



STUDENTS' PERCEPTION OF THE EUROPEAN PROFESSORS OF INDUSTRIAL ENGINEERING AND MANAGEMENT (EPIEM) NETWORK

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Abstract

This paper aims to mirror the way the European Professors of Industrial Engineering and Management (EPIEM) network perceives itself with a students' view. Along with a presentation of the status quo of the EPIEM network, a brief survey among students is deployed to get an impression of the perception of EPIEM by its most active partner association - the European Students of Industrial Engineering and Management (ESTIEM). The explorative findings (i) provide insights into the current situation of EPIEM from an inside and outside perspective and (ii) deliver ideas for the future development of the EPIEM network. With regard to the relationship management practice between EPIEM and ESTIEM this research represents an innovative approach within the European IEM organizations.

Key words: Industrial Engineering and Management, Management of Technology, Techno-Economics, Education, Research, Cooperation, Perception

1. Introduction

The high relevance of both education and research in the academic field of Industrial Engineering and Management (IEM) in Europe is undeniable [2].

This is supported by the fact that a majority of universities in the European Union (EU) member states as well as in the whole geographic area of Europe possess bachelor and master IEM programs. Hence, IEM organizations like European Students of

Industrial Engineering and Management (ESTIEM)(<https://m.estiem.org/>), European Students of Industrial Engineering and Management (ESTIEM) Alumni (<https://m.estiem.org/alumni>), and IEM Caring Foundation (<https://iemcaring.org/>) were initially founded by IEM students and alumni, respectively, in 1989, 1992 and 2014. In 2010 the European Professors of Industrial Engineering and Management (EPIEM) (<https://www.epiem.org/>) network emerged as the European-wide initiative to connect professors, teachers and researchers at universities within the IEM academic field. The core idea of the European IEM network (Fig. 1) – consisting of IEM students, IEM professors and IEM alumni – is to support a sustainable development of the whole society.

Next to the implementation of academic research in specialized disciplines like marketing, production system design or supply chain management, EPIEM focuses also on general aspects with a broad perspective within the IEM field. Examples include: employability for IEM graduates [2], [11], motivation of students, universities and industrial enterprises to get involved in joint projects, competencies requirements in IEM [4],[10] and solutions for developing them [8], [9], management models for IEM [8] as well as comprehensive framework models suited for this inter- and multidisciplinary field like the techno-economic framework [16], [17].

IEM programs across Europe are very different. Some are more related with Management and others with Industrial Engineering or Manufacturing. Also Engineering Management programs can be found.

Let's take a look back: For instance, according to Martin-Vega [7], Industrial Engineering was defined by the American Institute of Industrial Engineering in 1960's as: "*Industrial Engineering is concerned with the design, improvement, and installation of integrated systems of people, materials, equipment, information and energy. It draws upon specialized knowledge and skill in the mathematical, physical, and social sciences, together with the principles and methods of engineering analysis and design to specify, predict, and evaluate the results to be obtained from such systems*".

Today, maybe due to a "wild growth" and lot of varying definitions of IEM as well as diverse IEM field origins (geographically and professionally), the IEM curriculum at universities seems to suffer a serious reform. Alves et al. [1] identified a need to update IEM curricula with new production paradigms e. g. as Lean Production.

This context highlights the relevance of the EPIEM organization in a myriad of terms, definitions and differences. Thus the paper presents a case study that is related to IEM's history, EPIEM vision, its values, its mission and its activity. Additionally, this IEM background is mirrored through its perception by IEM students. This external view/the students' perspective is recognized as highly relevant by EPIEM, as

ESTIEM students in 2010 initially approached professors to engage and form the EPIEM network. Thus, this paper addresses to the following guiding questions:

- *What is EPIEM and how does the organization define itself?*
- *What is the perception of EPIEM among member of the ESTIEM network?*
- *What consequences can be read coming from points where the perception corresponds with the way EPIEM defines itself as well from points where there is a shift between these perceptions, or where the perception is "blurry"?*
- *How can EPIEM expand its cooperation with organizations within the IEM network?*

The findings of this work could help EPIEM to further broaden its activities in Europe and to increase its contribution for a better development of the cooperation within European IEM field. In this way, both readers with an academic and/or an industrial background who are interested in developing the IEM field further could benefit from this work-in-progress paper.

This paper is organized as follows: After a short introduction (section 1), we first review the background of the EPIEM network in the status quo (section 2). We then present the applied method for the survey among students (section 3). This is followed by the data analysis in the results section 4. Thereafter, we discuss the preliminary explorative findings (section 5) and conclude with an outlook on the future work within the EPIEM network (section 6).

2. EPIEM – Status quo 2020

This section is structured into four parts: the history of EPIEM, the EPIEM vision and values, the EPIEM objectives and the (recent) EPIEM activities (see also www.epiem.org).

As we referred to in the introduction, EPIEM was founded in 2010, 21 years (!) after ESTIEM. The initial goal was to connect IEM teachers by fostering collaboration across Europe to develop the IEM field further. The core idea was to have a network of professors who are conducting research in order to become better teachers for ESTIEM students and to help them to develop their personal successful career in industry and/or academia [27], [28]. This shows that EPIEM has its roots in ESTIEM / ESTIEM Alumni - as Fig. 1 shows [17] – as, of course, most IEM professors today have once been IEM students themselves. Back to history: Finally, in 2014 the IEM Caring Foundation was founded by some ESTIEM Alumni.

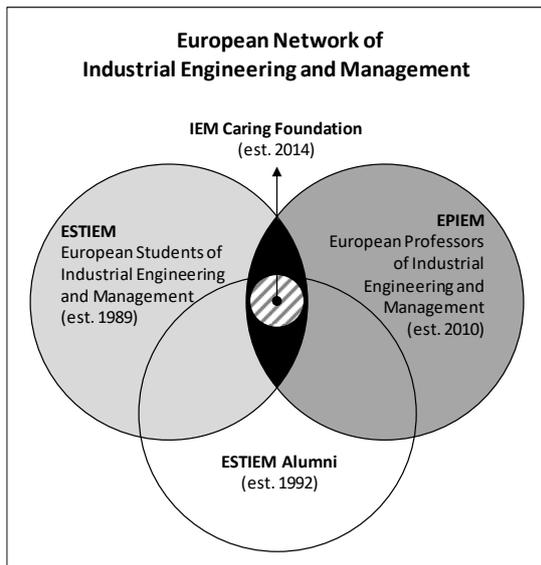


Fig. 1: Network position of EPIEM within the “European IEM Landscape” – Status Quo 2020 (www.epiem.org).

The actual EPIEM Vision [17] was refined in brainstorming sessions at the EPIEM conferences in Graz and Romania in 2018 (Fig. 2).

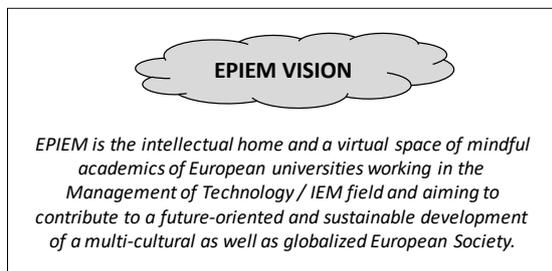


Fig. 2: The “EPIEM Vision” (www.epiem.org)

Based on the vision, the objectives of the EPIEM network were established as follows [14]:

- Create a common and well-known understanding of the Management of Technology (MOT) /IEM field across Europe
- Develop and promote IEM academic education on a university level and share best practices
- Enhance cooperation between academia and industry
- Encourage the engagement of IEM community in joint research projects
- Characterize IEM professional demands
- Facilitate international education of IEM students

One main activity – related with IEM research and teaching– is represented by 12 EPIEM Conferences in the last 10 years (see also www.epiem.org). These conferences took place in different Universities from Helsinki/Finland, Cambridge/The United Kingdom, Groningen/The Netherlands, Karlsruhe/Germany, Aveiro/Portugal, Graz/Austria and Vienna/Austria, Novi Sad/Serbia and Bucharest/Romania [15]. Note: Unfortunately, the two conferences scheduled in May 2020 in Vienna/Austria and in September 2020 in Tîrgu Mureş/Romania had to be postponed due to the

world-wide COVID-19 crisis.

Additionally, and with a focus on research, since 2017 the Austrian EPIEM network in cooperation with the Association of the three Austrian Technical Universities (www.tu-austria.at) performed 5 research design workshops (for further information please visit www.epiem.org) at Graz University of Technology. Two of these seminars are scheduled for the years 2020/21 [15].

3. Materials and Method

The instruments used in the present study are determined by an observation and a survey [12]. As authors are members of EPIEM they have access to information for observing and describing the EPIEM organization/network along with its activities connected with the vision, mission and values of EPIEM. So, in a first step a short overview of EPIEM in form of a “descriptive case study” is presented. In order to limit this risk, in a second step this paper involves an outside perspective. This is done by means of a survey targeting at investigating the students’ perception of EPIEM. Technically this is done through “a small sample survey”. The associated questionnaire was delivered anonymously and online to the target group: ESTIEM students. This practice in describing an “internal observation” and integrating a small sample survey is not an unusual way in research projects like this one. Thus, we opted for a qualitative analysis integrating quantitative data in form of a case study [10], which fits the exploratory nature of the research presented in this paper.

The qualitative research is perceived as shifting significant towards the creative, reflexive and narrative [3]. In line with this evolution the authors have participated in discussions with the EPIEM drive group (www.epiem.org) – a group of professors that act like an executive board in order to drive the organization as well as IEM in Europe towards a new level of development. The four professors from the drive group are active in Austria, Portugal and Romania within the Graz University of Technology, the University of Minho, the University of Aveiro and the University POLITEHNICA of Bucharest. The aim of the “discussion case study approach” within the EPIEM drive group is to identify trends and patterns in data – which is common to most qualitative research endeavors according to [6]: in this particular case the visions of the four drive group members, as well as to mirror how these trends are perceived by the ESTIEM students.

It has to be mentioned, that sharing sensitive data could lead to confidentiality problems [5]. This is a reason why both EPIEM drive group members as well as students participating in the survey remain anonymous. For data analysis there are three important quality requirements: (1) the use of instruments that are adequate for the research purpose and design, (2) unbiased extraction as well as (3) up-to-date

information.

With regard to the first requirement, this survey was done online with “Google Form” which have been sent out to the whole ESTIEM network via the ESTIEM representatives of each country. This – referring to the second requirement – ensures the anonymous character and avoids any bias among data coming from the participants in the survey. The third criterion for the quality of the research is, that the data has to be recent in order to be relevant, as old data may lead to findings that were relevant at the time of data extraction, but became irrelevant in the meantime. Therefore, (a) the discussions with the EPIEM drive group happened in September 2019 in Aveiro/Portugal and were (b) completed by reflective thinking and by intensive email communication in the period from September 2019 to March 2020. The survey questionnaire was developed in January 2020, refined in February 2020 and send to the ESTIEM student network in March 2020 via the above mentioned Google survey tool with anonymous responses. Thus, the responses are recent/up-to-date and the anonymity of the respondents is recognized.

Data analysis is done with the incorporated tool of the Google survey instrument and was combined with the enhanced Analysis Toolpak from Microsoft Excel®.

What follows is a descriptive analysis of the sample that will show the geographical distribution of the home universities as well as the graduation status (bachelor or master student) of the respondents.

The sample of students answering the survey consists of 96 students from 16 European countries: 32.3% (31) from Portugal, 20.8 % (20) from Romania, 11.5% (11) from Spain, from Austria 5.2% (5), Germany 5.2% (5), and The Netherlands 5.2% (5) and the rest 17.7% (17) from the countries with less than 5 respondents: Greece (3), Finland (2), Turkey (2), Serbia (2), Belarus (2), Italy (2) as well as Bulgaria (1), France (1), Poland (1) and Sweden (1). Two respondents 2% did not indicate their country.

The distribution of respondents – 33 universities across Europe: 20.8% (20) at the University of Aveiro, 12.5% (12) at the University POLITEHNICA of Bucharest, 7.3% (7) at the University of Tîrgu Mureş, 5.2% (5) at the Graz University of Technology, 5.2% (5) at the University of Porto and 46.9% (45) at other 28 Universities from which there were in each less than 5 respondents belonging to the countries previously mentioned. Two respondents 2% of the sample did not indicate their university. As shown in Fig.3, the sample consists of 61.7 % (58) bachelor students and 35.1% (33) master students, while the rest 3.2% (3) graduated recently. Two respondents 2% of the sample did not indicate their student status.

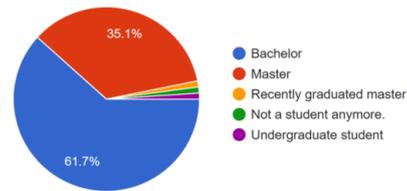


Fig.3: Sample: Distribution of respondents

Of course, the sample is rather small. Thus, it is not adequate for confirmatory research, but could be seen as exploratory research. The predominance of bachelor students in the sample is in line with the fact that usually bachelor students are active within the ESTIEM students’ association, as master students either already work while studying, or they orient their spare time towards their potential future employment.

4. Results

The external view from the perspective of the ESTIEM students is showed by the summarizing of the answers to the online Google survey undertaken with ESTIEM students in March 2020. The questionnaire contained 12 questions, from which 6 are relevant for this research. Five questions out of six were single choice question, so the respondents had to choose the answer option that fitted best their opinion. Only one question allowed multiple choices.

In the following, the results of the data analysis based on the answers to the survey are presented with the formulation of each question and the distribution of the answers.

Q1: Should the IEM curricula converge in Europe towards one unique model?

The answers (Fig. 4) where distributed 45.8% (44) with Yes, for a better identity of IEM and 54.2% (52) with No, differences are good for local/national needs.

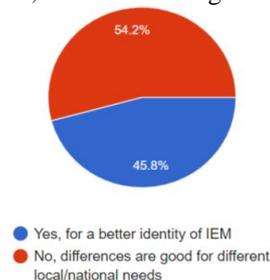


Fig. 4: Should the IEM curricula converge in Europe towards one unique model?

Q2: Do you know the values of EPIEM?

The answers (Fig. 5) to these question showed 46.9% (45) know a little bit about EPIEM values, while 8.3% (8) said yes and 44.8% (43) said no.

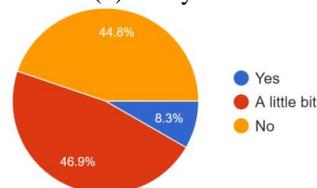


Fig. 5: Do you know the values of EPIEM?

Q3: Did you know ESTIEM students are invited to join EPIEM conferences if they wish?

As it is displayed in Fig. 6, 62.5% (63) answered No, but I would be interested, 15.6% (15) went for Yes, I didn't join an EPIEM conference till now, but I intend to do it in the future, 10.4% (10) chose Yes, but I am not interested, 6.3% (6) chose No and I wouldn't be interested and 5.2% (5) said Yes, I already joined an EPIEM conference at least once.

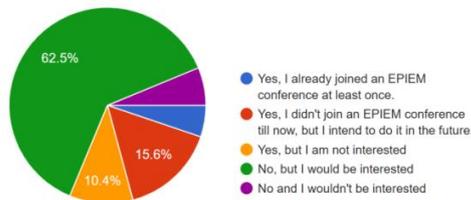


Fig. 6: Did you know ESTIEM students are invited to join EPIEM conferences if they wish?

Q4: Do you have at least one professor in the IEM field in your university that is close to students and open to their needs?

Q5: If the answer to Q4 was yes is he/she in EPIEM or would you tell him/her to join EPIEM?

The answers for Q4 are visualized in Fig. 7 and shows that a large majority of students 82.3% (79) do know at least one IEM professor that is close to the students, while 17.7% (17) do not.

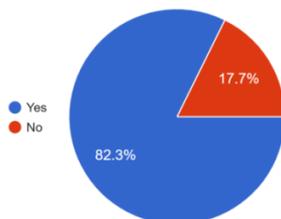


Fig. 7: Do you have at least one professor in the IEM field in your university that is close to students and open to their needs?

The analysis of Q5 related to the Yes/No answer to Q4 depicted that 43.4% (36) answered Yes. That professor is already EPIEMer, 33.7% (28) went for Yes. I don't know, but I will ask him/her, 3.6% (3) for Yes. He/she considers EPIEM but needs more information, 2.4% (2) chose Yes. I will send his/her email address to cristian.mustata@upb.ro so you invite him/her directly and 12% (10) answered No, I wouldn't dare to ask my professor such a question and 4.8% (4) went for No, I know he/she is not interested.

Q6: How could EPIEM be helpful for ESTIEM?

This was a multiple choice question, so a student could choose more than one way in which EPIEM could be helpful for ESTIEM.

87.5% (84) of respondents considered the option Through specific courses and training for ESTIEMers. 71.9% (69) chose Through academic recognition of ESTIEM activities, while 52.1% (50) chose Through communication about interesting master and PhD programs, 47.9% (46) chose each of the other choices Through interesting articles and insights in ESTIEM Magazine and Through new research offers for ESTIEMers. Seven answers were in the category "Others".

5. Discussion

We notice that responding students would wish to have curricula similar to their colleagues across Europe - 45.8% while 54.2% feel that differentiation is good. This would mean that EPIEM could try - in response to that - to define some key IEM courses that should be included in a European standard for IEM. Of courses, this should not be done solely on the basis of a survey with students, but also with companies hiring IEM graduates and universities.

The fact that only a small number of students know the values of EPIEM shows that EPIEM should be more transparent and engage in more public relations (PR) activities towards ESTIEM. This could be done e. g. by giving courses for ESTIEM according to the wish of a large majority of respondents 87.5% (84). These courses may include a seminar on Academic Ethics where EPIEM professors could also emphasize the values of EPIEM. In the same context, students think that EPIEM could send broader invitations to ESTIEM students to invite them to EPIEM conferences, as the respondents showed they would be very interested to join them 83.3% (80), but more than half of the interested students 62.5% (60) did not know that EPIEM conferences are open for them.

The survey also revealed a major potential to enlarge the EPIEM network through professor contacts originating from the ESTIEM students as it was also in the beginning of EPIEM going back 2010, as 39.7% (33) answered they know potential professors that fit the profile but are not yet EPIEM members. This development/growing potential should be used. At this point it should be mentioned, that the results/answers are biased through the fact that almost half of respondents 43.4% (36) are IEM students at European universities in the target countries which already "have an IEM professor". This means the potential could be even greater than measured. This instrument of network development could be measured with a survey that manages to reach more universities with ESTIEM students group that do not have an IEM professor yet.

In order to cover the needs of students, the EPIEM network could engage in further academic activities with students, which involve e. g. a target-oriented communication about their research activities including offers for students - as well as in relevant IEM master and PhD programs on a European level.

Besides the contributions of this work-in-progress paper, serious limitations such as the study design, the sampling process, the sample size, the sample distribution, the data analysis and its representativity have to be mentioned. A larger sample of ESTIEM students, of course, and an adequate representation of all the European countries/universities teaching IEM should be realized in future studies e. g. to make both the findings representative and benchmarking analyses across the European countries possible.

This working paper intended to address the description of the perception of students of the EPIEM network. Therefore, a survey was designed and based on the findings, the following measures have been generated. In the eyes of students EPIEM...

- should increase its PR activities,
- could better signalize its offer to students to collaborate on conferences,
- may advance more offers to students to participate in research projects,
- should offer courses and trainings for students that potentially are eligible to be recognized at the student's home university.

The findings are interesting as they would help the EPIEM network to act student-centered and integrate the students' view in its future strategic work. For instance, an option for future research would be e. g. the exploration of the perception of other relevant EPIEM stakeholder groups within the IEM network.

Referring to the strategic work [17] done from the strategic management of the EPIEM Drive Group so far and apart from that what is described in this piece of work, "EPIEM mid-term projects" might be done e. g. by:

- organizing an "Annual EPIEM Conference" including a competitive paper review process, published conference proceedings etc. Such an activity would increase the reputation and visibility of the EPIEM network.
- exchanging members of EPIEM for short-term research and teaching stays among the EPIEM member universities for e. g. teaching a class or writing papers.
- motivating students of the ESTIEM network to study at an EPIEM partner institution.
- foundation of a "legal entity" to organize EPIEM (e. g. postal address, secretary, issue invoices).
- signing e. g. ERASMUS teaching / exchange agreements between universities of the active EPIEM network on a professor's level. This would enable universities to set up visiting professorships between EPIEM professors for selected classes.
- supervising IEM PhD students collaboratively by signing up research and teaching agreements (with concrete goal) on a student's level.
- establishing strong partnerships with industrial firms that are willing to fund an IEM PhD research career and not only ordering short-term profit consulting projects as EPIEM perceives itself not as a business consultancy.
- writing textbooks (together with recognized publishing companies) in English language, targeting especially on IEM education.
- publishing in scientific IEM journals.
- trying to get transnational EU research funds.
- having some kind of "permanent paper development sessions" on the occasion of the Research Design Seminars which were

established by Graz University of Technology since 2017. This format could be spread out to every university within the EPIEM network if professors there are willing to collaborate.

6. Conclusions and Outlook

Grounded on the results obtained so far, it would be interesting to perform a survey among European IEM professors who are not yet involved in EPIEM and to among companies hiring IEM graduates. Also, ESTIEM Alumni and the IEM Caring Foundation should be addressed in order to evaluate their perception of the EPIEM network.

Finally, at this point it has to be made clear that the "EPIEM network 2020" perceives itself as [32] an active group of European professors that avoids duplication of work already undertaken by IEM partner institutions or partner networks e. g. IEM caring foundation, ESTIEM/ESTIEM Alumni (Fig.1).

"EPIEM network 2020" perceives itself as a network that represents the interests of its members (who are solely professors at European universities) that are in turn willing to support the IEM Caring foundation, the network of IEM students and IEM alumni voluntary and non-remunerated with activities that are in line with the EPIEM vision (Fig. 2).

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