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ABSTRACT

Student recruitment is an increasingly important topic and a major challenge for engineering schools all over Europe, which have difficulties in attracting and enrolling gifted students. On the contrary, French graduate engineering schools attract the most talented students of the nation. What are the forces at play? The aim of this paper is to investigate the decision-making processes behind the students' choice of engineering school. We carried out 18 semi-directive interviews with engineering students of three French graduate engineering schools and completed content analysis of our data. Based on the findings, we identified various individual, social, economic and institutional factors influencing the students' choice of engineering school. The findings indicate that the pre-university model (preparatory classes) has a key influence on engineering schools' recruitment process for attracting talented students.

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Engineering education; recruitment strategy; students' decision-making process; French engineering schools

Introduction

In spite of the labour market's constantly growing need for graduate engineers, as well as excellent graduate career opportunities and future job prospects, most universities in Europe face the major challenge of attracting and enrolling talented young students in engineering studies. On the one hand, there is a declining interest among young students for engaging in engineering (Becker 2010; Johnson and Jones 2006). On the other hand, with the globalisation of higher education, there is intense competition among universities to attract gifted students. In this situation, the understanding of the students' choice of their engineering school is essential to adopt an optimum student recruitment strategy.

In this challenging situation, French graduate engineering schools - called 'Grandes Ecoles d'Ingénieurs (GEI)' - have no difficulties in recruiting the brightest students of the country and they train 40% of the country's scientific students (Boudet and Saint-Luc 2014). The aim of our study is to explore the factors influencing the students' choices and understand how these talented students, who have a large choice of other Higher Education Institutions (HEIs), decide to enrol in graduate engineering school. Our research work is guided by the following research question:

- What are the factors governing the decision-making processes behind the students' choice of engineering school?

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Based on the successful results of French engineering schools in terms of recruitment, we would like to have a better understanding of the driving forces behind their student enrolment in order to provide useful, practical recommendations, to develop a more effective recruitment strategy for attracting talented students.

In the following sections, we give an overview of the literature on students' choice of universities. There then follows a presentation of the French GEIs to set the specific context of our study. Next, we present the applied methodology at the beginning of the empirical section. Finally, we present and discuss our findings and draw our conclusions.

A review of factors influencing the students' choice

Regarding the theoretical foundation of university choice models, an abundant body of literature applying three main approaches has been developed. The most well-known and frequently used models apply an *economic approach* based on the human capital theory (Becker 1962). From this perspective, students' choices are viewed as a long-term educational investment to increase their human capital (knowledge, skills, attitudes, and aptitudes) resulting in higher earning for individuals and increased productivity for organisations (Becker 2009). This approach focuses on monetary and non-monetary cost–benefit analyses without taking into consideration social and cultural influences. From a *sociological approach*, based on the status attainment theory (Blau and Duncan 1967), students' aspirations and decisions to enrol in a university are considered as a part of the status attainment process. According to this view drawing on Bourdieu's (1986) theory of capital forms, social capital (including social resources, real and potential networks) and cultural capital (involving style, manner, cultural knowledge and preferences, affinities, or habitus) might be integrated in university choice models through influences such as socioeconomic background (Baker and Brown 2007), family, friend and peer influences (Brooks 2003) or demographic characteristics (Shiner and Noden 2015; Cho et al. 2008). From a *psychological approach*, students' choices are influenced by psychological and psychosocial factors such as prior academic achievement, self-perception, perceived competencies, belief, aspiration, or motivation (Alpay et al. 2008).

Recent studies, combining the traditional economic approach with sociological and psychosocial approaches resulted in better conceptual models of students' university choice (Hemsley-Brown and Oplatka 2015). Although there are many studies focusing on undergraduate students' choice of university, only a few studies have been made on graduate students' choices, such as the comprehensive conceptual model proposed by Perna (2006, 117). Her university choice model is defined by four contextual layers: (1) the individual habitus, (2) the school and community context, (3) the higher education context and (4) the broader social, economic, and policy context by embracing four major stakeholders (students and their parents, K-12 institutions, higher education institutions and public policymakers). This combined model is particularly useful for a deeper understanding of graduate students' university choices in a comprehensive way by taking into consideration economic, social, psychosocial, and political factors influencing students' choices. Thus, we opted to use this model as a conceptual framework for the present study.

Most research about factors influencing university choice has been conducted in the United States (Obermeit 2012; Moogan and Baron 2003). In Europe the literature is much less consistent and, in many cases, limited to a national context (Briggs 2006; Obermeit 2012; Diamond et al. 2012; Tavares and Cardoso 2013) showing very different influences across countries (Kinzie et al. 2004). As far as we know, no previous research has investigated students' choices of their engineering schools specific to a French GEI context. What are the main characteristics of French GEIs? Why are talented students attracted to these engineering schools? Why are they so unique on the HEI market?

'Grandes Ecoles d'Ingénieurs' in France

More than two decades after the signature of the Bologna process, most European countries have transformed their HE into a 3 + 2 system with an undergraduate level (a three-year cycle leading

to a Bachelor's degree) and a graduate level (a two-year cycle awarded with a Master's degree). In some countries, this transformation has not taken place at all levels. In France and Germany, for example, there are still differences inherited from the past, such as the 'Fachhochschule' in Germany or 'Grandes Écoles d'Ingénieur' (GEIs) in France (Hedberg 2003). French GEIs follow a 2 + 3 system as they recruit undergraduate students having completed a two-year preparatory cycle after the Baccalauréat[1] and propose a three-year engineering cycle at graduate level. Consequently, French engineering students do not obtain the intermediate Bachelor degree[2], they are awarded the engineering degree ('Diplôme d'ingénieur') equivalent to a Master's degree.

French GEIs were founded after the Revolution to train a highly qualified engineering workforce to boost the progress of French society. Based on the principle of meritocracy with a highly competitive entrance exam which prevents favouritism, these elite institutions obtained privileged status with the strong support of the state (Zanten and Maxwell 2015). Their curricula focus not only on technical knowledge and skills, but also on the development of transversal competencies with a view to preparing their students for high status positions. From 1929, to meet the needs of private industry, private GEIs were developed. In response to the emergence of numerous GEIs and with a concern for harmonisation and regulation, the CTI – Commission des Titres d'Ingénieurs – was formed in 1934 (CDEFI 2018) as an independent accreditation body for French engineering schools. Today, there are 205 (126 public and 79 private) GEIs in France distributed throughout the country (according to the Official Journal of 1st September 2019). Unlike most European engineering schools with several thousands of students, these engineering schools have a small student body of between 300 and 4000 students per school. They also have privileged relations with local and national industrial organisations and adjust the technical specialisation of their engineering training to their specific needs (Kövesi and Kálmán 2020).

Traditionally, the GEI recruitment process only concerns students who have completed two years of Preparatory Classes for the Grandes Ecoles (CPGEs) after their Baccalauréat. These preparatory classes are viewed as elite HEIs and widely considered as offering high-quality scientific training for the most gifted students of the nation, providing high social status and opening doors to influential positions (Daverne and Massy 2012). They prepare students for the centralised entrance exams (called 'Concours') composed of written and oral exams. According to their engineering schools' preferences (Lefort and Bès 2019) and aspirations (Blanchard, Orange, and Pierrell 2017), students have to choose from five[3] major entrance exams.[4] Candidates are first ranked in each entrance exam according to the results of their written exams, conditioning their access to the oral exams. Then, a final national ranking is defined in each entrance exam according to the overall results (written and oral). Finally, students establish their own list of choices. As Lefort and Bès (2019) pointed out, this choice is often influenced by the GEI's classification provided by the SCEI (Service de Concours Ecoles d'Ingénieurs) based on the general ranking of students from the previous year. It is interesting to note that in each entrance exam, except for the X/ENS exam[5], we can find engineering schools with various positions in the general ranking.

More recently, GEIs have opened places for students from institutions other than preparatory schools provided that they have validated 2, 3 or 4 years after the Baccalauréat by good records and a convincing interview. Some schools have also created a system of 'Integrated Preparatory Classes', recruiting students directly after the Baccalauréat based on their high school records and motivation to join these specific engineering schools. If the students' academic results are satisfactory during the two years of preparation, they automatically obtain a place in the engineering school (See Table 1). As a consequence, one engineering student out of five is not from a preparatory class (Adangnikou and Paul 2004).

The French model of 'Grandes Ecoles' (GEs) does not only exist for engineering but also for other subjects: business and management, architecture, political science, journalism, art and design, defence and veterinary medicine (EMLV 2021). It is important to notice that the inscription fees of these GEs in other fields[6] are significantly higher compared to engineering schools.

Table 1. Main French higher education study programmes leading to 'Grandes Ecoles d'Ingénieurs'.

Bac level	High school + Baccalauréat (Bac)			
Admission (1)	Selection on records			Selection on records and interview
2 years	**CPGE = Preparatory Classes for 'Concours'**	**University (Faculty, IUT, University preparatory class)**	**BTS = Advanced technician's certificate**	**Integrated Preparatory Class (within an Engineering School)**
Admission (2)	Entrance exams	Selection on records and interview		Selection on records
3 years	**Grandes Ecoles d'Ingénieurs**			

Engineering students have an excellent employment rate for their first job: 65.2% of students found their first job even before graduation and 89.5% six months after graduation in 2019 (CGE 2020). They have a relatively high annual starting salary (€35,738), which is nearly double the minimum salary (€18,468). For Fontanini (2001), this is one of the major motivations of French engineering students. However, several authors (Aeberhardt and Henriquez 2005; Adangnikou and Paul 2004) highlighted that there is an important difference between GEIs - not only in the salary level but also in the career prospects for accessing prestigious positions. Even if newly graduated students have a wide range of international career choices, in 2019, only one GEI graduate student out of 7 chose to work abroad, and of those one in two chose Europe (CGE 2020).

Methodology

Most previous research is dominated by quantitative approaches proposing various models of university choice for a particular population (Hemsley-Brown and Oplatka 2015). However, as highlighted by Perna (2006), there is a growing tendency of using a qualitative approach to develop better theoretical understanding. In France, to our knowledge, no prior studies have investigated the question of the choice of engineering school. For this reason, we applied a qualitative research methodology to attain a deeper understanding of this question (Maxwell 2008) in the French context.

Study context

This study is based on empirical data consisting of semi-directive, in-depth interviews with 18 graduate engineering students in three French engineering schools situated in Paris, Grenoble, and Brest. These GEIs have several common characteristics (Cf.: Table 2) such as their public status, their three-year curriculum, generalist orientation and a small student body (around 1000 students).

Even if in France there are no tuition fees for studying at a University, compared to other European engineering schools, French GEIs have relatively low tuition fees (ranging from the highest, the Ecole Polytechnique with €5,500 /year to the least expensive institutions with €601 /year). Their students have an excellent scientific background with the results of their Baccalauréat averaging at around 17/20 or 85%. The proportion of female students is between 23-28% and international students represent 11-29% of the student body. There is also a remarkably high first employment rate and a low student-teacher ratio in these three engineering schools.

Sample selection

We selected interview participants on a voluntary basis from local groups of BEST (Board of European Students of Technologies), a large European student association network taking part in the project A-STEP 2030. We applied a non-probabilistic sampling method as a convenient time and cost-effective way to reach this specific student population (Blaikie and Priest 2019).

In our sample, all participating students were relatively young, between 21–25 years old (Cf.: Table 3) and were studying at least at Bachelor's level (with three students studying at Master's

Table 2. Engineering schools characteristics in 2020 (Sources: www.letudiant.fr, www.ensta-paris.fr, www.enste-bretagne.fr, www.grenoble-inp.fr).

	ENSTA Paris	ENSTA Bretagne	INP Grenoble**
Location (city)	Paris	Brest	Grenoble
Status	Public	Public	Public
Curriculum	3 years	3 years	3 years
Orientation	Generalist	Generalist	Generalist
Number of specialisation fields	11	9	27
'Concours' (entrance exams)	Mines-Ponts	Mines-Ponts	CCINP
Students' average Baccalauréat (High School Certificate) grade /20	17.67	16.68	16.13
N° of Students in cohort / year	219	214	1398
CPGE students	185 (84%)	173 (81%)	773 (55%)
Female students	27.40%	23.23%	24.74%
International students	28.61%	11.27%	15.52%
Student/teacher ratio	8.23	6.78	12.55
National scholarship holders	34.25%	24.50%	36.09%
Tuition fees	2650 €	2200 €	601 €
Average starting salary (gross)	42000 €*	39320 €	35291 €
Employment rate	97%*	92%	83%
Time to find the first job	NA	12 days*	25 days

*Data of 2019.

**INP Grenoble brings together six engineering schools: the figures in the table are averages weighted by the number of students in each school.

level). There were 7 female participants (39%) and 3 international students (17%) from three francophone countries.

With the exception of three of the students, they had followed the traditional route to enrol in their GEI, that is to say after preparatory classes (CPGE). All participants had a strong socioeconomic status having at least one graduate parent. Only one international student declared the need to work to finance his living costs.

Table 3. Overview of interview participants.

Interview participants' characteristics		Number of participants
Gender		
	Men	11
	Women	7
Age		
	21	9
	22	5
	23	2
	24	1
	25	1
Nationality		
	French	15
	Other	3
Degree		
	Bachelor	15
	Master	3
Admission		
	CPGE	15
	Other (University, BTS, IUT …)	3
Disciplines		
	Material Engineering	4
	Naval Engineering	3
	Automotive Engineering	3
	Electrical and IT Engineering	3
	Civil engineering (hydrography, renewable energies)	3
	Applied Sciences	1
	Industrial Engineering	1

Data collection

Our interviews followed a semi-structured interview guide (Cf.: Table 4) developed from prior literature consisting of open questions focusing on the participating students' individual habitus and school context (English and Umbach 2016; Perna 2006), decision-making process for choosing their engineering school (Perna 2006; Briggs 2006; Vrontis, Thrassou, and Melanthiou 2007), influences (Agrey and Lampadan 2014; Alpay et al. 2008; Brooks 2003) as well as their objectives and motivations (Alpay et al. 2008).

To test our interview guide design, following the suggestions of Chenail (2011), we carried out internal pilot tests by three different researchers of our research team to improve the quality of data collection. We discarded several redundant and ambiguous questions and simplified our interview guide using only questions giving an adequate range of answers.

According to the principles of ethical research, before starting the interviews, we asked all participants for their written consent to participate in our study as a volunteer without any incentive. They received written information about the purpose, expected duration and process of the study as well as our confidentiality guarantee, indicating their right to decline to participate and to withdraw from the study at any time if they so desired. The interviews lasted between 30 and 90 min depending on the participants' involvement. They were digitally recorded and fully transcribed with data anonymisation.

Data analyses

Data analysis was performed through the content analysis method by applying a two-stage coding process. In the first stage, three researchers, two junior and one senior, worked independently and carried out an initial coding of the corpus by describing a set of pre-defined codes based on the conceptual framework and interview scheme. In the second stage, researchers added complementary codes emerging from the textual data and discussed and revised the initial codes questioning differing understandings to reduce the interpretation bias and improve the interpretative validity (Franklin, Cody, and Ballan 2001). As a result, initial codes were converted into standardised codes and all textual data were coded as (1) individual, (2) social, (3) economic and (4) institutional factors. To ensure the trustworthiness of the study, researchers used the checklist compiled by Elo et al. (2014, 3) containing practical questions designed to help researchers verify and validate every detail throughout the data collection and analysis process.

Table 4. Interview guide.

Interview Guide
1. What is your background? What studies did you do before your engineering school?
2. How did you decide to study at an engineering school?
3. How did you collect information about engineering schools?
4. Why did you choose your engineering school?
5. Who influenced you in your choice of engineering school and how? Were you influenced:
• by your teachers?
• by your classmates, friends, or peers?
• by your family?
• by your associative activities?
• by academic counsellors?
• by former students?
• by the publicity (internet sites, forums, open days, …)?
6. Do you have engineers in your family?
7. How did you enrol in your engineering school?
8. What are your objectives and motivations during your engineering studies?
9. Why do you want to be an Engineer?

Findings and discussion

Individual factors

The primary findings relating to the students' individual or psychological factors are (1) academic achievement, (2) self-efficacy and passion for STEM subjects, (3) self-determination and (4) group influences.

With the exception of only one student, all the students interviewed had excellent *academic achievement* in secondary school. They were 'among the best students of my class' (S6) or 'the best student of my school' (S15). The vast majority of students interviewed had passed their Baccalauréat 'with the highest honour' (S17). Their excellent academic achievement enabled them to enrol in a preparatory school, as one of them put it: 'I got an excellent grade in my Baccalauréat and I had a solid record to enter a preparatory school' (S12).

The students interviewed all expressed a high level of *self-efficacy and passion* in STEM subjects: 'I got my baccalaureate with the highest honours … I got 19[/20] in maths, 20[/20] in physics, 19[/20] in biology' (S4) or 'I had great results, especially in physics and chemistry' (S9). Many students, beyond the school context, had a real passion for science -such as those who said: 'All science subjects … I love them … ' (S14) or 'it was an attraction to science that I had had since I was a kid' (S9). They showed a high level of scientific curiosity and a desire 'to always learn new theories, to see new things' (S12). Our findings, in line with the findings of several authors (Harris and Zhang 2019; Simonnin and Didier 2011; Alpay et al. 2008) indicate a particularly strong influence of the students' excellent academic achievement as well as good self-efficacy, and passion in STEM subjects on their choice to enrol in engineering school.

We noticed a very different level in the students' *self-determination*: low level for enrolling in preparatory classes and high level for engineering schools. As one of them pointed out, 'I did not necessarily know when I left secondary school what I wanted to do exactly, in what environment I wanted to work and what type of job' (S12). To enrol in a preparatory school was considered as an opportunity that 'opened a lot of doors for me and left me another two years to decide where I wanted to go' (S11). This low level of self-determination to enter preparatory school confirms the results of Simonnin and Didier's (2011) exploratory study. Conversely, at the end of the preparatory classes, students showed a high level of self-determination to pass the 'Concours' and enrol in an engineering school in accordance with the results of Daverne and Massy (2012). The driving force behind this high self-determination is explained on one hand, by their investment in the CPGE, on the other hand, by their motivation to work on inventions and make the world a better place - confirming the results of Alpay et al. (2008) concerning students' aspiration and motivation to invent new solutions and induce important changes. In a context where engineers play an increasingly important role in building a sustainable future, students are more motivated and inspired to study engineering by this new broader role of the engineer.

Another surprising finding was, on the one hand, the strong family (Cho et al. 2008) and teacher influence and on the other hand the relatively low influence of peers and advertising on the students' choice. The most important *group influence* on the students' choice was the influence of their families. All the students interviewed affirmed that they had been encouraged by their families to undertake engineering studies, with no exceptions. Many students therefore 'listened to mum and dad' (S3) or simply followed the example of their parents who were themselves engineers: 'I have always had engineering in mind because my dad is an engineer himself, so it helps, let's say, to know the job' (S18). We observed strong intergenerational transmission between students and their parents as noted by Falcon and Bataille (2018) and a strong influence of the socioeconomic background, especially family support, which played an important role in the information seeking process and their subsequent decision to choose an engineering school (Landrier and Nakhili 2010). In second position, we noted a huge influence of teachers despite the fact that teachers in preparatory schools do not typically have an engineering degree.[7] As one student stated, 'STEM

teachers, they push you to become an engineer […] if you are in engineering science classes in secondary school' (S7). Surprisingly, we noticed relatively weak peer, academic counsellor, and marketing action influence on the students' choice. In summary, social relations for French students, unlike American (Diamond et al. 2012), British (Shiner and Noden 2015; Alpay et al. 2008; Briggs 2006), Portuguese (Tavares and Cardoso 2013) and German (Obermeit 2012) students, have relatively little influence as to their decision.

Economic factors

The findings related to economic factors are future: (1) salary, (2) career opportunities, and (3) job security.

In accordance with the results of Fontanini (2001), *salary* was pointed out by the students interviewed as being one of the most important influential factors and explained by one of them as the simple reason that 'even if we say that money does not make you happy, it helps with a lot of things so it would be nice to have a good salary' (S3). Engineers who graduate from a GEI 'usually have a higher salary level' (S4). Consequently, if students choose to enrol in a GEI, it implies that they 'will obviously have an income that is high enough not to have problems in life' (S2). Surprisingly, none of the students interviewed mentioned the apparent differences in the starting salary level between the GEIs. However, in several European countries (such as Germany, Denmark and Switzerland), newly graduated engineers' entry-level salary in industry is not considered as an attractive or relatively high salary level (Becker 2010).

In addition to having a relatively well-paid job, students noticed that there are also numerous interesting *career opportunities* after graduation and good long-term career prospects. Students are confident of being able to find a stable job easily as 'there is also a good employment rate […], we do not have too much difficulty in finding a job that pays well enough' (S2).

There was a general agreement about the fact that engineering is 'a sector which will experience very little unemployment, which will have job security, good wages' (S3). This *job security* represents an important decisional factor and is viewed as a pledge of 'good security for the future' (S10). Regarding a recent quantitative study of the project A-STEP 2030 conducted in six European countries (Belgium, Denmark, Finland, France, Ireland and Sweden) examining engineering students' career motivations, in all countries except Belgium, the most important motivation was to have a good work-life balance. Having a secure and stable job comes second place at the European level but only sixth place in France which is contradictory to our findings (Lehtinen et al. 2020).

Only one of the students interviewed mentioned the costs related to enrolling in an engineering school. Interestingly, students emphasised only the monetary and non-monetary benefits, but not at all the costs involved in enrolling in engineering school – an attitude which is in total contradiction to the logic of the economic approach of human capital investment. However, it is in accordance with the results of Pigini and Staffolani (2016) confirming that the decision-making process of talented and higher ability students is based not on the cost but on the quality of institutions.

Social factors

The primary results associated with social factors are (1) prestige, (2) social status and impact, (3) social capital building, and (4) capacity building opportunities.

We noticed a relatively strong influence of the prestige and social recognition of the French engineering schools on the students' choice of enrolling in engineering school. For all students interviewed, it is undeniable that GEIs benefit from a certain *prestige* in the eyes of French society. As one of the students said: 'engineering studies are the hardest but recognised as the most prestigious' (S13). This idea of excellence and prestige is generally related to the GEI's strong image and reputation. Our findings confirm the work of Draelants (2010) concerning

the positive effect of French GEIs' strong institutional image and prestige on attracting talented students. However, there is a clear distinction between students who enrol in engineering school without passing via the 'Concours', and those who join after preparatory classes, as it is considered to be 'the royal road' (S2) to enrol in an engineering school. 'You are more likely to get to engineering school after preparatory classes and if that is what you want to do, you do preparatory classes, even if this is more demanding' (S8). As one pointed out, being an engineering student in a prestigious French GEI is viewed as 'one form of elitism' (S17) and 'in France, when we are talented, we go to an engineering school' (S6).

What motivates students to enrol in engineering school is also the high *social status and influence* associated with the job of engineer as 'these are people […] in prestigious positions' (S8). As stated in the interviews: 'I could change lots of things' (S5) and 'do a job where I feel useful' (S9). Students would like to 'use skills and competencies learned in engineering school to do what [they] want to improve the world' (S10): accomplish sustainable development goals 'to act to stop global warming, to find new solutions, save energy, new ways of producing it, things like that … ' (S15) to contribute to creating a better world.

Referring to Bourdieu (1989), we are led to highlight the importance of the social capital and capacity building opportunities offered by engineering schools. As one student pointed out, 'in engineering school, students are much more united, which is not the case in university because in the end, there are so many people that it is hard to keep everyone together' (S10). Small annual student cohorts, which are a general characteristic of French GEIs, allow good student cohesion. Moreover, numerous extra-curricular activities with 'various student associations and interesting events' (S2) on the school campus are viewed as excellent *social capital building* opportunities. We also noticed the importance of the schools' Alumni networks and the GEIs' traditionally close relationship with companies. The students interviewed underlined their expectations to 'meet people to have a chance to get the best opportunities regarding internships' (S14) and to 'diversify [their] contacts, perhaps to obtain some others among companies with which [they] will be working' (S10). They consider social capital building during their studies to be essential for their future professional career. As one of the students interviewed put it: 'I think that it is mainly through engineering school that you build your network' (S18). These findings are in accordance with Bès and Chaulet (2013) who highlighted that these traditionally strong alumni networks not only strengthen the image of the institutions but also give students the opportunity to build their social capital during their studies.

Students pointed out the importance of *capacity building* opportunities in engineering school to better prepare their future professional life. They would like to develop not only strong technical knowledge and competencies but also transversal skills. 'Through all human and social sciences courses, obtain the capacities to become a manager, which is to say to manage teams in the best possible way' (S2). They are aware of the necessity of these transversal skills for their future career as 'we have to know how to manage teams, I think, how to manage projects, or manage our time and budget' (S18). Between the capacity building opportunities, international mobility and internship opportunities were stressed. In the words of one student: 'Enrolling in engineering school is a very good way, I think, to open up to the world and to go abroad' (S2). As part of the status attainment process (Blau and Duncan 1967), this is perceived by students as an important and valuable investment for their future professional and personal life.

Institutional factors

The findings related to institutional factors are (1) academic programme, (2) ranking, (3) support system, (4) learning environment, and (5) student life.

As highlighted previously, the *academic programme*, including the choice of disciplines and subjects, is considered as one of the most important influencing factors on the students' choice to enrol in engineering school: 'for me, the important thing is really the specialisation. I don't see myself

going to a school without knowing what they do.' (S16) or 'we must first find the programme that correspond to our interest' (S3).

Another important question was the engineering schools' *ranking* with the objective being to enter to the best ranked school: 'I just wanted to try to get the best I could get, the best ranking' (S3). Indeed, there are several rankings of these schools, based on different criteria, the ranking which is the most prized by students is based on the 'rank of the last to be admitted' meaning the previous year's students' general ranking (S12) because 'as people from the year before worked hard to get into this school, it means that it was the best' (S17). Our findings demonstrated not only the strong importance of ranking (Lefort and Bès 2019; Horstschräer 2012) and academic programme, as we expected, but also that the academic support system - in line with the results of English and Umbach (2016) - have a significant influence on the students' decision. As one student interviewee explains that compared to University 'you are more supervised. You just simply get more help if you want it.' (S4). Engineering students also stress the availability of teachers as an 'advantage of having the research lab with the teachers and researchers who are on the campus, they are really available' (S11). Interestingly, the engineering schools' research activities and opportunities were not outlined as separate influential factors but were integrated implicitly in the support system.

Another criterion influencing the students' choice is the *learning environment* of engineering schools. As expected, the geographical situation has a particular influence: 'I knew it was a student city, I knew there were mountains around, it is a nice city' (S8), 'I didn't want to stay in Paris' (S5) or 'being in Paris, for me, is very good because I am not too far from where my parents live and Paris is also a nice city' (S12). The quality of the school campus and facilities were also pointed out: 'when I learned all the [school name] sport facilities, I thought: 'That's it'' (S15). Contrary to the results of several studies conducted in the Scottish (Briggs 2006), German (Horstschräer 2012) and Portuguese (Simões and Soares 2010) contexts, neither geographical proximity nor situation were the most important factors influencing the students' decisions.

In addition, *student life* was mentioned by all the students, with the exception of only one who 'figured that no matter which school [he] would go to, [he] would find a club that would suit [him]' (S16), as an undeniable decisional factor. As one of them expressed: 'the first thing I looked at once I saw the school was the student life, what they offered, the diversity, the associative world' (S8). 'Since you are in preparatory school, you hear about clubs and associations in engineering schools and it attracts you to join it' (S13).

General overview

In summary, we identified a wide range of individual, economic, social and institutional factors that have an impact on students' choice to enrol in an engineering school. It is important to note that these factors are interdependent and the students' choice is multidimensional.

Concerning the individual factors, good academic records, self-efficacy and passion for STEM subjects were jointly-mentioned by almost all the students interviewed. This passion motivated them not only to obtain excellent academic results but also to participate in STEM related extra-curricular or non-academic activities (e.g.: scientific clubs, Olympiads …) allowing them to experience flow and integrating it into their identity. This passion, mainly based on a high level of personal interest (pleasure and enjoyment of these activities) and attainment value (creating and developing new solutions)[8] was, without exception, highly supported by their social environment and more particularly by their family. It is interesting that the proposed engineering specialities on offer[9] were mentioned by nearly all the students in relation with their passion for and personal interest in a specific engineering field. In addition, economic factors such as a comfortable salary with high social status and impact, job flexibility and security with good career opportunities were jointly-mentioned almost every time to justify the choice of engineering school and profession.

Significant differences were observed between the students from preparatory classes and the other admission systems. None of the students from the other admission systems mentioned the influence of the ranking, the support system, the learning environment (e.g.: geographical location, campus facilities) or the student social facilities (e.g.: sport activities on offer) that were mentioned together by nearly all the students from the preparatory classes. Among the institutional factors, only the specialisation was mentioned together with their passion for a specific engineering domain and good career prospects.

Only a few slight differences were found based on the engineering schools the respondent students originated from. Students from ENSTA Bretagne mentioned more frequently job security and less frequently school ranking and social networking opportunities compared to the two other engineering schools. For students from ENSTA Paris and Grenoble INP, the ranking of engineering schools with good social capital building opportunities were more important, which coincides with the high rankings of these two schools within their respective entrance exams (SCEI 2020).

Conclusion

In this study, we identified diverse individual, social, economic, and institutional factors influencing student decision-making processes underlying enrolment in engineering school in the specific context of French GEIs. Our results provide a more comprehensive understanding of the students' choices and outline four key issues:

(1) One of the main contributions of this study is related to the application of a pre-university model having a particularly important role in the recruitment process. As demonstrated in our findings, preparatory classes provide not only an excellent academic background but also facilitate the school-university transition with the reinforcement of students' self-determination to enrol in an engineering school. The application of this pre-university model, regarding the encouraging outcomes in France, would be worth taking into consideration by other European engineering schools to attract talented students and enhance the efficiency of their recruitment process.
(2) At this point in time, numerous European engineering schools are having to face strong financial constraints. In response to these constraints, the most obvious solution is to cut organisational costs and progressively increase tuition fees. However, these interventions would have major consequences on the recruitment process through changes in the institutional factors (e.g.: higher student/teacher ratio, reduced individual support and learning environment, etc.). On one hand, as demonstrated in our study, talented students are highly attracted by the quality of engineer training that should be considered before these institutional cost-cutting measures. On the other hand, the example of French engineering schools shows that relatively low tuition fees could make engineering schools more attractive for talented students compared to other HEIs.
(3) In many European countries, engineering schools' recruitment strategy usually focuses on the institutional (e.g. large choice of up-to-date academic programmes, campus facilities, geographical situation, etc.) and economic factors (e.g. good salary, employability, and career prospects, etc.). However, our findings suggest that this strategy could be enhanced by social factors and related values, more particularly, by putting more emphasis on the social factors such as social capital (e.g.: large choice of students' associations, alumni network, etc.) or capacity building (recognition of extra-scholar activities, attractive internship opportunities or international mobility, etc.) in their recruitment strategy.
(4) The efficiency of this multi-factor recruitment strategy is closely related to the applied marketing communication approach. According to our findings, talented students who have generally a higher cultural and social capital prefer to use direct social sources via interpersonal influences (interaction with family, teachers, or former students) but not media sources. Consequently, we would suggest the application of a more targeted and differentiated marketing approach based

on interpersonal interactions (such as personal invitations for events or direct counselling). Also, these direct relationship marketing actions between the students and the institutions could provide a positive contribution to the development and strengthening of engineering schools' institutional images.

Our study presents several acknowledged limitations. First, it was conducted in France and is consequently limited to one European country. Second, our qualitative sample is not representative given that participants are from three French engineering schools and, moreover, are selected from a specific student association. Third, we have interviewed students who have passed their entry exam and thus have successfully enrolled in their engineering school. Future studies could explore this issue by questioning students in preparatory classes before they sit their entry exams. In addition, it would be interesting to interview teachers and academic staff as well as the students' parents. A quantitative study with a representative sample could confirm our findings. Future research could replicate the results in other countries or extend the investigations of these issues at a European level in the context of a comparative study.

Notes

1. The French Baccalauréat, equivalent to the High School Certificate, is usually taken at the age of 18 with an average of 10/20 or above and is a term which refers to a series of exams. For example, future engineering students usually take the 'Science Series' Baccalauréat.
2. However, ECTS are validated for each semester creating possible equivalences between engineering schools and universities.
3. There are currently other specific competitions for certain schools.
4. The five principal entrance exams that students from scientific preparatory classes are trained for are X/ENS, Centrale-Supelec, Mines-Ponts, Concours Commun INP and E3A (in 2020, it became E3A-Polytech). These exams, although they aim at assessing similar skills (mathematics, physics, computer science, English, French, etc.), do not include exactly the same tests with the same coefficients. French engineering schools thus choose to recruit on the 'Concours' best suited to the expectations they have from their future students.
5. The X/ENS competitive entrance exams grant access to the most prestigious engineering schools including the Polytechnique. Beyond scientific knowledge, candidates are thus tested on their analytical skills and capacity for abstraction.
6. For example, the average tuition fees in French GEs business and management schools were €11 635 / year (CGE 2020).
7. They have to hold a Master level diploma in a STEM subject and have to pass a very a competitive and prestigious exam called 'aggrégation' for obtaining a distinguished civil servant position of 'professeur agrégé' allowing them to became a teacher in a preparatory school.
8. Interestingly, no mention of cost or utility values.
9. Both in the sense of a particular interesting specialisation or the interest in a large choice of future specialisation.

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