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# University–industry–student: A volatile triangle

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## ABSTRACT

Collaboration involving student–industry activities entails a complex interaction between university, students, and industry. The university–student–industry triangle identified here is neither static nor balanced, and each of the three intertwined relationships displays distinguishing characteristics. Each has its own structure; the activity phases of the relationships are not synchronous, and each of the three parties enters into collaboration guided by different motives and expectations of the outcome.

Though the reasons for engaging in collaboration differ dramatically from party to party, they all relate to one of three aspects, i.e., a strategic/tactical, an operational, and an individual/emotional aspect, which together form the “motivation prism”. To ensure enterprise longevity, university representatives should concentrate on the realistic set-up of student–industry activities, on calibrating company expectations, and on personal relationships with company representatives.

**Keywords:** Student–industry Activities, Collaboration Strategies, Motivation Prism, Real-client Projects, University, Relationships.

## 1. INTRODUCTION

University–industry collaboration comprises three types of activities: activities centred on research, on study programme design, and on student–industry cooperation. It is important to distinguish between these three types, as both objectives and implications (including investments and possible benefits) differ significantly between them. Each has its merits and pitfalls. This study focuses exclusively on collaborative efforts belonging to the student–industry category. Educational institutions, industry, and students all seem to agree that collaboration resulting in student–

industry activities is highly desirable. Teachers find that students are more motivated and work more efficiently when confronted with real-world problems [1]. Beckman et al. [2] also note that students who have participated in industry activities return to their studies with a changed attitude, while Mailhot [3] comments that not only do students engage eagerly in industry activities but they also seem to be well prepared for success as professionals after graduation. Moreover, industry seems to have a genuine willingness to contribute in education [4] and Swedish students state that the availability of collaboration with commerce and industry is a crucial factor influencing their choice of university [5].

Resources are committed for establishing collaborative schemes resulting in student–industry activities; time and energy are invested in conceiving, designing, and implementing collaboration models. This results in a wide variety of course constructions as for instance described by Watson et al. [6], the common denominator of which is student–industry contact. In some instances, collaborative schemes are successful, being integral to a university’s study programs. All too frequently, though, collaborative schemes are initiated and started, but never achieve stability. At least from the university’s viewpoint, collaboration should be robust and stable in the long term. Considerably less time and energy are required to maintain an existing university–industry relationship than to establish and fine tune a new one. Accordingly, student–industry activities should be repeated year after year, involving the same participants from academia and industry, but engaging new students each term. This would allow the university to build education programmes in which student–industry activities are integrated tightly with courses, without risking unstable student–industry activities and without investing an unreasonable amount of resources.

Our aim is to shed light on the relationships between university, industry, and students, believing that a better understanding of the driving forces of such collaborative endeavours will help us to design and choose collaboration strategies and to invest our resources wisely. More specifically, we strive to identify each of the three parties' motives for engaging in student–industry collaboration; we then go on to ask whether these motives can be structured into categories. Finally, we hope to identify key factors in successful collaboration strategies.

## 2. THE STUDY

To gain input on student–industry activities from the perspectives of all three involved parties, i.e., university, students, and industry, the study is based on 34 interviews.

The university perspective was conveyed by eleven university representatives (nine teachers and two university–industry coordinators) from four universities, the student perspective by eleven students with experience of student–industry activities (e.g., various project forms and master thesis projects), and the industry perspective by staff from twelve companies, typically consultant managers, product managers, development managers, and project leaders. The projects represent a wide range of collaboration forms. The time elapsed between the completed student assignments and the interviews represent a wide range in time (e.g. one month to two years). No students received any payment for their student–industry activities.

This study focuses on engineering education, understood broadly, in order to include a variety of student–industry activities. The interviewees were chosen so as to obtain a valid sample; a requirement set by the researchers was that all interviewees should have personal experience of student–industry activities. Personal networks were used to find interviewees, but since collaborative activities are not registered, it was difficult to find interviewees with experience of unsuccessful collaborative activities. People involved in unsuccessful activities will often let contacts drop; nevertheless, some failed collaboration activities are represented in this study. The interviews are in-depth interviews based on a flexible design incorporating open-ended (semi-structured) questions [7]. The interviews were conducted by phone, except one that was conducted face-to-face. All interviews lasted 20–30 minutes. After the interviews, the material was transcribed verbatim. Before analysing and reviewing the interview transcripts, the researchers specified ten factors derived from the interview questions. The interview material was then coded using the predefined factors, analysed and discussed jointly by the researchers.

### 2.1. Validity

According to Yin [8], validity can be classified as construct validity, internal validity, external validity, and reliability. To reduce participant bias, which threatens construct validity, the interviewer was able to provide explanations during the interviews to prevent interviewee misunderstanding. All interviews were transcribed verbatim and then reviewed by the interviewees; this reduced the risks inherent in having one person perform, transcribe, and analyse the interviews.

No conclusions as to causal direction were drawn in this study, which sought to reduce internal validity threats. One threat to external validity is that participants may not be representative of the target population; to reduce this risk, all interviewees were required to have personal experience of student–industry collaboration activities. Reliability is clearly affected by how well the described procedures are followed and documented. Researcher bias must not affect the interpretation of the material, since this threatens reliability. To reduce researcher bias, observer triangulation [7] was implemented by having two researchers with different roles cooperate during the study, and by considering alternative interpretations and explanations.

Participant bias could threaten this study, if participants focus excessively on their own side of the story, articulate a distorted view of reality, and try to defend their own actions. Another threat is that the interviewees may have felt they were being evaluated, since the university itself had commissioned the interviews, even though the interviewer was external and it was initially explained that this was an objective study.

## 3. RESULTS

### 3.1. Relationships

Each of the three relationships between university, industry, and students has distinguishing characteristics. The *university–student relationship* is formal and is ultimately based on governmental regulations. It exists before, during, and after the collaborative activities, which are themselves closely linked to other educational schemes. Collaborative activities form only a small part of a long and many-faceted relationship; whether successful or unsuccessful, these activities are unlikely to permanently alter the relationship.

In contrast, the *university–company relationship* may be established shortly before the collaborative activities begin and may be terminated immediately after the student–industry activities end. Communications and meetings are concentrated in the period before the student–industry activities begin, when the foundation for these activities is built. A mutual understanding of the activity's structure,

content, and required resources must be established during the pre-activity phase. This is a time-consuming task for both university and company; university interviewees expressed a desire to build longer-lasting relationships with companies, reducing the time and energy needed to build new relationships. The university–company relationships encountered in the study are informal and rely on mutual trust; if agreements exist, they tend to follow the honour system rather than being strictly regulated. The relationship as such is not productive, its aim being to facilitate future student activities.

The *student–company relationship* varies greatly in duration depending on the type of collaborative activity taking place, ranging from a few hours to a full term. No contracts were signed between companies and students and no students in this study were remunerated for their efforts. The student–company relationship represents the active phase of the collaboration; during this phase, value is created directly for both company and students and thereby indirectly for the university.

### 3.2. Motivation

University, industry, and students enter into collaborative activities, each prompted by their own motives. The reasons for engaging in collaboration differ dramatically from party to party, but all comments made in the interviews relate to one of three aspects: 1) a strategic/tactical aspect, 2) an operational aspect, and 3) an individual/emotional aspect. The three aspects form *the motivation prism* (Figure 1).

The motivation prism

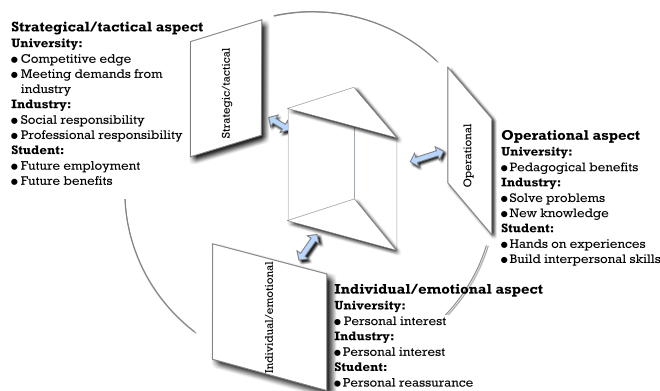


Figure 1. The motivation prism

#### 3.2.1. Strategic/ tactical aspect

For the *university*, motives relating to the strategic/tactical aspect concern external relationships. Several interviewees pointed out that universities face political pressure to meet industry demands, and to supply students with industry experience during their education. A motivating factor was also that student–industry activities would give the university a competitive edge in terms of student recruitment.

*Company representatives* demonstrated a sense of responsibility towards society. Companies were prompted to invest resources in student activities as a way of taking responsibility for society in general and for the profession more specifically. “It is all about taking responsibility for the industry” and “It is important to let students experience reality” were typical observations.

*Students* focused on their future. They wanted to engage in student–industry activities because they expected participation to ease their entry into professional life; all eleven interviewees in the student group cited this as a major motive. Ten student interviewees emphasized the value of establishing personal networks that include professionals from their chosen working field, to help them find suitable employment after graduation. Five students described the expected value of industry experience when applying for jobs in the future. Students also chose to engage in industry activities in the hope of gaining other benefits, such as the opportunity to conduct bachelor-level research at the company.

#### 3.2.2 Operational aspect

As far as the *university* is concerned, pedagogical goals dominate the operational aspect. University representatives said that they would initiate student–industry contact to establish a context in which students’ confidence and personal growth were encouraged; this factor, in combination with industry activities as an inspiration for students, was mentioned by eight of eleven interviewees in the university representative group. “We find this important in order to inspire students, so that they understand that this is for real and will work hard at their studies”, was how one interviewee put it. Bridging the gap between theory and practice was cited by five of eleven university interviewees as an important motive for entering into collaboration activities.

Regarding the operational aspect, *industry representatives* were very clear: A company will enter into collaboration to access new knowledge and strengthen itself by having students solve complex problems outside the company’s normal scope. Nine of twelve interviewees in this group cited this as a major reason for engaging in collaborative

activities with students. Another important motive was the possibility of selecting the most talented students and offering them employment at the company; this was mentioned by nine interviewees.

The main *student* motive relating to the operational aspect was to gain insight into real-world practice, this being cited by six of eleven interviewees in this group. They all found it worthwhile to invest time and energy to gain hands-on experience in their working field.

### 3.2.3 Individual / emotional aspect

An unexpected finding was that an individual/emotional aspect was an important part of what drives university, industry, and students to seek collaboration.

*University representatives* spontaneously commented that collaborative schemes were initiated because they personally found them “interesting”. Likewise, *industry representatives* commented on the value of meeting young people, finding such interaction “refreshing” and “invigorating” for them as individuals. Six of twelve interviewees in this group cited this as a motive for engaging in student–industry activities.

For *students*, individual/emotional motives emphasized reassurance, as students sought confirmation that they had chosen the right profession. “To me the most important thing is to get to know what my work is going to be like, so I know that I have chosen the right educational programme, the right education”, one student commented.

### 3.3 Evaluation

The interviewees cited several motives for engaging in collaborative activities. These motives clearly relate to the three aspects of the motivation prism, but the relative importance of the motives cannot be determined directly from the answers. However, interviewees were also asked to evaluate their own experiences of the collaborative efforts in which they had participated. All parties described what they found to be important for the success (or failure) of the collaboration. Comparing the fields mentioned gave an indication of the relative importance of the motives.

Notably, neither university nor industry interviewees cited factors relating to the *strategic/tactical* aspect during the evaluation. Obviously, the activities were not judged by whether or not they would advance strategic/tactical goals. Students, on the other hand, consistently found it important for a positive outcome to have established contacts with professionals, who would presumably help them in the future. Several student interviewees reported that they had already obtained employment or were scheduled for job interviews as a direct result of their student–industry activities. These students accordingly deemed the student–

industry activity an unconditional success, an evaluation relating directly to their strategic/tactical motives.

For all three parties, *operational aspects* dominated the evaluation. This was especially true for industry representatives; a positive or negative evaluation was largely dependent on the quality of the results delivered by students at the end of the activity. Industry representatives would frequently comment on the usefulness (or lack of the same) of the results delivered by students. One industry representative, who was dissatisfied with the student results, was disinclined to continue collaborating with the university, commenting that his company was not a “playground”. This relates directly to the collaboration motives stated by industry representatives. Likewise, university representatives would evaluate activities in light of their pedagogical benefits. If they felt that students had developed personally or had been inspired by the experience, they deemed the activity a success. This is also in keeping with their stated motives for entering into collaboration. Students found that the quality of the work experience was critical to the success or failure of the activity; several students also pointed out how important it was that the task assigned by the company be real. This clearly correlates with their original wish to gain genuine hands-on experience in their future working field. In addition, up to six of the students also cited the activity itself as an important learning experience and inspiration: “It is a much better way to learn, to gain knowledge”; “I produced things I couldn’t before, I was forced to learn”; and “It is a more practical job, where you have to apply theory, so it is valuable for my studies”.

The *individual/emotional* aspect also figured prominently in the evaluation. Industry representatives were especially eloquent on the subject, focusing on both the personal and working relationships between company representatives and university teachers. This does not correspond directly to their stated motivation for entering into collaboration, according to which relationships with *students*, not *teachers*, were cited as important. That personal relationships between company representatives and teachers were deemed important was highlighted by one industry representative, who found that a not quite satisfactory student result was compensated for by an excellent working relationship with the teacher during the activity phase of the project. Because of a personally satisfactory relationship with the teacher, she was prepared to continue collaboration in the future. University representatives found it conducive to a positive outcome that the activity be personally satisfactory, a view in keeping with the expressed motives. For students, it was important that they received the time and attention expected and that the company took a genuine interest in their results; this may indirectly relate to their wish to be reassured that they had chosen the right profession.

#### 4. DISCUSSION AND CONCLUSION

Collaboration focused on student–industry activities entails a complex interaction between university, students, and industry, and the university–student–industry triangle identified in our study is neither static nor balanced. Each of the three underlying relationships has its own structure; the activity phases of the relationships are not synchronous, and furthermore, each of the three parties enters into collaboration guided by different motives and expectations of the outcome. For university, industry, and students, the motives for entering into collaboration encompass three aspects: the strategic/tactical, operational, and individual/emotional aspects. However, when asked to evaluate actual activities, both university and industry representatives lost sight of the strategic/tactical aspect, concentrating instead on the operational and individual/personal aspects. University representatives may well be spurred to engage in collaborative activities to gain political and economic advantages for the university, while industry representatives may well be prompted to engage in student–industry activities by self-imposed social and professional obligations. However, once the relationship between university and industry is established and student–industry activities begin, the focus shifts. The participating company expects to receive talented students, whom it may later employ, and to have company assignments completed successfully by them. The university concentrates on securing pedagogical benefits for the individual students. A slight shift can also be seen in industry attitudes regarding emotional/personal aspects. Personal relationships with university representatives were not cited as a motivating factor, but nonetheless seemed to play a significant role in the ongoing success of the collaboration. The students' motivation and evaluation regarding the three aspects proved much more consistent throughout, focusing on future benefits, hands-on experience, and personal reassurance.

It is in the university's interest to stabilize the university–industry–student triangle, in which each of the three intertwined relationships displays its own characteristics. The student–university relationship extends beyond, and is only marginally influenced by, student–industry activities. In contrast, the student–industry relationship is defined by the activities. A successful student–industry relationship has two main components: 1) students who deliver results that meet the company's expectations; and 2) company representatives who display interest in both the activity outcomes and the students. The university–industry relationship relies both on the quality of the student–industry relationship and on the personal relationship between company representatives and their university counterparts. This highlights the importance of a successful student–industry relationship and indicates that to ensure stable collaboration, universities would do well to invest

time and energy during the pre-activity phase discussing the student assignments with the company. The students' tasks at the company should be ones that they can realistically complete successfully. Companies should therefore thoroughly understand student capabilities, and company expectations of the outcomes should be carefully calibrated. Universities should also make sure that companies fully understand the demands on company staff and time entailed by student–industry activities. However, a successful student–industry relationship is not enough. To further stabilize the university–student–industry triangle, university representatives should be prepared to enter into personal working relationships with industry representatives.

When first initiating student–industry activities, universities may well focus on the political and economic implications, recalling that companies may be prompted to participate in student–industry activities by their sense of social and professional responsibility. To ensure enterprise longevity, university representatives should concentrate on the realistic set-up of student–industry activities, on calibrating company expectations, and on their personal relationships with the company representatives.

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