouvrais and Chelin 2010). The data reflected the importance of the institution in linking students to industry through networking, internships, work placements, projects, and even the role that staff play in shaping the development of students. This corresponds with prior research which has attested to the importance of such methods as a way of preparing students for the workplace (Baytiyeh and Naja 2011; Blicblau, Nelson, and Dini 2016; Remaud et al. 2010; Finkel 2013). The curriculum was considered largely satisfactory, although some students reported a need for further networking and interaction with former students to better understand the engineering working world. Deciding on areas of specialisation and passing subjects, preparing for placement and work abroad, anxiety, and even financial well-being, appeared to be of short-term concern for some.

6. Conclusion

Engineering education should equip students with the necessary skills for entering the workplace, and the ability to know themselves, to self-assess, to manage their own competencies in the perspective of lifelong learning, to affirm their identities as professionals, so as to make their own professional choices in line with career opportunities. The research presented has highlighted the perceptions that engineering students at a French engineering school hold regarding their preferences for and expectations of their first jobs. The study indicated the perceptions that students have of engineers, identifying some motivating factors that may contribute to the selection of their first jobs, and the obstacles that they anticipate; and also reflected on whether the curriculum is sufficiently preparing engineering students for their future careers. This research has attempted to provide insight into ways in which future engineers may best be equipped for their first jobs, in order to better realise the French CTI vision of ensuring that engineering graduates are able to assimilate easily into their future organisations, making a meaningful contribution.

Key findings indicate the strategic importance that engineering students place on having a challenging job, teamwork, independence, opportunities for development, and a very participative management style. Thus, suggestions for revising the curriculum could include ensuring that students are prepared, both from a technical and managerial perspective, to enter the engineering profession; more fully understanding the various options available to them for decision-making in light of a career kaleidoscope. The likelihood of realising expressed ideals in the first job may be more objectively investigated when bringing in industry and former students as proposed in the actual curriculum courses on professional careers. Personal aspects such as self-confidence, values, decision-making abilities, stress related to subjects, career choices, and personal anxiety, along with key skills and attributes necessary for a successful engineer, may also be emphasised in career counselling. The influence of preparatory school on the confidence levels of students and future preparedness for the workplace may also be analysed and acted on accordingly. There is rich and recent French literature on the perceptions of the role of engineers, the expectations of engineering students on their careers, and their identity construction, both individually and collectively (Roquet, Cohen-Scali, and Obertelli 2017). Thus, links may be initiated with social sciences researchers of the French Ingenium[1] network (linked with the French UNESCO Chair 'Formation et Pratiques professionnelles'), to investigate, for example, temporal formative aspects and chrono-pedagogy in identity process construction.

In France, engineers express a high professional satisfaction, they know how to play an important role in the economic and social evolution of society; they make it their main motivation (IESF 2016a). The contextualised results of this research cannot be generalised to all French engineering students, nor to engineering students on the whole, as located in a French engineering professional context,

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owing to the use of a small sample size which was based on the qualitative research approach; and owing to the specific programme educational style of French 'Grandes Ecoles' (Lemaître 2017). Even so, the method could be transferable to other educational contexts; and findings may provide insights for programme leaders who are also analysing the same research goals.

Future research on the influence of identity and factors on first-job preference could rely on complementary discourse methods as proposed by Hatano-Chalvidan and Lemaître (2017), to analyse links between identities and professionalisation with a discursive ethos framework. A mixed-methods study comprising survey questionnaires and interviews may also be advantageous in this respect. This study identified differences that could possibly be observed between generalist and apprenticeship students. It called attention to the importance of self-confidence, as well as to work experience which students may have gained from an internship, or time spent in an organisational context, whether formal or not. It is therefore suggested that a survey be drawn up to determine the impact of these demographic details on career expectations, planning, and decisions. This study also alluded to a strong desire by students not to be 'managed' as such, and to engage in teamwork; while at the same time, many students appeared quite comfortable with the idea of being in managerial roles, rather than in purely technical roles in their future jobs. These aspects may be further probed in a quantitative, large-scale research study, which could also include the views of potential employers on these matters, linked with institutional culture as French 'Grandes Ecoles' may differ on this aspect.

Note

1. https://reseau-ingenium.fr/.

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Notes on contributors

Cecile N. Gerwel Proches is an academic in the Graduate School of Business and Leadership at the University of KwaZulu-Natal (UKZN) in Durban, South Africa. She is programme coordinator of the Postgraduate Diploma in Leadership and also lectures and supervises Master's dissertations and doctoral research projects. Her research, supervisory and consulting interests include leadership, change management, and organisational behaviour. She has presented at national and international conferences, and has published a number of papers in academic journals.

Siegfried Rouvrais is an Associate Professor in Software Engineering, Computer Science Department, at IMT Atlantique (formerly Télécom Bretagne), France. Dr Rouvrais is co-leading the French Transdisciplinary Research group in Engineering Education (TREE, http://recherche.telecom-bretagne.eu/tree). Author of various publications in Engineering Education, his current scholarly interests are in higher education quality enhancement and models and processes for curriculum design and transformation.

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Nathalie Chelin is responsible for the career preparation programme, student internships, and relationships with professionals and companies at IMT Atlantique (formerly Télécom Bretagne). Prior to this, she was Human Resources Manager at Thales Group (technology leader for the aerospace). She is specialised in human resources, more specifically in skills management, career mobility, and job cartography. She is qualified as a MBTI assessor. She can be reached at nathalie.chelin@telecom-bretagne.eu

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