Developing an Entrepreneurial Spirit among engineering college students: what are the educational factors?

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Although engineers are often associated with innovation, they tend to create far fewer businesses than business schools graduates (Fayolle, 2001). Most noticeably, the career model for French engineers has for a long time been oriented towards technical or managerial functions within large companies (Bouffartigue, 1994).

Considering the importance of innovative business creation in the economy, the North Region in France initiated a research programme to study entrepreneurship education for engineers. Our research is carried out within the framework called Pôle Régional de Recherche sur l'Entrepreneuriat set up by Conseil Régional du Nord Pas de Calais. The initial question was to find out how to promote an Entrepreneurial Spirit among new engineers and find the factors that can be influential.

Arguably, the most widely recognized factor favoring entrepreneurship is family background, but this is typically a factor that cannot be influenced by education. Another advanced approach is based on the identification of entrepreneurial fitness and skills (Gartner, 1988, Carter et al., 1995, Loraine et al. 1998), but this approach does not make it possible to predict the occurrence of the phenomenon or to detect entrepreneurs. More interestingly for us, a number of authors emphasize the part to be played by the educational system in the promotion of an Entrepreneurial Spirit prior to the intention to set up a business (Albert and Marion 1997, Fayolle, 2000).

Our own experience of teaching grande école engineers at Ecole Centrale de Lille shows that very few students choose to join the Entrepreneurship Master course, which requires applicants to have a personal business project (about 2 per cent of students). And when they do, it is not on impulse, but the result of a process over a period of time (Verzat et al. 2002). Within this process, which we call, as Fayolle does, the awakening of an

Entrepreneurial Spirit, a major part is played by a hands-on project management experience during the two first years of their curriculum.

The purpose of this chapter is to further what can be called the Entrepreneurial Spirit. Indeed these words, although widely used, have not yet been properly defined in the literature as to how it is created, and what precise aspects can be enhanced through teaching activities. It is a matter of suggesting hypotheses in order to build up a model of how an Entrepreneurial Spirit is engendered among newly trained engineers.

Our chapter is divided into four section. The first deals with the question of the definition of the Entrepreneurial Spirit: How does it arise prior to the decision to set up a business? How can the components of an Entrepreneurial Spirit be defined? We suggest a dynamic model. The second section deals with the factors leading to an Entrepreneurial Spirit among young engineers: What is the relevance of the educational background ? What are the possible teaching method variables within engineering college training? The third section presents methodological features of our research. The fourth section presents early results about the projective dimensions of our model of engineering students in 2004. As a conclusion, we present theoretical and practical implications of our research.

I.   ENTREPRENEURIAL SPIRIT: SUGGESTION OF A DYNAMIC MODEL TO EXPLORE THE BEGINNINGS OF THE ENTREPRENEURIAL PROCESS

How should Entrepreneurial Spirit or Entrepreneurising Spirit be defined? Although this notion has been largely used, it has still to be properly defined. And we believe this could very much help understanding what happens prior to the declared intention of creating a business. In that regard, this is a new insight into the beginnings of the entrepreneurial process.

The unknown beginnings of the entrepreneurial process

For a few years, researchers in entrepreneurship have suggested the idea that setting up a business can be understood as a process. (Gartner 1985; 1988; Stevenson and Jarillo 1990). Fayolle (2002) shows that this vision of entrepreneurship is first justified by the fact that entrepreneurship is a rather complex phenomenon. Indeed, it includes psychological, social, economic and organizational dimensions. Secondly there is a large diversity of entrepreneurial situations, because entrepreneurs and their projects differ greatly.

This vision of entrepreneurship as a process is important because it allows research in entrepreneurship to go ahead of a dual conception of entrepreneurship: On one side is the functional approach of economists (Baumol, 1993; Landstrom, 1998) where the entrepreneur is described as an innovator, an organizer and a risk-taker. On the

other is the psychological approach where the entrepreneur is defined by his or her personality, motivations and behaviours, looking for an entrepreneurial personality type.

Our research is based on the idea that becoming an entrepreneur is more about how a person builds up a vision of what he is or she capable of and what he or she wants to become in relationship to an environment that will confirm this project or not. It is much more a process than a predetermination.

Talking about an entrepreneurial process is a nevertheless a very large subject, because it can take many steps and years from the first idea to the effective setting up of the firm. Tounès (2003) suggests a representation of the entrepreneurial process in five stages. (see figure 11.1). Our choice is to explore the uphill stages of this process prior to the decision of setting up.
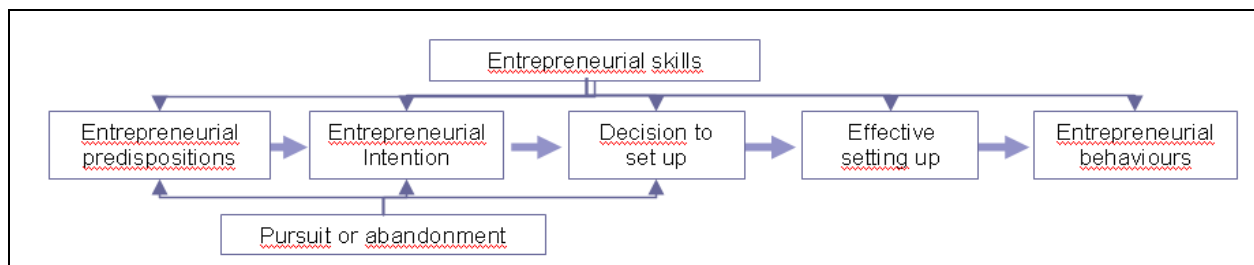

Figure 11.1: **Representation of the entrepreneurial process by Tounès**

Source: Tounes 2003

Many authors already have explored the first stages of the process around the notion of intention. Most research is based either on Ajzen's theory of planned behaviour (Ajzen, 1991; 2002) applied to the intention to create a business or on the theory of the predictability of the entrepreneurial event by Shapero and Sokol (1982). According to Ajzen, any behaviour finds expression in an intention to adopt this behaviour. This intention springs from positive attitudes as regards this behaviour, normative beliefs and a feeling of control regarding this behaviour, which results in a control locus on the one hand, and in the perception of a self-efficacy (Bandura, 1982) on the other. This is the way, for instance, he analyses the intention to give up smoking. According to Shapero and Sokol, the entrepreneurial intention derives from the perceptions of its desirability and its feasibility. Kruger and Carsrud (1993), Autio et al. (1997), Wang et al. (2001), Peterman and Kennedy (2003), Tounes (2003) try to explain the intention to set up a business.

Our position is that this model is very important but not sufficient to approach the early stages of the entrepreneurial process, ecause in many cases, awarness of this intention occurs very late. We already know from Fayolle (1994) that many engineers become entrepreneurs late in their careers. We also know from Wang et al. (2001) that students in Singapore, who have declared their intention to set up a business do not do it when the economic environment offers better job opportunities. We also believe that deeper or earlier influences may exist. For instance, Fayolle (2001) notes that many engineers setting up a business had taken responsible positions in

associations when at school. As far as we are concerned, we noted in our exploratory research that most newly trained engineers embarking the setting up a business had been in a decisive leader position for two years within their innovation project team. (Verzat et al. 2002*)*.

We can thus get to the hypothesis that the stages before the business setting up decision refer to something that can be named an Entrepreneurial Spirit. But how can we define it?

According to Albert et Marion (2001) the Entrepreneurial Spirit consists – for business as well as for all human activities", "in identifying opportunities, in gathering resources of various natures, in order to create a wealth that meets a solvable demand*"*. Other authors define the Entrepreneurial Spirit as a set of positive attitudes as regards the notion of enterprise or of starting a business, or as regards the Entrepreneurial Spirit which involves taking initiatives and action *(*Léger-Jarniou, 2001*)*. The Entrepreneurial Spirit also defines the basic characteristics of an entrepreneur, who is different from the manager or the inventor (Fayolle, 2002), regarding the activation of mental images allowing an organization to develop (Fonrouge, 2002). A set of personality features, of abilities, values and attitudes which reveal entrepreneurial behaviours are to be found in these models.

So there is no clear consensus as to the definition of an Entrepreneurial Spirit, and the definitions that can be found in the literature seem to be closer to the consequences of an Entrepreneurial Spirit than to the concept itself. Our approach is to understand the dynamics that contribute to building up such a "spirit". When students arrive at the engineering college, very few know about their future career or on their specific abilities. The three years they spend in college help them to develop professional competence and to build up their professional identity. So our main hypothesis about the Entrepreneurial Spirit is that it is progressively built up through a dual elaboration: of professional identity and of specific attitudes, behaviours and competence feelings. Our model tries to encompass these two dimensions in a dynamic process of elaboration.

Suggestion of a dynamic model

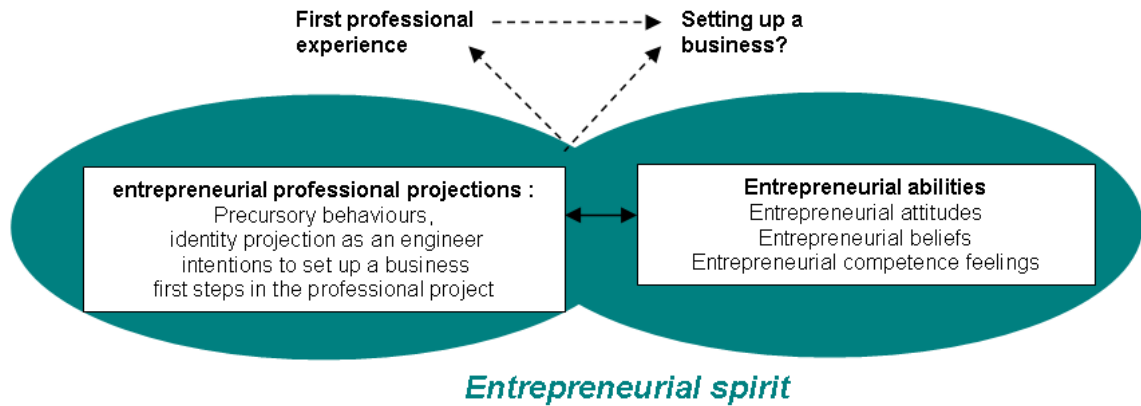The model of the Entrepreneurial Spirit we propose can be roughly drawn in a diagram like this:

Figure 11.2: **model of the Entrepreneurial Spirit**

Through academic and pre-professional experiences (internships, activities in associations) the young student will progressively understand what he or she is capable of and what are his or her values or beliefs towards what is good for him or her. That will help him to choose orientations for the future and progressively summarize his professional project. At each step, we postulate that some features can be identified as entrepreneurial. Let us summarize all those features as regards professional projections and abilities in a broad sense.

Building up entrepreneurial professional projections.

We have noted, through our exploratory interviews, the importance of a projection of an identity and/or professional type which shows through some assertions, such as: "I have known for a long time that I have an entrepreneur profile" or "I don't feel myself as a classical technology or large business minded engineer" or else " there are many business creators in my family, and I am interested in it too". How can we give an account of those implicit professional models?

All the more so as, for some authors such as Gottfredson (1981) (quoted by Guichard and Huteau, 2001), the professional and career choices are first an attempt for the person to realize a social self , and, secondarily, the realisation of a psychological self. Using the related story of life, Rae and Carswell, 2000 reveal the importance of

building up a meaning for oneself in front of other people in the entrepreneur's learning process: becoming an entrepreneur is building up values/incentives with precise objectives, so once they have been achieved, the successful realizations feed a self-confidence and the ability to be successful, which is close to Bandura's self efficacy concept.

Becoming an entrepreneur may be approached on the basis of the double transaction identity building theory *(*Dubar*, 1991)*. In fact, we can identify here:

1. On the one hand, a biographic transaction in which the engineering college student sees a possible future continuing or breaking up with his or her former experience (family experiences, the choice for an engineering college, activities with associations, projects …and so on).

2. On the other hand, a relational transaction in which the engineering college student has the legitimacy of his or her aspirations (career and life projects) recognized by a favourable environment (parents, relatives, friends, other students ready to get involved, outside potential partners, lecturers helping to build up a business plan or confirming the feasibility of a creation idea) among which the college's culture plays an important part.

For many students, the professional projects build up slowly, through explorations and trial and error where some encouragement can occur to explore the trail and then confirmation of the feasibility of a business setting-up project by the lecturers.

In that respect, the way some career guidance psychologist analyse the building up of a professional project is interesting. For Ginzberg et al., 1951, quoted by Guichard and Huteau, 2001 building up one's professional project is a process including realistic choices. This process goes through three stages: an exploratory phase, along which first-year students carry out an active search for information, taking part in discussions with well-informed people, such as lecturers or career advisers, in order to elaborate on a professional choice. The second phase is a crystallization phase, in which students – generally fourth-year students – crystallize their choices and experience, which then enable them to draw up a hierarchy of their choices and to identify their aspirations. The last phase of the process is called specification and corresponds to the expression of the "professional tendency"; final-year students choose a profession and devote many hours of work to the project they are interested in.

To sum up, several hypotheses can be set out about the way to define the projections of an Entrepreneurial Spirit prior to the decision to set up a business.

H1. An Entrepreneurial Spirit expresses itself through an intention to set up a business.

H2. An Entrepreneurial Spirit expresses itself, during study at college, through precursory behaviours such as taking responsibilities in associations or taking the leadership of a project team.

H3. An Entrepreneurial Spirit expresses itself through an identity projection which can be spotted through claims to other people of what one is or wants to be, as opposed to the technology-minded engineer model.

H4. An Entrepreneurial Spirit expresses itself through a professional project gradually built up around the setting up of a business: with first-year students, it expresses itself in an information search exploratory phase. With second-year students, it finds expression in a search for opportunities, advice and training related to the project. As soon as they get to the third year, the students have roughly completed their project work (contacts have been established with banks or partners; they have turned towards the Business-setting up Master Course.

Building up entrepreneurial abilities

An important literature deals with the psychological profile of the entrepreneur or his or her necessary competence. All authors using Ajzen's theory describe various components of the intention to be an entrepreneur

1) favourable attitudes as regards entrepreneurship

2) Interiorised social standards related to an entrepreneurial behaviour

3) the feeling of having entrepreneurial skills, self-control, and the ability to get successful.

We tried to take all these dimensions into account, which ends up with three types of features concerning a potential entrepreneur:

• specific attitudes, which refer to internal predispositions to act in certain ways and account mainly for specific personality traits

• normative beliefs as regards entrepreneurship

• feeling of having entrepreneurial skills (self-efficacy)

Tables 11.1 and 11.2 show the detail of these three features.

Entrepreneurial attitudes. In order to estimate someone's attitude as regards an entrepreneurial behaviour, we have selected eight attitudes in the relevant literature so as to be able to work out the students' attitudes regarding an entrepreneurial behaviour.

For each attitude, a series of questions are asked, evoking precise situations, on the basis of the Biodata technique (Mael, 1991), which makes it possible to ask factual questions about real issues, involving opinions, attitudes and values in a historical perspective.

Table 11.1: **entrepreneurial skill estimating variables**

Attitude-estimating variables	References	A few situations evoked in the questionnaire
Autonomy	Craid (1990), Cromie (1987)	Working on one's own or with a group, preferring to be framed when working on a project.
Need for fulfilment	McClelland 1961, Koh (1996)	Setting up personal challenges, working more than required to.
Dynamism	Craid (1990)	Extra curricular activities, with associations …
Risk taking	Koh (1996)	Aversion or not to risk

Initiative taking	Cromie (2000)	Initiatives within a class, a group, the family …
Responsibility	McClelland (1961)	Responsibilities within an association, class representative functions
Innovation	Koh (1996), Craid (1991)	Favourable to changes, to new working methods
Will, determination	Cromie (2000)	Achieving one's objectives at all costs

Normative beliefs towards entrepreneurship. The normative beliefs concept in Ajzen's intention model refers to the person's interiorised values which are confirmed by his or her social models and referents. The person's relevant others are the people who are important to the person as regards career and professional projections, but also to a favourable environment supporting the person in his or her project.

The questions we ask in our questionnaire aim to identify the professional reference models and the favourable environment towards the student's building-up of a project (parents, relatives, close friends, lecturers, former students, banks, school friends) on the one hand, and, on the other, finding out whether these reference models support the student's entrepreneurial project.

The feeling of having entrepreneurial skills. The estimation of this aspect goes through two sub-aspects:

1. Self-efficacy: within the scope of our study, we have defined self-efficacy in relation to entrepreneurs' key-skills as identified in the relevant literature. Our purpose is to identify the potential existence of those entrepreneurial skills among students, through our questionnaire.

Table 11.2: **Self-efficacy estimating variables**

Entrepreneurs' skills	References	A few situations evoked in the questionnaire
Seizing and making up opportunities	Herron (1990), Vesper (1989), Baum (1995)	Opportunity of a placement or employment, vacancy opportunity …
Working with a team	Chandler and Jansen (1992), Lorrain et al. (1998)	Working on one's own or with a team, dealing with tensions within a group.
Developing and maintaining a network	Aldrich et all (1987), Herron (1990)	Relationships with friends, school friends ; developing further acquaintances
Technological skills	Baum (1995), Herron (1990), Chandler and Jansen (1992)	Solving technical problems (computers …)
Working intensely	Chandler and Jansen (1992)	Working so as to comply with deadlines, physical efforts …
Organizational skills	Lorrain et al. (1998), Deeks (1976)	Organizing events at school or with a group of friends
Self projection into the future	Hambrik and Crozier (1985), Milton (1989)	Having a personal idea of a professional project after college, anticipating difficulties pertaining to the project activity …
Making decisions	Deeks (1976), Hoffer and Sandberg (1987)	Making a decision with little information

2. The locus of control: this notion refers to the feeling of controlling the causes and running of an event, or taking them for granted (Rotter, 1966; Brockhaus,1982)

The purpose of our questionnaire is to test these aspects on two levels:

a.The internal locus of control: this aspect is tested through questions helping to find out whether the person takes his or her own of the control of some events (his or her ability, efforts).

b.The external locus of control: the questions asked to estimate this aspect help to find out whether the person sees the running of some events as due to external causes (chance, luck, omnipotence of others).

So our hypothesis is that the Entrepreneurial Spirit builds up through different entrepreneurial features related revealed or confirmed trough entrepreneurial projections. But this does not explain why such a spirit can arise. So the second part of this model is to investigate the possible causes and especially to identify what factors can be acted on during the engineering college curriculum.

II.   ENTREPRENEURIAL SPIRIT INFLUENTIAL FACTORS

Two main factors can be found: the personal past of the person and the pedagogical factors during college. We have to look carefully at both to weight the role of teaching methods and other features at college.

The identity-building past

In Ajzen's intention model, the identity and dynamics only partly appears through the normative beliefs aspect. With the model we suggest, the identity building dynamics is to be considered on two levels: On the one hand is the identity displayed (self definition, particularly as a would-be engineer, and projections into the future) which builds up interactively with other people (see above). On the other hand is the identity-building past which is related to legacy and identification models drawn from the social and family backgrounds: parents being or not entrepreneurs, parents' career as experienced by themselves and their child, entrepreneurial or not social background.

These aspects are spotted as model entry variables: they may have an influence upon Entrepreneurial Spirit, but we do not see them as determining factors. Our hypothesis is that, with some students, the past may constitute a kind of predisposition which will develop during their studies. With others, there may be a deliberate break with the past, which may also be seen as some sort of determination. With others, we admit the hypothesis that university education can provide the opportunity to develop an Entrepreneurial Spirit in a student who has not had an Entrepreneurial Spirit background. This hypothesis is supported by a few examples of paths followed by students we have met in the course of the qualitative phase of our research.

Now let us see how university education can be of some influence upon this starting point, whereas it be favourable or not, in relation to the development of an Entrepreneurial Spirit.

The influence of training

There is a rich literature about the construction of an educational and entrepreneurial paradigm: Sexton and Bowman 1984; MacMullan and Long 1983; Leicht and Harrison 1999. There are also a great deal of reports, syntheses and evaluations of educational experiments in the field of university entrepreneurial training (Garavan and O'Cinneide 1994; Gorman et al. 1997). It is remarkable that the reported experiments mainly concern management training at a university level, even though an awareness of entrepreneurial attitudes involving initiative-taking and an approach to changes can, and should be addressed very early (Neunreuther, 1979*)*.

As regards entrepreneurship teaching objectives, many authors insist on the necessity of avoiding any mechanistic type of teaching that would bring entrepreneurship down to a set of techniques and ignore the students' incentives (Hynes, 1996). With Gibb (1993), teaching methods should not just transfer knowledge, but develop the building-up of skills and attitudes in favour of entrepreneurship. They are different from other career objectives because they are multiple and because of a necessary pluridisciplinarity. They represent a specific challenge, particularly for engineering college students whom we are dealing with, as the point is to forget risk-aversion attitudes induced by analytic approaches and approaches consisting of searching for a unique solution to cope with a well-defined problem. In fact, we have noticed in the course of our qualitative study, that the students interested in entrepreneurship are less focused on technology and more open to a selection of the courses they wish to attend.

In the relevant literature, learning entrepreneurial skills and attitudes can be carried out through a teaching method that puts the student in a real-problem solving position. Numerous empirical researches show that certain types of teaching are more favourable than others in the training of entrepreneurs: action learning, learning by doing, learning through experience, learning from one's own mistakes, learning from other people … T.N.Garavan and B.O'Cinneide, 1994; Leicht and Harrison 1999; Harshorn and Hannon 2002. Reviewing various works about learning styles, Gibb (1993) suggest seeing entrepreneurs as characterized by a learning style that would rather be focused on real life experience and either on action (pragmatic/intuitive mode) or thinking (reflexive/intuitive mode). In their life story telling approach, Rae and Carswell (2000) mention that the entrepreneurs interviewed are typically fond of learning and quick and keen on applying the knowledge and skills acquired. They even build up their own theory about their way to learn and to make their own decisions.

Our first qualitative research has enabled us to identify the actual links between an active teaching method and the training to achieve an Entrepreneurial Spirit. The project activity at EC Lille is a central activity in the curriculum (300 hours per student). The students' interviews have shown that this teaching method, which applies to groups, was seen by the students, as the best to encourage an Entrepreneurial Spirit. The intention to become an entrepreneur, when the time has come for the person to make that decision, has appeared to be influenced by two major experiences: 1) In the course of the project activity the student discovers his or her ability to lead the group, which is an essential asset for a would-be entrepreneur; 2) Through the project activity the student discovers product, market, and customer opportunities which drive him or her to reveal and confirm to him or herself his or her abilities to create, decide and develop a social network.

In the light of these theoretical elements and of our first qualitative research, we produce several hypotheses regarding the selection of courses and the learning style which are typical for the students with an Entrepreneurial Spirit:

H5. The students with an Entrepreneurial Spirit reveal more varied choices regarding the available courses than others. They'd rather choose non-technological courses.

H6. The students choose active teaching activities, such as project or placements, as opposed to lectures.

Beyond the learning styles which rely on variables of a socio-cognitive type, A. Gibb (1193) supposes that an Entrepreneurial Spirit builds up within a specific environment. More precisely, he evokes a culture with which all actors (lecturers, students, career advisers, various partners) support the setting-up of businesses and entrepreneurs. Likewise, in his study about entrepreneurial engineers, Fayolle (2001) also mentions that the college's own culture is a factor to be taken into account when considering the decision to set up a business. A study carried out among Quebec management college students estimates the impact of the choice of courses (business plan or field study) on the desirability and feasibility of an entrepreneurial career (Audet, 2002*)*. In our preliminary research, the students who have decided to join the Business Setting-up Master Course appear to see the college's culture as rather favourable to entrepreneurship.

In a similar field, Curran and Stanworth (1989) put forward an aspect which we feel to be of some importance in the training leading to the choice of a career: the "affective socialization element" conditioning "the inculcation of attitudes, values, psychological mind sets and strategies necessary for the subsequent taking on of the occupational role in question". In our qualitative research, we have been able to observe the influence of a group on the decision to go into the business setting-up process. Some students who had not revealed any predisposition at first sight, eventually turned towards the setting-up of a business, following the leader of their project work team.

Relying on these two results and of our first research, we provide several hypotheses regarding the part played by the students' environments in the building-up of an Entrepreneurial Spirit:

H7. The students with an Entrepreneurial Spirit see the college's culture as favourable to entrepreneurship.

H8. The students with an Entrepreneurial Spirit belong to a group of close friends who are favourable to entrepreneurship.

Thus, the part played by teaching methods is an action variable which our questionnaire will test at two levels:

1. On the one hand, it will test the students' perception of the interest and contribution of the various teaching methods provided by the college.

2. On the other hand, the updating of the questionnaire every three years will make it possible to identify the impact of the various types of teaching provided by the college as regards entrepreneurial projections, skills and attitudes. It is then possible to put forward the hypothesis of an evolution of the management of the college curriculum that would be more or less favourable to the development of an entrepreneurial model internalised by students.

To sum it up, the figure 11.3 presents the different factors that can influence the building-up of an Entrepreneurial Spirit:
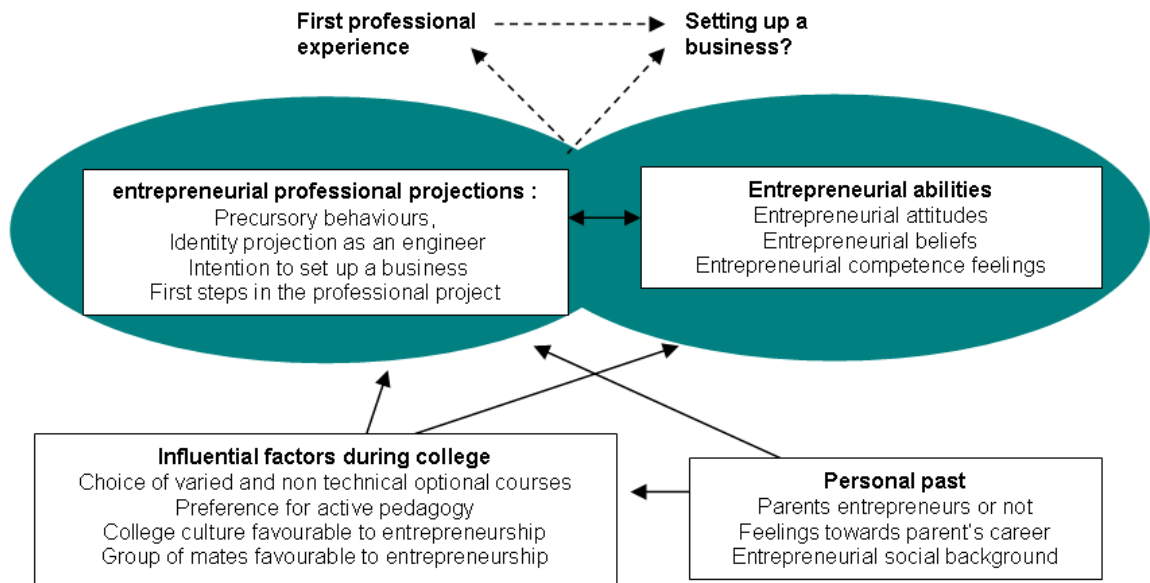
Figure 11.3: **Our exploratory model of the Entrepreneurial Spirit**

The figure 11.3 model is an exploratory model that points out the different elements that interact in the building up of the Entrepreneurial Spirit. The way it can be tested and how it can lead to more precise explanation models needs some methodological explanations.

III. METHODOLOGICAL ISSUES

In the methodological issues, there are four different levels :

1. The balance between quantitative data and qualitative data.

2. The creation of a questionnaire that can encompass reliable quantitative data on the relevant dimensions in the context of students' life.

3. The administration of the questionnaire to obtain reliable longitudinal data.

4. The different steps and statistical procedures we are using to test the links between a tremendous amount of variables.

A balance between qualitative and quantitative data

The first approach of our research was qualitative (Verzat et al., 2002; Frugier et al., 2003). We wanted to explore the students attitudes, representations and beliefs towards entrepreneurship and their links with the family-social and educational trajectory of the students.

We did two-hours semi-directive interviews with 11 engineering students at different stages in our curriculum. Some of them had been taking the entrepreneurial course and others had not. This gave us to two major results (Bachelet et al., 2004):

1. A first modelling of the building up of the professional project of our engineering students, showing three major dimensions: the professional projection related to specific values and beliefs on one hand and knowledge and skills on the other. All these dimensions were gradually internalized and confirmed through significant experiences at four stages of the student's path: influence of his or her family environment, secondary school, classe préparatoire stage (two first years of college in France before taking the elitist concours), and college years at the French High School.

2. The identification of three different types of attitudes and projections towards entrepreneurship

(a)Type 1: the determined entrepreneur = older students who have chosen to take the entrepreneurial course in their third year to prepare setting up their business after school. Their intention to create had been awakened during the project experience at school where they took a leading role and stems from deep values inherited from their family environment; but the parents or close family are not necessarily entrepreneurs themselves.

(b)Type 2: the potential entrepreneur = young students who declare their intention to set up a business atsome time but have not taken any step in that direction so far. For the time being they do not see themselves in a project leader's position but they are ready to take on risks on an associate's position. They reveal entrepreneurial abilities (autonomy, taking initiatives) but need either an opportunity to go forward or more information on business creation.

(c)Type 3: the students (at any stage of the curriculum) who are not interested in entrepreneurship: they declare no intention to create a business, they consider it too complicated and risky. They seek security for their future career.

These data were very interesting but could not decide on the cause effect relationships between factors and the diversity of trajectories could not be combined in clear actionable paths. This is the reason why we launched a large study of full intakes of students to obtain quantitative longitudinal data so as to explore more systematically these complex relationships between factors and trajectories.

When we draw conclusions about types of spirits or trajectories, we have also plan to come back to interview "typical" students to complete our understanding. Indeed our questionnaire includes a closing question to ask the student if he or she will take part in a future interview.

Another major issue is to go beyond the vision that Entrepreneurial Spirit is a result of an individual process. As matter of fact experiences of several engineering students of our school really setting up businesses

show a major influence of group dynamics within students' project teams. To study this lead, we chose specific methodological options:

- For quantitative data, we added specific questions in our questionnaire about how teamwork was carried out (roles and attitudes in the group, motivation and satisfaction). But we also included the means to analyse questionnaire data at group level, and not just at individual level.

- As to qualitative data collection, individual interviews are not the best way to study a group process. Instead we need to use another methodology: focus groups (Morgan, 1998; Stewart and Shamdasani 1990).

The creation of the questionnaire

Different types of data need to be gathered, as we have seen in the exploratory model. How were they transformed into a valid questionnaire ? We followed the classical procedure (Churchill, 1979):

1.Definition of the concept (Entrepreneurial Spirit), its dimensions and actionable factors (intention, projections, attitudes, self-efficacy, social background, pedagogy…and so on) based on the literature and the related hypotheses.

2.Definition of each variable and of indicators for each variable.

3.Choice of number and nature of questions related to each construct (see below for details) and elaboration of questions for each variable. This was done in teamwork with two students and three researchers in entrepreneurship and psychology. The student's help was important to imagine the kind of situations that were relevant in the students life.

4.Test of those questions on paper with 50 students: observation of students filling in the form and discussion afterwards between the researchers and the students who had taken part about the questions that had not been understood.

5.Conclusions on the version of the questionnaire to be launched for the complete intake (200 students).

A specific problem we had to face concerned the type and nature of questions to investigate such personal and social factors.

On a large number of constructs, we decided to associate self-evaluation questions on opinions (answers on a Likert scale) and biodata questions to investigate historical objective and verifiable features (Lautschlager, 1994; Mael, 1991; Stricker and Rock, 1998). The following example of the self-efficacy "capacity to build on opportunities" explains the different kinds of questions using the two techniques. These are some of the questions we asked:

- If somebody offers me an unexpected but attractive project, I take the opportunity immediately and think it over afterwards, I:

    •Totally agree

    •Slightly agree

    •Slightly disagree

    •Totally disagree.

- One of my father's friends came to dinner at home in the last six months. His activity branch interests me for a potential traineeship.

    •I seized the opportunity to talk about my traineeship and make an appointment.

    •The next day I asked my father to talk to him about my traineeship.

    •I waited for another occasion to meet him.

Administering the questionnaire

The 180 questions-long questionnaire has been launched through Computer Assisted Web Interviewing (CAWI) for first-, second- and third-year students at Ecole Centrale de Lille (230 to 250 students per year), for first-year students at ITEEM (Institut Technologique Européen d'Entrepreneuriat et de Management, 50 students) and at Ecole Centrale de Paris (450 first year students).

The same questions (except those not expected to change, like the person's past for example) are asked of the same student dring each year of their curriculum so as to explore what has evolved or not. After three years of

completing this questionnaire at the different stages of the curriculum, we will be able to analyse the individual and collective evolutions and link them to factors at college.

The statistical procedures

At first, we used classical correlation analysis and data mining to single out variables which were linked. To try to build a typology of students or of their evolution, factorial component analysis was implemented on selected items.

In the near future, more sophisticated techniques will be used:

- odd-ratios and log-linear analysis to separate the impact of different variables (and eliminate the effect of factors education cannot act upon, like family background).

- structural equations to try to confirm or disconfirm more complex models, like Ajzen's.

PRELIMINARY RESULTS

In this section, we show preliminary results that were obtained in 2003-04 for the three current intakes at Ecole Centrale de Lille:

- 197 first year students (third year of higher education because French students take an examination to enter the Grandes Ecoles after 2 years of classes préparatoires), who represent 81 per cent of the intake.

- 200 second year students (fourth year of higher education) who represent 81 per cent of the intake.

- 125 third year students (fifth year of higher education).who represent 73 per cent of the present intake (since many students go abroad for this last year of their curriculum).

At this stage, the results we can show cover only the projective dimensions of the students representation of the engineer, the professional activities envisioned by engineering students, the kind of career they imagine and their intention to set up a business. The main conclusions we can draw at this stage are detailed below.

The student's Vision of the French Engineer is a Manager with a Privileged Status, the Technical Dimension is Dominant but not Necessary

Unsurprisingly, the identity projection of French engineering students of Grandes Ecoles is linked to the historical figure of the engineer as a member of the elite. For most students, the engineer evokes a privileged status (87 to 90 per cent in the different intakes). Among all other questions about what being an engineer evokes, this is the dominant feature.

The mastering of technical knowledge is also a very important feature, but as table 11.3 shows, it is not as important as the management role, although it usually goes together. It seems that the managerial aspect of the engineer increases each year (this will be confirmed in the longitudinal analysis with the same students).

Table 11.3: **students' vision of the engineer**

First year students' vision of the engineer	Third year students' vision of the engineer
Mastering technical knowledge only = 15%	Mastering technical knowledge only = 12%
Mastering technical knowledge + management role = 68%	Mastering technical knowledge + management role = 58%
Management role only = 17%	Management role only = 24%

Asked about the kind of role they would prefer for their future job, the students detail what they understand by the managerial dimension: project management as opposed to the classical hierarchical role of the manager gains popularity during the studies. We suggest that this may be influenced by their experience of project activity during the first two years of the curriculum at Ecole Centrale de Lille. Most of them love this experience of teamwork, which gives them a clearer vision of daily work in design engineering (Table 11.4). In the future, this will be compared with other colleges or universities where there is no such pedagogy.

Table 11.4: **students' preferences for their professional role**

First year students' preferences for their professional role	Third year students' preferences for their professional role
Team manager (hierarchical role) = 41%	Team manager (hierarchical role) = 30%
Project manager = 35%	Project manager = 48%
Technical expert = 24%	Technical expert = 21%

But these visions are built up very progressively. Indeed the building up of the professional project is a lengthy process.

The Elaboration of the Engineer's Professional Project is a Long Process

Few students have a precise project when entering college. Sixty seven per cent declare they have no precise idea about their future job. In third year, 34 per cent still remain in this position, even though they will have to choose a job a few months later. We believe this is partly due to the specificity of generalist engineering studies. In Ecole Centrale de Lille, the students have the opportunity to acquire technical knowledge in all fields of engineering disciplines (from electronics to mechanics, automatics, chemical engineering, civil engineering…and so on) and this leads to many possible jobs. The students who choose that kind of Grandes Ecoles do so, mainly because in France it offers more prestige and broader job opportunities but also because it delays the choice of a professional speciality. As such they choose to make make no choice yet and thus keep all opportunities open.

However, as they advance in the curriculum student's choice of career becomes progressively more precise. Table 11.5 shows the progression in what the students thinks of doing when the time comes to leave college.

Table 11.5: **Expected occupation after leaving college**

What first year students think, they will probably do after leaving college	What third year students think, they will probably do after leaving college
R&D executive = 23%	R&D executive = 22%
Technical executive = 15%	Technical executive = 25%
Business or Finance executive = 11%	Business or Finance executive = 10%
Sales or Marketing executive = 6%	Sales or Marketing executive = 4%
Entrepreneur = 8%	Entrepreneur = 5%
Other studies = 11%	Other studies = 20%
No idea = 26%	No idea = 14%

Most students want to occupy managerial positions in technical fields. Another group will choose to become a management executives in non-technical fields, and many students want to go into further studies, which can be interpreted in two ways: either as a way of delaying a choice of profession a bit longer or to acquire more knowledge in specific fields (often in management), which is often appreciated in French engineers' curricula.

Some students still have no idea, which means they rely very much on opportunities in their job search. But what is more striking for our subject is the case of potential entrepreneurs.

Entrepreneurship is a Minority's Choice but it can be Influenced by College Experience

Entrepreneurship might appear as a potentially attractive job opportunity for a few first-year students (8 per cent), but this is less the case for third-year students (5 per cent).

The standard career model of French engineering students is still to stay in the same firm: 55 per cent for first year students and 53 per cent of third year students envisage such a career. In the first year the remaining students either think of changing regularly (21 per cent) or build up their own evolution by setting up a business or being independent (24 per cent). But in the third year only 14 per cent still envisage building up their evolution, whereas 32 per cent think of changing regularly.

In fact, when we ask further questions about what they think of doing after a few years in their first job, the majority (46 per cent) give an opportunistic answer ('I will see later'). The other more precise answers ('I envisage staying in the same firm', 'I think of going into another firm', 'I think of setting up my own business') are much less attractive. The last possibility (setting up a business) attracts only 7.5 per cent of first-year students and 6.4 per cent of third-year students.

All these figures tend to confirm many studies about potential entrepreneurs: the longer the studies, the less attractive entrepreneurship appears because many other and less risky job opportunities show up. This hypothesis needs confirmation with longitudinal analysis for the same students.

However, it could also indicate a generation effect between the two intakes, suggesting that entrepreneurship is more popular now than it used to be two years ago. Indeed, since a majority of students do not know very much about their future job when entering college, they can be influenced to a certain extent by opportunities in the curriculum that offers more and more choices. In fact the creation of a third-year option in entrepreneurship in 2002 might have modified the perception of the attractiveness of entrepreneurship for actual first-year students.

However, the main figures confirm that engineering students have a low level of entrepreneurial intentions., and these intentions seem to decline between the different intakes. The following figure shows the intentions to set up a business (at any time during their career) for the 3 intakes.
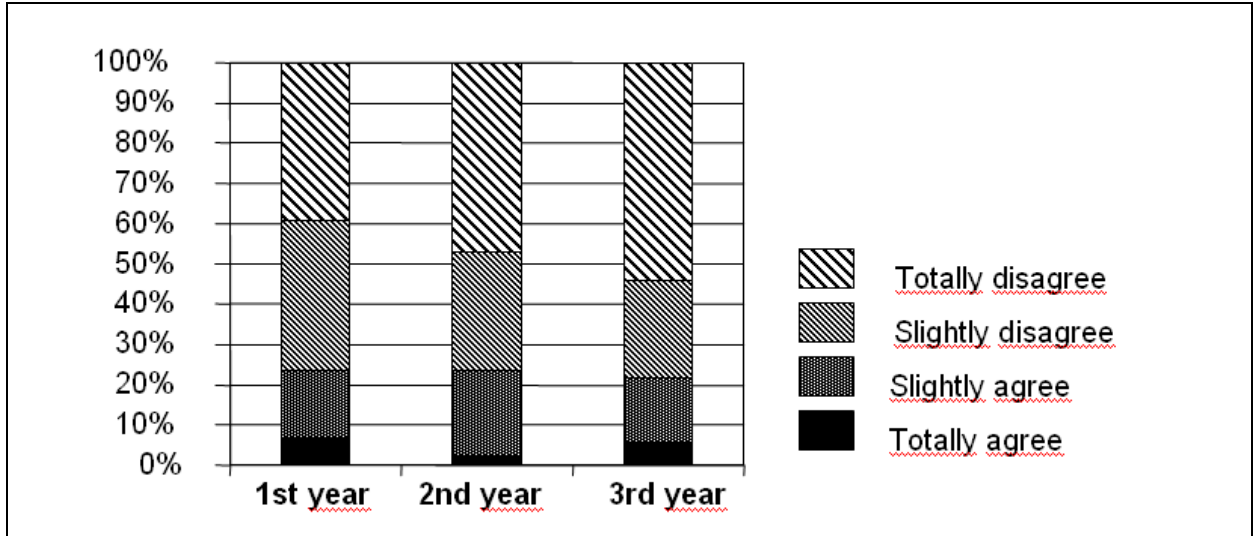
Figure 11.4**: Engineering students' intentions to set up a business**

Again, the results must be interpreted with prudence since a generation effect might be present. This needs further examination using longitudinal data from the same students. Apart from the very small proportion of 'totally agree', two dimensions are striking in those Figure 11.4; First the clear progression of 'totally disagree' which coincides with the progressive precision of the professional project. Secondly the stable proportion of 'slightly agree' which can reveal a potential for entrepreneurs in the long term. In fact, very few engineers in France create a business just after graduation. France is known to specialize in older entrepreneurs (Fayolle, 2004).

So effective intentions are really low, but another interesting figure concerns the question on the intention to start a business with a partner. Compared with the pessimistic vision shown above, this question paints a very different picture, as figure 11.5 below shows.
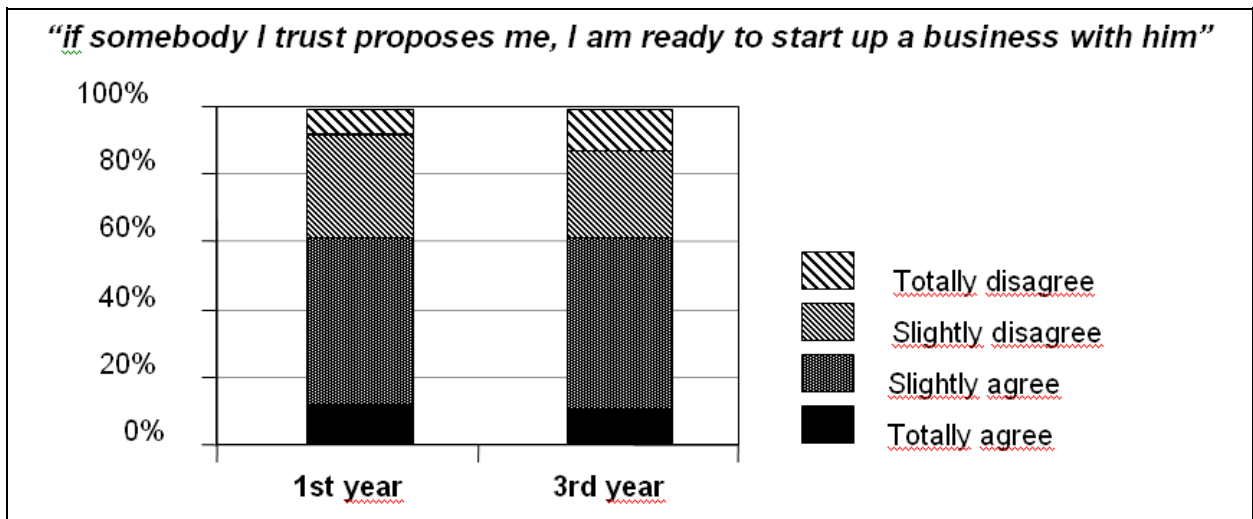

Figure 11.5: **Engineering students' intentions to set up a business**

At this stage of analysis the surprising result in figure 11.5 is difficult to interpret with certainty we formulate the hypothesis that project work experience during engineering studies has an influence on student's perception of their

future career and jobs attractiveness. Qualitative interviews with students' teams show that when this project work experience is successful, many students of the same group choose the same job or curriculum orientation, or engage on management responsibilities in students' societies. And in our experience, among students who effectively set up businesses at the end of their curriculum at college, a significant share did it in teams that originated in the project activity at Centrale. A further exploration of more precise intentions of common groups of students will be proposed in the near future, to test this hypothesis.

CONCLUSIONS

A number of papers study the intention of setting up a business. The choice we made in this research was to find out what happens before this intention, during undergraduate and postgraduate engineering studies. Indeed, the genesis of the Entrepreneurial Spirit starts very early in life, but we posit that the university years are decisive. We also posit two other things:

1.There is more to entrepreneurship than business creation since this can occur late in a career. Entrepreneurial Spirit and behaviour can show up early in other ways, like taking initiatives in students' unions and simply having certain attitudes towards studies and students' life.

2.Beyond well-explored factors like the personality of the entrepreneur, business opportunities and so on… other variables must be studied: college/university culture, professional identity as an engineer, attraction for certain courses of pedagogies within the curriculum and so on…

That is why we decided to define and explore the concept of Entrepreneurial Spirit, studying how university years affect the individual.

Our preliminary results about the projections students make about their career and professional identity unsurprisingly show that entrepreneurial orientation is weak in engineering students in the French context of Grandes Ecoles. But we also see that the professional identity is progressively built up and there might be some ways to influence this progression towards entrepreneurship. The choices the students make in the curriculum and the experience they gain from teamwork could influence them a great deal.

This has some practical implications for entrepreneurship education:

1.We point out the importance of group dynamics during the curriculum. This is an issue we will explore in the future. Setting up these project activities is probably a major factor for developing Entrepreneurial Spirit. But we need to know precisely under which conditions such a dynamic can appear. As far as we have seen on a qualitative

basis, stimulating characteristics of such projects could be innovation objectives, real stakes (market and customer) and significant weight in the curriculum in terms of available resources (time, consultant teachers and so on).

2.Another important practical implication for entrepreneurship education concerns the evaluation of pre-entrepreneurship education. The current tendency in entrepreneurship education evaluation is to measure differences in students' intentions to set up a business. Other actionable dimensions, like choices in the curriculum could be also measured. The longitudinal analysis of our questionnaire will probably help us to define such interesting variables that occur before the intention to set up a business.

On the methodological level our research offers new perspectives in entrepreneurship education research:

1.To measure more than a difference in intentions, specific methodologies must be used: questionnaires with a wide range of dimensions tested, association of opinion/self-evaluation and biodata questions, longitudinal studies to follow the life path of students.

2.We also see that Entrepreneurial Spirit is not only to be studied at the individual level, nor at the cultural level, but also in the group dynamic. This needs a specific statistical analysis of the questionnaires (group analysis), qualitative focus groups methodologies might also be of use to refine our results.

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