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Organising an early phase of academic engagement: a case study of interactions between engineering and equestrian sports

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ABSTRACT

This paper explores the underlying processes of initiating academic engagement, seen from the university perspective. We do so through a longitudinal case study, of the university, Chalmers, and specifically around the engineering subjects, and the development of such relationships with a sector with few such traditions, namely equestrian sports. In terms of how the chosen university has worked to initiate academic engagement, we find, in contrast to existing literature, how, what we call researcher-teachers, primarily used students to engage with a variety of external organisations, rather than relying on research excellence. University management offered support and made small investments. In terms of perceived benefits, the researcher-teachers, university managers and students all stressed positive reputational benefits, especially attracting female students into engineering and diffusing engineering knowledge in society. Acknowledging the limitations of our study, three propositions for future research are to conceptualise the university as providing knowledge-intensive services, to explore the potential involvement of university management, and to articulate different phases of academic engagement.

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1. Introduction

University–industry interactions and collaborations are addressed in an extensive literature, and is also a contentious topic for public policy debates. Relevant review articles focus on academic entrepreneurship through spin-off companies (Rothaermel et al., 2007); the contributions of graduate students (Thune, 2009); the differing antecedents and consequences of such interactions, when differentiating commercialisation as patents and start-up companies from academic engagement (Perkmann et al., 2013); the impact of entrepreneurial universities on regional development (Guerrero et al., 2016; and how science can be effectively commercialised (Fini et al., 2019). The recent article by Perkmann et al. (2019) – based on an initial search yielding 4,156 publications – stresses the lack of longitudinal studies about university–industry interactions. Our interpretation is thus that 1) Previous literature tends to focus upon formal mechanisms for

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technology transfer, especially commercialisation, while more recently paying attention to academic engagement; and 2) Previous literature tends to focus upon already existing university–industry interactions, specifically on firms and sectors with a long tradition of interacting with universities. This suggests a gap in the literature, specifically the need to study the initiation of university–industry interactions, and in areas where both partners have little experience of such interactions. Therefore, this paper explores how and why a university can initiate academic engagement, and in a sector where both partners have limited experience of such interactions.

Our focus is upon initiating academic engagement. We define it now as 'Academic engagement refers to knowledge-related interactions by academic researchers with non-academic organisations, as distinct from teaching and commercialization', cf. Perkmann et al. (2019) Academic engagement is thus part of the portfolio of activities that individual researchers do, and although distinct, the literature indicates that academic engagement can be related, in different ways, to research, teaching and commercialisation activities. Within this broader concept, both formal and informal channels may be used. Extant literature (Davey et al., 2016; Laredo, 2007; Louis et al., 1989; Perkmann & Walsh, 2008) has shown that academic scientists can interact with external organisations through formal channels such as contract research and consulting as well as informal channels such as networking, discussions with practitioners, and informal technology transfer. We adopt this definition, and specify that these activities can include both formal and informal technology transfer channels.

Our aim is to explore the underlying processes of initiating academic engagement, seen from the university perspective. Within that, we analyse how a university has worked to establish and develop relationships with new external organisations, as well as why different groups inside the university perceive benefits. Empirically, we conduct a longitudinal case study, which is an appropriate research design to address our research questions. Moreover, the chosen empirical context allows us to investigate how the Chalmers university, and specifically around engineering subjects, develops such relationships with a sector with few such traditions, namely equestrian sports. Previous research has documented the change at Chalmers to an entrepreneurial university (Jacob et al., 2003) as well the organisation of the extensive relationships with existing engineering companies through university-industry centres (Lind et al., 2003; McKelvey et al., 2015). Later in the case study description, we describe how interacting with sports was chosen as a new direction for this university, Chalmers.

Section 2 provides a conceptual framework for addressing the initiation of academic engagement, while section 3 describes the research design. Section 4 presents the longitudinal case study, organised in terms of how the university initiated academic engagement, followed by why, e.g., the perceived benefits to groups inside the university. Section 5 concludes with three propositions, of relevance for future research.

2. Conceptual framework for understanding the initiation of academic engagement

Given the definition of Perkmann et al. (2019) of academic engagement as 'knowledge-related interactions of academic scientists with external organizations, set apart from research, teaching and commercialization', our focus starts from the perspective of

academic scientists working at universities. Note that we will also explore the possible roles for university management, as well as for students in initiating these processes.

2.1. Dependence upon academic scientists who excel in science

We will use the extensive literature on commercialisation and academic engagement to develop expectations for the initiation phase, even though the extant literature focus on existing university–industry interactions (Steinmo & Rasmussen, 2018), and often lack a dynamic perspective (Azagra-Caro et al., 2017). This literature has provided a fairly robust empirical finding, namely that the successful individual, academic scientist is key to understanding the phenomena of both commercialisation and academic engagement.

More specifically, certain characteristics of the individual scientists help explain the existence and impact of existing university–industry interactions, as documented in (Perkmann et al., 2013, 2019). Those individual characteristics which positively affect societal impact are: male, highly scientifically productive, with higher seniority, and having government grants (Azagra-Caro, 2007; Bozeman & Gaughan, 2007; Gulbrandsen & Smeby, 2005; Link et al., 2007). Different informal and formal transfer channels may impact the research orientation and standing of the scientist in slightly different ways. Fini et al. (2018) find a curvilinear effect between contract research with industry and academic standing. Individual academics are driving the change towards a more entrepreneurial university, such as through technology transfer, as well as changing the culture, leading to later peer effects (Bercovitz & Feldman, 2008; Berggren, 2017). Perkmann and Walsh (2009) differentiate academic consulting into opportunity-driven, commercialisation-driven and research-driven, with a discussion on the impact of more applied research. Perkmann et al. (2015) find that the 'independent activities' of scientists – e.g., outside their university's formal channels – is an underestimated but important part of academic engagement. Barbieri et al. (2018) find that creating a spin-off company has a negative effect on collaborating with industry, as measured by co-publications. Link et al. (2007) find that male, tenured, and research-grant active faculty members are more likely to engage in informal technology transfer. Our interpretation is that these characteristics of the individual scientists are also relevant to the initiation phase.

When turning to the motivations, the perceived benefits for academic scientists to engage in university–industry interactions are quite broad and diverse. Iorio et al. (2017) examine academics' motivations for engaging with industry, finding that intent to access funding and pro-social objectives are important. Ankrah et al. (2013) find that both university and industry actors have similar motives, and while they do not seek control over the others, both seek stability in the partnership. D'Este and Perkmann (2010), find that most academic scientists engage with industry to further their own research agenda, especially for joint research, contract research, and consulting. In doing so, the scientist and university expect some types of returns – such as beneficial outcomes, fulfiling goals or obtaining resources – in order to carry out these different types of activities like commercialisation (Ankrah et al., 2013; Chai & Shih, 2016). Mowery et al. (2004) argue that informal technology transfer channels are more common in areas involving practical subjects such as farming. Our interpretation of this literature is that academic scientists expect benefits to research and that informal transfer channels are likely relevant in engineering, also in the initiation phase.

Hence, based on the existing literature discussed above, our expectations for academic scientists in initiating academic engagement:

- The initiation of academic engagement is primarily driven by academic scientists to advance their own research agenda. Individual researchers take decisions and engage in activities to develop interactions externally.
- Researchers with the individual characteristics of male, higher productivity, higher seniority, and having more grants should be more likely to initiate academic engagement.
- Informal university–industry interactions should be especially relevant within our empirical context of engineering.

2.2. Exploring the possible roles of university management and students

Despite the focus in the extant literature on the importance of the individual academic scientists, we wish to use our qualitative study to explore the possible roles of university management and students as well.

To understand the possible role of university management, we briefly introduce literature that provides a broader framing of university management, given new demands for the university to explicitly interact with society and industry. A major shift of the university is to adopt the third mission, or entrepreneurial university (Etzkowitz & Leydesdorff, 2000; Etzkowitz et al., 2000). In Europe specifically, previous research has argued that the external national institutional contexts in terms of funding for research and teaching have been changing, putting pressure on the university to change its portfolio of activities (Bonaccorsi & Daraio, 2007; Genua, 2001). Thus, universities have external and internal pressures to increasingly interact with society.

Moreover, some literature has suggested changes in organisational management to become more strategic (Deiaco et al., 2012). In contrast to previous periods of self-organised professionalisation, university management – rather than individual scientists – are increasingly responsible for shaping the organisation by making decisions, and for representing, and articulating organisational goals (Krücken & Meier, 2006). This line of literature argues that universities are becoming more similar to other organisations in society, with formalised managerial decision-making, which is primarily top down, at least in strategic intent (Deem et al., 2007; Krücken & Meier, 2006; Miller et al., 2014). Bianchini et al. (2016) acknowledge that for knowledge transfer to industry, that there are feedback loops between the organisational and individual levels, specifically that how the university determines the allocation of duties and time will affect the economic incentives and career perspectives of the scientists. This literature suggests that university management is interested in certain circumstances.

Specifically in relation to commercialisation, the implication of this long line of research is that universities have had to transform their organisations in order to contribute to entrepreneurship, technology transfer, and the knowledge economy (Ankrah et al., 2013; Dietz & Bozeman, 2005; Siegel et al., 2004; Wright, 2007). In doing so, the university builds up competencies in new organisational forms, such as technology transfer offices and incubators (Rasmussen & Wright, 2015). Moreover, university management has financed the development of these formal organisational

structures (Bercovitz & Feldman, 2008; Link et al., 2007; Shane, 2004; Wright et al., 2008). Our interpretation of this literature is that university managers devote resources to developing high-level organisational capabilities for commercialisation, outside the control of academic scientists and traditional faculties, and this may also happen for the initiation phase.

Hence, based on the existing literature discussed above, our expectations for university management in initiating academic engagement are that:

- University managers may represent a strategic orientation for the organisation, in the sense that they are responsible for shaping the organisation by making decisions, representing the organisation, and articulating organisational goals.
- University managers are more likely concerned with formal structures to aid commercialisation of science rather than academic engagement.
- University managers can try to channel resources, develop incentive structures, and form new organisational structures in order to obtain such organisational goals, but outside the control of academic scientists and traditional faculties.

To understand the possible role of students, the current literature on academic engagement provides little guidance, leading to an expectation of low levels of involvement. Only a few current articles explicitly examine the relationships of students to academic engagement, whereas there is a huge literature on a different topic, namely how external organisations may impact education.[1] One exception is, Bianchini et al. (2016), who find that in a technical university in Italy, teaching quality is negatively related to consulting and positively related to research experience, but with mediating factors of seniority and scientific publications. In our empirical context, two papers identify Masters and PhD students as an important mechanism for interacting with companies within university-industry centres (McKelvey et al., 2015; Thune, 2009). Another paper identifies that teachers can organise students through projects inside courses, which deliver knowledge-intensive services to the community in social innovation and entrepreneurship (McKelvey & Zaring, 2018). Otherwise, regarding commercialisation, a large and expanding literature focuses on students as entrepreneurs in the sense of their roles in starting up companies (Minola et al., 2016). This includes their impact on regional economic growth (Guerrero et al., 2016). In Åstebro et al. (2012) the authors argue that in the USA, start-up companies by recently graduated students with degree in science and engineering are at least an order of magnitude larger than those by faculty members. Our interpretation is that students may play important roles, if organised within temporary structures such as centres or courses, or else primarily for commercialisation.

Hence, based on the existing literature discussed above, our expectations for students in initiating academic engagement:

- Students are not likely to initiate academic engagement, and if involved, to a low extent.
- If involved, then Masters and PhD students are the most likely categories to be involved in university–industry interactions.
- If involved, then students are most likely to help academic scientists with the commercialisation of their ideas into start-up companies.

3. Methodology and empirical context

Our research design is a longitudinal case study, in order to address the underlying processes of initiating academic engagement, seen from the university perspective. In doing so, we answer two sub-questions, how the university has worked to establish and develop relationships with new external organisations to initiate academic engagement, as well as why different groups inside the university perceive benefits.

The chosen empirical context allows us to investigate how the university develops new relationships with a sector with few such traditions. The university that we study is Chalmers University of Technology, shortened to Chalmers. In our single case study design (Stake, 1995), the case study is an analysis of the process involving the specific actors within this Swedish university, where academic engagement is initiated between engineering with a sector with little experience of interacting with universities, namely, equestrian sports. Equestrian sports specifically are important economically and socially in the chosen national context. Equestrian sports constitute the second-largest sport for youth in Sweden; approximately 20% of the Swedish population of 9 million ride horses either as a hobby or at a professional level; 90% of these are women.[2] A recent study estimated the size of the economic impact of the horse industry in Sweden to approximately 2.9 billion EURO (31,3 billion SEK) in 2016. This turnover is expected to generate just over 17,000 full-time jobs. In relation to GDP, the horse industry is estimated to be approximately 0.5% (Heldt et al., 2018). This empirical setting was chosen, because it differs from settings investigated in previous research (Perkmann et al., 2013, 2019) by providing us with a case study of a sector that is not accustomed to collaborating with universities.

3.1. Data collection

Our phenomenon of interest corresponds to what Yin (2009, p. 18) calls an investigation into 'a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between the phenomenon and context are not clearly evident'. Our data collection occurred contemporaneously with the period of the process studied, and was conducted following two distinct methodological steps for data collection, building on Yin (2009), Eisenhardt (1989), Strauss (1987), and Ailon-Souday and Kunda (2003).

The first step of data collection was to gather general material about the empirical context, over a longer period of time. We did so in order to understand the background empirical context, and this initial work allowed us enough understanding to choose this case study as relevant for our research questions. From 2011 to 2017, two of the authors collected background documents, and participated in events, specifically

(1) Background documents consist of 426 newspaper articles and press releases from the period 2011–2017, identified through internet searches.
(2) Ten events that were organised by the technical university, including its activities at associated events (such as horse shows) were attended. Two of the authors attended individually or jointly, in order to observe, collect printed documentation, take photographs, and make initial contacts with persons for interviews.

The second step of data collection was to interview selected informants, based on a semi-structured interview guide.

As reported in Table 1, we interviewed 18 key informants; and they were selected as active in this case study of academic engagement with equestrian sports, including researchers, students, and university managers. They were chosen, based upon participation in events, screening relevant university websites and through our identification of the key persons during the first step of data collection. We used an iterative and also a snowball effect strategy to find new informants, either through interviews or conversations with individuals at events.

These 18 interviews were conducted between August 2016 and August 2017 by one or two of the authors. The interviews conducted resulted in eight and a half hours of audio recordings and 67 pages of transcribed interview scripts. Twelve of the interviews were conducted face to face, three were telephone interviews, and three were email interviews since distance and time differences were an issue. All interviews were conducted in Swedish, and the authors have translated the quotes. Seven of the interviews were transcribed in full, from recorded sources whereas eleven resulted in written in a Word document based on hand-written notes and quotes taken during the interview. Our semi-structured interview guide focused on questions regarding the development of academic engagement with equestrian sports, the roles and motivations of informants to obtain data on the different types of actors involved, as well as questions related to outcomes and dynamics of key events and activities. Following Yin (2009), we complemented the guide with a few open questions.

3.2. Data analysis

The interviews constitute the main data collection for the data analysis, with background documents and participation at events useful for triangulation.

Following Ailon-Souday and Kunda's (2003) procedural advice of 'making sense' of data, we iteratively followed a series of procedures for analysis of the interviews in relation to our conceptual framework. The first step was to develop a chronology of the process. In doing so, we focused upon the process, and how the university initiated academic engagement, also using the additional activities of academics as providing education, research, and commercialisation. Our next step involved coding relative to the empirical categories of academic scientist, university manager and student. Each category was marked in a different colour and thereafter put into a dedicated computer file. We examined this interview material in order to identify perceived benefits. We then created a new document, where we sorted the quotes from the interview material chronologically, and in relation to the questions of how and why these processes were initiated. Finally, in order to increase internal validity, and partially check the reliability of our informants as sources, we triangulated the interviews against the main events, that we had previously identified by examining background documents and event participation. We examined the overlap between them and information from interviews, such as quotes, activities, and events. With this approach, we could provide a richer description of the historical development (Bowen, 2009), in relation to our research questions. Thus, in developing the data analysis, we have moved back and forth between the empirical material and the

Table 1. Overview of interviews conducted by authors (A1 = Author 1, A2 = Author 2).

	Informant	Role	Within semi-structured interview guide, main focus on	How	When	Transcribed or notes	Time	Authors involved
1	Informant 1	Student representative for equestrian sports in CST	Student perspective, development of CST, dynamic of projects	Face to face	2016	Audio tape In full	63 min	Author 1 (A1)
2	Informant 2	Mentor and moderator for the CST initative	Organisational view of Chalmers	Face to face	2016	Audio tape In full	50 min 42 sec	A1
3	Informant 3	Initator and researcher at equestrian CST	The history of CST, key actors	Face to face	2016	Audio tape In full	52 min 39 sec	A1
4	Informant 4	Initator and researcher at equestrian CST	The history of CST, key actors	Face to face	2016	Audio tape In full	64 min 14 sec	A1
5	Informant 5	Part of the Chalmers University management	Organisational view of Chalmers	Face to face	2016	Audio tape In full	67 min 40 sec	A1 & A2
6	Informant 6	Part of the Chalmers University management	Organisational view of Chalmers	Face to face	2016	Audio tape In full	68 min 3 sec	A1 & Author 3 (A3)
7–9	Group interview with three informants 7–9	Students engaged in horse projects	Student perspectives, engagement and experiences	Face to face	2017	Audio tape Summary notes of one page	c.a 15 min	A1
10	Informant 10	Students engaged in horse projects	Student perspectives, engagement and experiences	Phone	2017	Audio tape Summary notes of one page	29 min	A1
11	Informant 11	Students engaged in horse projects	Student perspectives, engagement and experiences	Face to face	2017	Audio tape Summary ntes of three pages	55 min	A1
12	Informant 12	Representative from a start up with experience of collaborating with CST	Key informant in project	Face to face	2017	Audio tape Summary notes of one page	c.a 15 min	A1
13	Informant 13	Initator and researcher at equestrian CST	Follow up interview key informant	Face to face	2017	Audio tape In full	21 min 14 sec	A1
14	Informant 14	Founder of a company working with ergonomic bridle and part of a project related to smart textiles with CST	Key informant project	Phone	2017	Audio tape Notes of two pages	c.a 25 min	A1
15	Informant 15	Researcher within equine science	Key informant project	email	2017	Email Summary notes of one page		A1
16	Informant 16	Researcher within equine science	Key informant project	email	2017	Email Summary notes of one page		A1
17	Informant 17	Researcher within veterinary science	Key informant project	email	2017	Email Summary notes of one page		A1
18	Informant 18	Employee at an equestrian company	Key informant project	Phone	2017	Audio tape Summary notes of two pages	c.a 20 min	A1

relevant literature, not only to identify gaps in the literature, but also to work with issues of external and internal validity, and to relate our findings to extant literature.

3.3. Limitations

Because our case study focuses on a single case study, we recognise that there are many limitations in terms of generalisability. Our case study is limited to one university in Sweden and examines only the initiation of academic engagement with external actors not accustomed to such interaction. Moreover, two of the authors are amateur equestrians, which can lead to methodological limitations. On the one hand, this background provides experience and contacts in the equestrian world, to understand the phenomenon studied. On the other hand, our personal involvement in the equestrian world risks to introduce some negative effects, such as a potential bias in positive interpretations of events. We are aware of this potential bias and the third author, who is not involved in equestrian sports, plays a valuable role in monitoring and relating the longitudinal case study to the theoretical contributions.

4. Initiating academic engagement between engineering and equestrian sport

4.1. How initiated? A chronology

In this sub-section, we address the question of how the university initiated academic engagement with new external organisations and individuals through a chronology of the case study. Figure 1 represents the timeline, as well as six lines of activities, and three arrows representing flows into the processes.

Figure 1 starts on the left-hand side, in 2011, with the first line of activity, namely 1) Initial researcher and stakeholder meetings. The initial idea for engineering researchers to interact more with sports came up due to an institutionalised form of search, whereby Chalmers holds annual seminars to stimulate new directions for research. The October 2011 seminar gathered about 150 participants, and the main speaker stressed that engineering could impact sports, specifically through equipment and material. This event also led to further activity for researcher and stakeholder meetings.

Figure 1 represents the arrow with stakeholder inflow, as well as linkages to four lines of activity, within the university, starting soon thereafter. In early 2012, a few faculty members decided to organise the first events related to sports – and they did so jointly with support from a university manager and student volunteers. Through their efforts, Chalmers arranged a series of workshops, where the first line of activity seen in Figure 1 is 2) Series of thematic interdisciplinary network workshops. These were called 'sports cafes', and organised in relation to the three sports of swimming, sailing, and equestrian sports. From his perspective of being involved in these events, Finnsgård (2015, p. 5) states there was an explicit choice to take a few sports 'within which Chalmers had committed faculty with both a background and connections'. Established in 2012, and including multiple sports, Chalmers started the initiative Chalmers Sports Technology, described as 'a platform where researchers engage with universities, industry, public

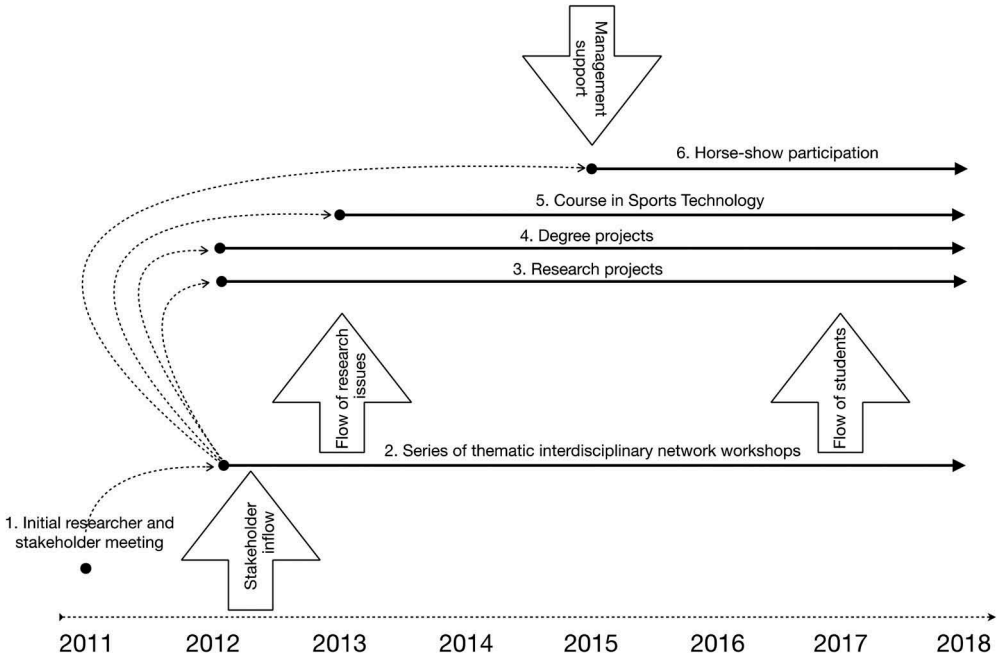

Figure 1. Timelines in initialising academic engagement between engineering and equestrian sports.

policy, students and society to undertake advanced sports-related research'.[3] This multidisciplinary initiative was hosted at the Materials Science Area of Advance at Chalmers.

One informant involved in equestrian sports explains the initiation of these activities as follows:

> Around 2011–2012 … somewhere … X and I started to talk about whether we could do something since … since we had noticed an announcement where you could apply for grants (from Chalmers) within equestrian sport … I have experience with horses since I was 9 years old … it has always been a hobby, nothing that I have been working with … and then X said that he had begun to work with smart textiles, so then we thought about it a little bit, about how we could use it … somewhere there it all started. (Informant 3)

For specifically equestrian sports, their cafe was initially conceptualised as a small event, but the response from the wider equestrian community was far beyond what as initially imagined. At the first workshop organised at Chalmers, about 300 participants came to listen to presentations, discuss problems, and interact with university representatives, in relation to finding out how engineering might improve both horse welfare and riding within equestrian sports. The participants included a wide range of external organisations and individuals, such as hobby riders, veterinarians, and small business owners. Hence, our interpretation is that the activities by Chalmers centrally inspired a few faculty members – both male and female – to act, using some administrative help and small grants from the central university, as well as being members of the Chalmers platform for collaboration with external organisations in sports.

As further visualised in Figure 1, these initial activities soon led to additional lines of activities at the university, namely 3) Research projects; 4) Degree projects for students;

and 5) A Course in Sports Technology. The course was more generally available for Chalmers students, and hence we will concentrate on the first two lines of activities in relation to engineering and equestrian sports.

Indeed, the lines of activities of research projects and student degree projects can be conceptualised as part of larger projects, organised by the involved researchers who were also teachers (hereafter, researcher-teacher). These faculty members worked to organise interdisciplinary research projects on 'Horse welfare', which can be further divided into one project for smart textiles for horses, such as sensors and measurements aimed at improving performance and health, as well as one for measuring techniques to identify cracks in hoofs. One respondent stated that the volunteering has been the most important reason for their success in the equestrian sports initiative, and also that their informal volunteer work should be considered the largest investment by Chalmers (and not monetary or other formal support).

In terms of the line of activities 3) Research projects, the idea was to start new projects in equestrian sports, based on existing knowledge. The interdisciplinary approach should include veterinary science, biology, behavioural science, textiles, physics, and engineering. Some conference papers and publications have emerged. While small sums have been provided by the university, and some initial research results have been published, at the date of writing, no large-scale external research funding has been obtained for engineering and equestrian sports. We do not find that the academic scientist is involved primarily for developing a research agenda, but instead their focus has been upon applying engineering to solve other issues, such as equestrian wellbeing and improving performance.

In terms of the line of activities 4) Degree projects, much more activities have been ongoing, involving students, as illustrated here. The teachers developed student projects, such as project assignments within course and thesis projects, and students were expected to have extensive external interactions. For smart textiles, a few smaller existing companies selling clothing and equipment within equestrian sports were interested if the project lead to evidence-based evaluations, such as sensors for rider posture. Students at the Bachelor and Masters levels can thus be seen as mechanisms for connecting Chalmers with external actors, working on topics such as 'Fitting a saddle to the back of the horse', 'Analysis of equine locomotion', and 'Measuring ECG, heart rate, and breathing with smart textiles'. As another illustration, students have tested a specific new measurement technique, in relation to existing ones, to detect cracks in horse hoofs. In this case, the students discussed both with practitioners such as veterinarians, both for technical and animal welfare issues in engineering classes as well as to examine the feasibility of commercialisation in entrepreneurship classes. Moreover, for Bachelor and Master's thesis projects, the Chalmers website has listed different projects, and specifically encourage students involved in equestrian sports to apply.[4]

In terms of the sixth line of activities, Figure 1 visualises that both 6) Horse-show participation and the arrow Management support occurred around the same time. The main horse-show referred to is the Gothenburg Horse Show, said to be the largest indoor horse jumping show in the world, with up to 70 000 tickets sold annually during the week-long show.[5] EuroHorse is run concurrently, with annually between 150 and 200 vendors, public shows and seminars related to equestrian sports.

As shown by this arrow, management support came in connection with the visibility associated with the professional horse-show. During a lunch held in the summer of 2015,

Chalmers university management decided to invest some resources to develop a 'smart fence' for show-jumping at the next Gothenburg Horse Show. The Chalmers fence would be 'smart' in the sense of gathering measurement data. The initial idea came from a central Chalmers manager, also engaged in equestrian sports, as reported in the news: 'We wanted to show that it is possible to combine an interest for equestrian sports with engineering studies'. The first Chalmers fence was a project lead by a researcher at the physics department, involving a team of eight students, and working on a design chosen through a contest. Subsequently, in years between 2016 and time of writing, Chalmers as an organisation has paid for a presentation booth, staffed by students and researcher-teachers, as well as some workshops.

According to our interviews, the perceived benefits from university managers include that a 'Chalmers smart fence' would allow Chalmers to be visible in the media, promote collaboration among students studying different disciplines such as engineering and design, as well as to attract engineering students interested in equestrian sports. In terms of media and social media, the Chalmers fence is arguable, according to researchers and students working with the smart fence, one of the most visible results of any research conducted or course given at Chalmers in the past several decades.[6]

In later years, the line of activities 4) Degree projects continued to be active, whereby Chalmers students and researchers interacted with other large external organisations, in discussion about how to reach their differing goals. The Swedish Warmblood Association wanted them to investigate whether such measurements could be used to select and breed horses that are less prone to injury. The organisers of the Gothenburg Horse Show hoped to enhance the audience experience of show jumping with the Chalmers fence, and also allowed a prototype dressage app (also a student project), where the audience could record their personal judgements digitally, to assign points to dressage movements. The audience judgements were then compared in real-time, to the points given by the dressage judges. For sustainability goals, Chalmers students and University of Gothenburg students worked in cooperation with SWT Development, Lövsta Future Challenge, the Swedish Equestrian Federation, and Got Event AB to develop the Ecoestrian fence, made of recycled textiles and paper. These are illustrations of how the university initiated interactions with external organisations, and also lead to the placement of the arrows in Figure 1. The arrow indicating stakeholder inflow through workshops and meetings continued to promote the arrow indicating the flow of research ideas as well as the arrow indicating the flow of students.

4.2. Why of interest to the university? Perceived benefits

This sub-section addresses why different groups inside the university perceive benefits. Table 2 is divided into the three groups inside the university, including the results of our analysis of their perceived benefits, as well as illustrative quotes.

The first row in Table 1 addresses the perceived benefits from initiating academic engagement, from the perspective of what we now call researchers-teachers. As identified in the previous sub-section, we find in our case study that there are only a few key researchers-teachers who are most active in initiating this academic engagement. Many of these individuals have a personal interest in equestrian sport, although some persons who later worked actively with equestrian sports as part of the Chalmers Sports Technology, such as horse-show participation were not involved in the sport.

Table 2. Perceived benefits for elements of the university, when initiating academic engagement in sports technology.

Elements inside the university	Benefit of academic engagement	Quotes
Researchers/ teachers – A few –	- Connecting researchers and interested students with new types of stakeholders - Providing the opportunity to commercialise science - Recruiting female students	'Both students and parents can be interested … make this connection … Chalmers and horses … which they may not have made before … if they had found us in another context.' (Informant 3) 'We have received support from the head of division of the Area of Advance. The person responsible for the educational programme, the vice president, has been positive; the former was a horse enthusiast and had four or five horses …. we received more and more (support. We went) … from being weird and odd individuals that did things illicitly … to receiving more support … both in words but also money.' (Informant 3)
University managers	- Branding and recruitment of female students - Knowledge diffusion - Networking with new types of stakeholders	'It is a very successful initiative that is very fun, and now it is at the Gothenburg Horse Show, a Chalmers fence that can measure how high the horses jump … it gives us a lot of goodwill … and recruitment of students.' (Informant 6) 'To diffuse research knowledge, including to individuals who do not work or study here … and this is an important part from many areas to reach individuals that normally do not encounter science on a daily basis … get a sense what is going on … what you can do … a kind of popular adult education … and it is a good PR too.' (Informant 1) 'The equestrian sport, I believe, is the most successful initiative … here we can collaborate with other types of companies than we usually work with … another type of arena, and it is also interesting for young people, it is a way to recruit individuals and encourage an interest in technology.' (Informant 6)
Students – many –	- Applying teaching to real-world problems - Connect with stakeholders - Recruiting female students	'As a student I hope that this initiative will attract more students to apply to the university; as a horse enthusiast I am really looking forward to using my knowledge as a contribution within equestrian sport.' (Informant 10) 'If you perform well, there is a chance for you to be a part of really fun projects, but also to access a valuable network for the future. I really think that this is something you should take advantage of as a student, to be connected to Chalmers' brand and image.' (Informant 11) 'They see someone sitting by the computer or someone wearing a lab coat writing on the blackboard … they see a new image and they are like, aha! This was fun and I like this, so maybe I can take a technical course and apply it to something that I like.' (Informant 1)

Our interpretation of the perceived benefits from the perspective of researcher-teachers is three-fold. One benefit reported is connecting researchers and interested students with new types of stakeholders, which has been covered extensively in the previous sub-section. Another is providing the opportunity to commercialise science. We identified a few cases of very early entrepreneurial projects aiming at commercialisation. As one researcher put it, 'for us it is important that there is some interesting research on the whole, but it is not very common that it actually leads to products as well'

(Informant 4). While the students' projects may lead to tangible outcomes (e.g., apps; smart fence; hoof crack detection project), we have not identified any viable commercial product sold on market at this time. Finally, another benefit that we identified is the potential to recruit students. Early on, the involved researchers-teachers have often stressed that their small-scale initiative could help encourage qualified female students to apply to Chalmers.

The second row in Table 1 addresses our interpretation of the perceived benefits, from the perspective of university managers. The first benefit is branding and recruitment of students, especially female students into engineering. This perceived benefit has likely helped the researchers-teachers to mobilise some resources from the university centrally, not least due to the positive publicity especially around the Chalmers fence. A university manager argued that the initiative has given the students an opportunity to be innovative and productive. A related benefit is to promote knowledge diffusion, to new areas not often in contact with engineering education. As one of the heads of a research division at Chalmers put it, 'Just think what good advertisement that can be for engineering education when they use the stable as a lab!' Finally, by engaging in these activities, Chalmers are networking with new types of stakeholders, the details of which have been provided earlier.

The third row in Table 1 addresses the perceived benefits, from the perspective of students at Chalmers. One benefit is that within their studies, they can apply teaching to real-world problems, and another benefit is to connect with stakeholders. By conducting their projects, the students can apply existing technology and methods to solve sport-related problems. Moreover, a final benefit also stated by current students involved is the potential for future recruitment of women into engineering.

5. Discussion and future research

5.1. Discussion

Our longitudinal case study explores the underlying processes of initiating academic engagement seen from the university perspective. It also places our analysis of the case in relation to our conceptual framework. While the presentation of the case study in the previous section addressed the how and why question separately, our analysis below is presented according to the three groups inside the university, ending with more general interpretations.

In terms of expectations of the possible role of academic scientists in initiating academic engagement, we expected the initiation phase to be driven by academic scientist to advance their own research agenda; that these researchers would have specific individual characteristics; and that informal university–industry interactions are especially relevant. Our finding about the role of individual academic scientists does not replicate previous research, as we do not find their motivation to be the primacy of research. Instead, we find that there are a few key individuals, who are instrumental in developing the lines of activities represented in Figure 1, but we renamed them researcher-teachers, due to the interlinking of education and research. Moreover, previous research led us to expect that the key individual characteristics would be male scientist, highly scientifically productive, with higher seniority, and having extensive research grants, especially public funding, where they can use their prominent positions from which to mobilise resources for research (Azagra-Caro, 2007; Bozeman & Gaughan, 2007; Gulbrandsen & Smeby,

2005; Link et al., 2007; Perkmann & Walsh, 2009). In contrast, we find that the researcher-teachers in our case spent much (unpaid) time and used small amounts of resources to mobilise resources; they set up smaller research projects and used students as volunteers. Their personal involvement – at least initially – appears to be more individually motivated as interested in the sport, rather than being led by research per se. Relatedly, we see most interactions as informal in this case study, also as found in the previous literature (Davey et al., 2016; Laredo, 2007; Louis et al., 1989; Perkmann & Walsh, 2008) but do not find that these informal interactions are primarily related to commercialisation per se.

In terms of expectations of the possible role of university managers in initiating academic engagement, we expected that university managers can represent a strategic orientation, that they are likely more concerned with commercialisation than academic engagement, and that they could channel resources to develop high-level goals, but likely outside control of academic scientists and traditional faculties. In contrast, we find that the university managers provide administrative support and small grants directly to the researcher-teachers, and some individuals interested in this specific sport initiated some early activities. However, our case study on academic engagement does not suggest that Chalmers has used intermediaries nor built up strategic and organisational capabilities, which contrasts with previous research about how universities build centralised organisations, in order to promote commercialisation (Rasmussen & Wright, 2015; Wright et al., 2008). Moreover, Chalmers' involvement with equestrian sports has led to a very high level of media visibility, especially on recruitment issue. Our interpretation, in line with extant research (Ankrah et al., 2013; Dietz & Bozeman, 2005) is that university management likely prioritises activities that give a more positive image, enabling goodwill and recruitment. Note however that low levels of financial or administrative support were given, relative to other central initiatives.

In terms of expectations of the possible role of students in initiating academic engagement, we expected that students would not be involved or only to a low extent; and if students are involved, it is more likely Masters and PhD students and that they are involved in commercialisation rather than academic engagement. In contrast, our analysis of the case indicates that students play a very important role in creating academic engagement by discussing and solving problems for external organisations, and also in being active at events outside the university. Students were very important to realise these goals, both through volunteer work, paid work, and student projects. Students primarily apply known technical and engineering knowledge to problems related to equestrian sports. Through the activities of the researcher-teachers, many different students have been involved, both graduate and undergraduate students, which is in line with previous research which stresses the role of PhD students (Thune, 2009) as well as PhD students, undergraduate and Masters students (McKelvey et al., 2015). However, in contrast to research on university-industry centres as continuing sets of relationships (Gulbrandsen & Smeby, 2005; McKelvey et al., 2015), we have not been able to identify much repeated and sustained interaction with known external organisations. With the notable exception of the Chalmers fence, most projects by students are one-offs, or else require the researcher-teacher to mediate contacts between students and external organisations.

Hence, in summary, our analysis of the case shows a different pattern for the initiation of academic engagement, than expected in extant literature. Rather than being motived

by research per se, in this case, the researcher-teacher develops and orchestrates student projects of relevance for their knowledge domain, but the student projects, not research, are the main mechanism for knowledge-related interactions with external organisations. Our interpretation of the case study thus suggests that students can be interpreted as resources that are useful to researchers for delivering academic engagement in two ways; first, the researchers use students as project workers to provide advanced knowledge to external organisations, and second, by reporting the student completion of courses and theses, the researchers are able to gain additional financial resources internally in the university. Our interpretation is that the main reasons given for connecting researchers and students to new stakeholders have to do with the ability to generate ideas and problems, and in diffusing relevant (existing) methods to the wider equestrian sports community. Interaction also gave students training in 'real problem-solving' activities – and in a sport where they are active. Note that in making this comment, we interpret that the student activities involved are not a classic case of outreach, and thus differs from documented charity work (Holdsworth & Quinn, 2010; Nicholls et al., 2015). Moreover, the possibility to recruit future students, specifically female students into engineering, was identified as a positive perceived benefit for all groups inside the university, and together with positive media exposure, helps clarify the interest of university management. The main differences from extant literature are that we find interaction as organised by researcher-teachers are not obviously dependent upon research per se, and they are primarily carried out by students.

5.2. Propositions and future research

Our first proposition is that the experience of partners inside and externally to the university affect outcomes over time, and therefore, different phases of academic engagement may have different antecedents and outcomes.

Studying different phases within academic engagement will require an understanding of the underlying taxonomy. We propose that such a taxonomy could be built by defining two dimensions which may affect these different phases. One such dimension is whether partners are experienced with previous interactions (Steinmo & Rasmussen, 2018). Another such dimension could be based upon degrees of formalisation of interactions, which may be evident in analysis of key events (Azagra-Caro et al., 2017). The temporality of interaction is a key issue, because in our case study, we interpret that the lines of activities, and virtual centres we identified, are examples of more temporary organisational devices for university–industry interactions, as compared to technology transfer offices, incubators and centres. In particular, we recommend that future research should analyse a variety of similar initiatives, as they unfold over time, to consider the dynamics of different phases.

Our second proposition is that the central role of the academic scientist in academic engagement may be augmented by university management in the phase of initiating contact with external organisations.

Future research should link the individual level and organisation level, especially to investigate the ability to obtain large amounts of external financial resources for research. Future research should tackle how different views of the university as a professional organisation, dependent upon autonomous scientists, who are conforming to universal codes of conduct in research (Merton, 1973) as compared to professional managers

(Krücken & Meier, 2006) may affect academic engagement. Future research should consider whether long-term success in academic engagement continues over time to rely upon the research excellence of individual academic scientists, and if that success is moderated by the allocation of resources and tasks by university managers.

Our third proposition is that researcher-teachers can initiate academic engagement by coordinating student projects as a knowledge-intensive service, but that over time, relying primarily upon students makes it difficult to maintain it over time without a strong research base.

We propose that future research conceptualise that academic scientists perform a portfolio of activities, leading to the delivery of knowledge-intensive services (Gallouj et al., 2013; Tether, 2014). They may be seen to do so in regards to research, teaching, commercialisation (McKelvey & Holmén, 2009; McKelvey & Zaring, 2018), as well as to academic engagement, as studied here. In our case study, instead of research *per se* or to commercial ends, the benefits here are often discussed in terms of improving equestrian welfare and 'the horse as a happy athlete'. Future research could analyse how researcher-teachers, using students, provide knowledge-intensive services as social innovations, designed for social change, improved welfare, and system-changing, as found in McKelvey and Zaring (2018). As compared with how companies succeed with service innovations (Tether, 2014), the university may not be able to deliver heterogeneity in a standardised service, nor more tangible outcomes, which can be delivered over a longer period of time, due to the inherent nature of research and education as dependent on knowledge production and diffusion.

Notes

1. Specifically, we acknowledge – but do not investigate – the extensive literature on how to organise education to design practical projects, which integrate theoretical and practical knowledge in this institutional context (Thune, 2011).
2. http://www.ridsport.se/Svensk-Ridsport/Statistik/http://www.hastsmart.se/sand/ accessed 2017-08-28.
3. http://www.chalmers.se/en/centres/sportstechnology/Pages/default.aspx accessed 2018-03-03.
4. Website chalmers.se, accessed September 18th, 2018.
5. Website gothenburghorsehow.se and eurohorse.se, both accessed September 18th, 2018.
6. See for example, https://www.chalmers.se/sv/centrum/sportteknologi/utbildning/Sidor/Chalmershindret-2018.aspx accessed 2019-05-05.

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