Bringing together engineering and equestrian sports: Exploring how a university initiates academic engagement with society

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Abstract

Within the extensive literature on university-industry interactions, one recent and influential stream of literature defines academic engagement with industry, and differentiates it from commercialization. This paper examines academic engagement with society and industry in a broad sense, by focusing on an area where interaction did not previously exist and where stakeholders do not have a tradition of interacting with universities. Bringing together engineering and equestrian sports in a European university constitutes the case study. The empirical material used includes 15 interview transcripts, field notes from 9 observations and document studies of 426 newspaper, articles and press from the period 2011-2017. We focus on how academics create the engagement with society, and the stakeholders, e.g. the process of developing the actual knowledge-related collaboration. Contrary to expectations, the main activities are related to education, but organized by individual researchers, and the university embeds what was initially an informal organization into a more formal organization, because the initiative attracted much public attention and potentially a target group for recruitment (e.g. female students interested in the overlap of engineering and equestrian sports).
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Abstract
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1. Introduction

Universities and higher educational institutions are widely recognized as important organizations in the knowledge economy (Gibb et al., 2013 Etzkowitz et al., 2000b, Florida and Cohen, 1999 and Gulbrandsen and Slipersæter, 2007). Some studies argue that universities are becoming “knowledge brokers”, “knowledge businesses” and “knowledge factories” (Gibb, Haskins, & Robertson, 2013 Padilla-Meléndez & Garrido-Moreno, 2012). When taking on these new roles, universities and higher educational institutes have also developed new organizational structures to stimulate knowledge transfer and innovation, such as technology transfer offices as well as more micro-level knowledge networks (Bonaccorsi & Piccaluga, 1994; D’Este & Patel, 2007; Link, Siegel, & Bozeman, 2007; Perkmann et al., 2013; Perkmann & Walsh, 2008) (Alexander, Miller, & Fielding, 2015).

Within the extensive literature on university-industry interactions, one recent and influential stream of literature defines academic engagement with industry, and differentiates it from commercialization (Perkmann et al 2013). Much previous research focused upon commercialization including how the universities have changed their organizational structure to promote the entrepreneurial university (Link, Siegel, & Bozeman, 2007; Wright et al, 2008). Previous research on commercialization have examined activities such as generating patents and inventions as well as the creation of spin offs companies (Bercovitz & Feldman, 2008; Perkmann et al., 2015; Rothaermel, Agung, & Jiang, 2007; Shane, 2004). Other research details changes within teaching and research (Davey et al., 2016; Laredo, 2007; Louis, Blumenthal, Gluck, & Stoto, 1989).

While commercialization can be primarily measured as patents and start-up companies, the concept of academic engagement encompasses a wide variety of activities involving knowledge-related collaboration between academics and external partners. Knowledge-related collaboration includes both formal activities such as contract research and consulting as well
as informal activities such as networking, discussions with practitioners, and informal technology transfer. Some research suggests that these ways of interacting have been more common at higher educational institutions that emphasise practical and technical education (Mowery, Nelson, Sampat, & Ziedonis, 2004), although other research demonstrates that academics in many different disciplines employ a wide range of ways in which the university can impact society (Hughes and Kitson, 2013).

At the same time, the role of universities more generally has captured the attention of practitioners and policy-makers, and is closely related to national institutional experiments to measure and steer money according to impact. The UK in particular – preceded by Australia and followed by other countries – have set out to identify impact, with a broad meaning on ‘society, industry, the third sector and policy-makers, and cultural health’ and the Stern (2016) report recommends implementing a very broad understanding of impact. In parallel with policy changes, recent research contributes to this on-going debate to understand the benefits, drawbacks and ways to measure the impact of universities on society more broadly (Salter et al, 2017; Penfield et al, 2014). There has been a surge of published paper on impact, yet the knowledge on this topic remains fragmented, with competing frameworks and often political agendas interpreting the results of research. More research should be done on topics that have attracted some initial attention, namely include what are productive interactions with stakeholders (Molas-Gallart and Tang, 2017) and why companies interact with universities for knowledge development (Ljungberg, Bourelos, & McKelvey, 2013). Still, the whole notion of ‘university impact on industry and society’ suggests intuitively that the university acts, and the society is impacted, e.g. an arrow from the university to society.

We address these gaps in existing literature by studying processes whereby the university tries to develop new areas, involving knowledge-related collaboration between actors internal and external to the focal university. Thus, our work adds to existing research in two ways. Firstly,
this paper examines academic engagement with society and industry in a broad sense, by focusing on an area where interaction did not previously exist and where stakeholders do not have a tradition of interacting with universities. Bringing together engineering and equestrian sports constitutes the case study. It is the only sport where men and women compete on equal basis. A European university specializing in engineering, e.g. Chalmers University of Technology (hereafter, Chalmers) is studied, and specifically their attempts to develop a knowledge-related collaboration between engineering and equestrian sports, within Chalmers Sport and Technology.¹ Equestrian sports constitute the second largest sport in Sweden; approximately 20% of the population rides either as a hobby or at a professional level; and 90% of the athletes are women.² Previously, interactions between universities and the equestrian world were in other areas (such as equine nutrition, veterinary sciences, agricultural economics). In contrast, this case study should contribute to innovation in sports. Hence, the national context where this initiative was developed is one in which there is a broad interest in this specific sport. Our case study is of the first more systematic attempt here to bring together engineering and equestrian sports.

Secondly, this paper examines the processes underlying the development of this specific case study of knowledge-related collaboration, involving actors internal to the university and external to the university. Our analysis defines academic engagement as a multi-level phenomenon, determined “by both the characteristics of the individuals as well as the organisational and institutional context in which they work” (Perkmann et al, 2013:429). This statement refers primarily to the academics. While we start from that side, we are interested in both the academics engaging with society, and the stakeholders, e.g. the actual knowledge-

¹ Chalmers in its documents defines it as a platform “where athletes, coaches, enterprise and governing bodies meet researchers, engineers and students to undertake advanced sports-related research” (Chalmers tekniska
related collaboration. Finally, because our case study was chosen in an area where stakeholders do not have a tradition of interacting with universities, the case study explores the processes of developing knowledge-related collaboration over time.

2. Understanding how the university initiates process of academic engagement with society

2.1 How to conceptualize what the university does?

Universities are widely recognized as particular types of organizations, with many debates about management, focus, goals, etc. Universities are creating offers to the community through “the creation of legitimacy for courses of action by full engagement of the relevant community stakeholders; and ensuring that the plans and proposals are clearly within the capacity, goals, and values of the institution”…” and at the same time manage to “engage interest from different parties in the process of doing things” (Gibb et al., 2013, pp. 22-23).

Our underlying understanding of the university and higher educational institutes (hereafter, universities) is built upon theories related to sectoral systems and knowledge-based competition, in an evolutionary economics sense (Nelson and Winter, 1982), but applied to the university sector. We therefore follow previous research, which argues that Schumpeterian theoretical perspective about the role of specialized knowledge in developing knowledge intensive services can be applied to analyzing competition in the university sector, in the sense that universities are trying to act strategically, and positioning themselves in order to obtain resources to meet new goals (Deiaco, Hughes, & McKelvey (2012). McKelvey and Holmén (2009) argue that this perspective enables us to conceptualize why universities provide particular activities, or knowledge intensive services, namely research, teaching and commercialization / third mission / impact. A service is characterized by an intangible output
by a close interaction between production and consumption by individuals, and intellectual property rights cannot easily be awarded for this type of services (Tether & Hipp, 2002). Universities may be adapting to a process where exchange of resources is co-delivered with various stakeholders (Davey, Rossano, & van der Sijde, 2016). One understanding is that they are intertwined, for example through generating knowledge, education, develop methods for science, networking and encourage social interaction (Salter & Martin, 2001), but in recent years, they are often separated. We study knowledge-based collaboration, where the main goal is not commercialization.

Building upon these ideas, we propose a more specific conceptualization of what universities are doing, when they provide three types of knowledge-intensive services: 1) Research. By engaging in research, universities generate new knowledge. This act of generating new knowledge is closely tied to advanced education and specialist knowledge found globally, and hence is primarily carried out by researchers; 2) Education and Teaching. By engaging in education and teaching, universities diffuse knowledge. This act of diffusing knowledge relies upon interactions between researchers, administrators and students. Students take what they have learnt, and diffuse that knowledge into society through their later activities and jobs; 3) Third mission. By engaging in commercialization and impact on society, universities help to diffuse and implement knowledge designed to fulfill practical goals, and with external stakeholders. Impact can engage researchers, students, administrators, etc., as well as many external stakeholders. There are many different conceptualizations about how to measure and conceptualize impact, such as, Does impact constitute separate activities or is it integrated in research and teaching? Does one primarily refer to commercialization (e.g. patents and start-up) or does one constitute all types of impact? We therefore start with these three types of knowledge-intensive services, and examine what the university has done.
2.2 How academic engagement is linked to individuals and organization

Given that academic engagement is a multi-level phenomenon, this means that many different factors influence its development and foci. In launching the concept, Perkmann et al., 2013:430) identify three factors which influence academic engagement – e.g. individual factors, organizational factors, institutional factors - and also identify three types of output, e.g. scientific, educational and commercial. Moreover, they postulate that academic engagement is primarily driven by individuals, and much less organizationally embedded. We will analyze three actors internal to the university, namely the researcher, the student, and the university manager.

Researchers (employed at the university) constitute the first type of individual that we will study. As defined in this literature, individual factors primarily refer to the researchers. Individual determinants which positively influence academic researchers to be involved in academic engagement include male, scientifically productive, higher seniority, and government grants (Azagra-Caro, 2007; Gulbransen and Smeby, 2005; Bozeman and Gaughan, 2007; Link et al, 2007). In terms of their rationale (or what they expected to get out of the collaboration), a wide range of different reasons has been found in the literature. Generally, these studies find that the least important rationale for a researcher is to commercialize while the most important ones were receiving new insights in research, learning opportunities and feedback as well as networking and increasing visibility (Perkmann and Walsh, 2009; Perkmann et al., 2013; D’Este and Perkmann, 2010; Berggren and Berggren, 2017). Academic engagement may also positively contribute to research and teaching, through access to grants, ability to address complex problems in groups, and funding for equipment, materials and students (Lee, 2007; Baba et al, 2009; Ankrah et al, 2013). Logically, researchers with a large network may have an easier access to find channels to contacts in the industry, which additionally could have a positive impact on the
collaborative behaviour, productivity and increase the access to public resources as well as attract funds.

Students are the second type of individuals. This literature does not provide specific predictions or understanding of what types of students might be involved in these types of activities. Social innovation resembles what we are trying to capture, e.g. this broader impact upon society, and literature on this subject shows how students are often heavily involved, often in volunteer capacity. Our focus is only on activities that student engage in as related to their studies. McKelvey & Zaring, 2017, p. 1) propose that the university as an organization can organize social innovation, leading to “a type of public good involving collective action by multiple stakeholders. This public good can be regarded as a service, as it is co-delivered based on the development of multiple network and partner relationships”. Moreover, they conceptualize social innovation, as involving three characteristics: 1) The main purpose and driving force for social innovation is societal change rather than profit making; 2) Social innovation leads to an increased welfare, life quality and improved networks (not reciprocally excluding); and 3) Social innovation is system changing, because it changes opinions, behaviours and structures as well as stimulating more profound societal changes. In relation to sports specifically, sport management literature defines individual athletes as being willing to try new ideas, and propose they are more creative due to high level of interest (Franke & Shah, 2003; Ratten, 2016). Similarly, much of the research on user innovation has focused upon sports (von Hippel).

University managers are the third type of individuals. They are individuals but we see them as a proxy for the organizational level, in the sense that they determine, represent and articulate organizational aspects such as formal incentive structures for careers, leadership, department

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3 Recent research has focused extensively upon students and alumni engaging in entrepreneurship, but this is not so relevant here, because that literature focuses upon commercialization.
climate, and strategy. Much research suggests that universities have had to transform their organizations in recent decades, in order to more intensively contribute to societal interaction, entrepreneurship, technology transfer, and the overall knowledge economy (Ankrah et al., 2013) (Bramwell and Wolfe, 2008; Wright et al., 2008; Youtiea and Shapira, 2008). University management has aimed to improve personal prestige, academic fame as well as resources for conducting research (Ankrah et al., 2013; Dietz & Bozeman, 2005; Siegel, Waldman, Atwater, & Link, 2004). (Siegel et al., 2004).

Building upon these ideas, we thus propose to study three types of individuals – researchers, students and university management. By researchers, we mean active researchers, who are involved in research and teaching within the area. By students, we mean ones who are being educated at the university and involved somehow. Given the empirical phenomenon is sports, we expect a high level of interest from active athlete-students. By university management, we mean persons involved in leadership positions, and as a proxy for the ‘organizational support’ and strategy. We recognize that they would typically also be researchers, but we are interested in them in their role as leaders and thus representatives for the organization.

2.6 Conceptual Framework

Our view is that knowledge-related collaboration constitutes the core activities in academic engagement, and therefore study the processes of creating knowledge-related collaboration, in a new area. Our broader conceptualization includes universities as providing knowledge-intensive services to obtain resources and ‘compete’, and therefore we examine what the university has done within each, and in connection to which types of actors external to the university. We will then go on to analyze the university as consisting of three types of internal actors – researchers, students, and university management. In order to capture these processes, we will study what researchers, students, and university management do (e.g. activities) and
their rationale (e.g. how they motivate activities and providing resources), during these processes of developing knowledge-related collaborations. In this, we assume the university decides to structure collaboration (e.g. co-produce the service) in a new area for a reason or rationale, which enables them to position themselves in order to obtain resources to meet new goals. We acknowledge that this rational may be initially ill-defined initially, but propose that over time, different rationales can be identified. By focusing upon the time when the university tries to create new knowledge-related collaborations, we will therefore be able to identify the actors external to the university as well, e.g. who is willing to interact with the university.

Building on existing research discussed above, we have extracted four propositions of what we expect to find: 1) The university can organize new processes in this new area to co-produce the three knowledge intensive services, but research related ones are likely the basis for interaction; 2) Researchers involved are likely to have certain characteristics - male, scientifically productive, higher seniority, and more government grants; 3) Students involved are likely personally engaged in the sport; 4) University managers are likely not very engaged or interested. The reason is that academic engagement can be characterized as not very organizationally embedded and instead autonomously driven by individual researchers.

3. Research design and empirical context

3.1 Motivation for research design

This paper is based on a single case study design (Stake, 1995), where the case study represents the phenomenon of a focal university initiating academic engagement with society, in a new area. The reasons and steps taken in conducting our case study build upon Yin (2009) and Eisenhardt (1989). Our phenomenon of interest corresponds to what Yin (2009, p.
18) says provides us the opportunity to investigate “a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between the phenomenon and context are not clearly evident”. Furthermore, we use many different data sources and also make some limited contributions to theory building, in area where there is little previous research and where there is comparatively poor understanding Benbasat, Goldstein, and Mead 1987).

Empirically, the case study can be described as bringing together engineering and equestrian sports under Chalmers Sports and Technology (CST; see Section 3.2). From the beginning, two of the authors are participated sporatically in activities, but as individuals interested in the topic. In January 2016, we started a systematic research project, based upon conducting interviews, field notes, transcribed interviews and document studies. Given that we are examining a process under development, we have collected data at multiple level and from different sources, including: 1) Documents. We have collected and analyzed 426 newspaper, articles and press releases from the period 2011-2017 and 2) Interviews. 15 key informants at Chalmers, e.g. involved in CST were interviewed. 3) Authors’ participation at activities, events and social media. The authors have also participated in most associated activities and events in Gothenburg during three years. This enabled us to collect more documents, take pictures, interact with the persons interviewed, contact additional persons, etc.

The first step in the research design was collection of documents, in order to to understand the empirical settings (Merriam (1988) and especially outline the specific central activities and major events. We primarily used the documents. The documents were collected, based on searches of internet, with different combination of the following key words such as “Chalmers Sport and Technology”, “Chalmers”, “Equestrian”, “Horses” and “Projects”. As detailed in Table 1, we collected different types of web-based data including news articles, web sites, blogs, social media, magazines, catalogues and documents. During participation at
activities, we collected documents, both printed and electronic, as well as documents from the activities which took place before our research project started.

Table 1: Collected documents including social media 2011-2017

<table>
<thead>
<tr>
<th>Type of document</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>Unknown Year</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Webb based newspaper</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>8</td>
<td>32</td>
<td>23</td>
<td></td>
<td></td>
<td>69</td>
</tr>
<tr>
<td>Websites/web based documents</td>
<td>10</td>
<td>7</td>
<td>15</td>
<td>6</td>
<td>42</td>
<td>55</td>
<td>4</td>
<td></td>
<td>139</td>
</tr>
<tr>
<td>Report, magazines and brochures</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>News sites, radio and TV</td>
<td></td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td></td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>Blogs</td>
<td>10</td>
<td>10</td>
<td>7</td>
<td>3</td>
<td>5</td>
<td>6</td>
<td>1</td>
<td></td>
<td>42</td>
</tr>
<tr>
<td>Press releases</td>
<td></td>
<td>1</td>
<td>4</td>
<td></td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>Scientific articles</td>
<td>1</td>
<td>2</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Social media (Facebook, twitter, Youtube and Instagram)</td>
<td></td>
<td>7</td>
<td>3</td>
<td>90</td>
<td>58</td>
<td></td>
<td></td>
<td></td>
<td>158</td>
</tr>
<tr>
<td></td>
<td>22</td>
<td>23</td>
<td>20</td>
<td>24</td>
<td>179</td>
<td>152</td>
<td>6</td>
<td></td>
<td>426</td>
</tr>
</tbody>
</table>

The next step was to conduct interviews with identified key informants in order to develop a more in depth understanding. In total 15 key informants (see Table 2) active in CST were selected for semistructured interviews, including researchers, students and university
managers. The interviews were conducted between August 2016 to August 2017, by one of
the authors. We used an open qualitative interview guide and focused on questions regarding
the development of CST, their roles and motivations, examples of projects and collaborations,
outcomes and dynamics of key events, activities and key individuals. We also followed Yin’s
(2009) advice, that open interviews are a way to find explorative material, including asking
additional questions and more material. Interviews were recorded and transcribed in most
cases. Otherwise handwritten notes have been conducted. The interviews were mostly
conducted face to face but when that was not possible, telephone interviews were conducted.
All interviews were conducted in Swedish, made anonymous and the authors have translated
quotes reproduced here in this paper into three different levels (students, researchers and
university manager). Three email conversations provide additional information from
respondents.

Table 2: Interviews
<table>
<thead>
<tr>
<th></th>
<th>Respondent</th>
<th>Focus of interview</th>
<th>How</th>
<th>When</th>
<th>Transcribed</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Informant 1</td>
<td>Student perspective, development of CST, dynamic of projects</td>
<td>Face to face</td>
<td>2016</td>
<td>Yes</td>
<td>1:03:00</td>
</tr>
<tr>
<td>2</td>
<td>Informant 2</td>
<td>Organisational view of Chalmers</td>
<td>Face to face</td>
<td>2016</td>
<td>Yes</td>
<td>50:42</td>
</tr>
<tr>
<td>3</td>
<td>Informant 3</td>
<td>The history of CST, key actors</td>
<td>Face to face</td>
<td>2016</td>
<td>Yes</td>
<td>52:39</td>
</tr>
<tr>
<td>4</td>
<td>Informant 4</td>
<td>The history of CST, key actors</td>
<td>Face to face</td>
<td>2016</td>
<td>Yes</td>
<td>52:39</td>
</tr>
<tr>
<td>5</td>
<td>Informant 5</td>
<td>The history of CST, key actors</td>
<td>Face to face</td>
<td>2016</td>
<td>Yes</td>
<td>1:04:14</td>
</tr>
<tr>
<td>6</td>
<td>Informant 6</td>
<td>Organisational view of Chalmers</td>
<td>Face to face</td>
<td>2016</td>
<td>Yes</td>
<td>1:07:40</td>
</tr>
<tr>
<td>7</td>
<td>Informant 7</td>
<td>Organisational view of Chalmers</td>
<td>Face to face</td>
<td>2016</td>
<td>Yes</td>
<td>1:08:03</td>
</tr>
<tr>
<td>8-10</td>
<td>Group interview with three informants 8-10</td>
<td>Student perspectives, engagement and experiences</td>
<td>Face to face</td>
<td>2017</td>
<td>Notes</td>
<td>0:15:00</td>
</tr>
<tr>
<td>11</td>
<td>Informant 11</td>
<td>Student perspectives, engagement and experiences</td>
<td>Phone</td>
<td>2017</td>
<td>Notes</td>
<td>0:29:00</td>
</tr>
<tr>
<td>12</td>
<td>Informant 12</td>
<td>Student perspectives, engagement and experiences</td>
<td>Face to face</td>
<td>2017</td>
<td>Notes</td>
<td>0:55:00</td>
</tr>
<tr>
<td>13</td>
<td>Informant 13</td>
<td>Company employee engaged in Chalmers</td>
<td>Face to face</td>
<td>2017</td>
<td>Notes</td>
<td></td>
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<tr>
<td>14</td>
<td>Informant 14</td>
<td>Follow up interview key informant project</td>
<td>Face to face</td>
<td>2017</td>
<td>Notes</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Informant 15</td>
<td>Key informant project</td>
<td>Face to face</td>
<td>2017</td>
<td>Notes</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Informant 16</td>
<td>E-mail</td>
<td>2017</td>
<td>Written e-mail</td>
<td></td>
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</tr>
<tr>
<td>17</td>
<td>Informant 17</td>
<td>E-mail</td>
<td>2017</td>
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<tr>
<td>18</td>
<td>Informant 18</td>
<td>E-mail</td>
<td>2017</td>
<td>Written e-mail</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The third step was to analyze the material both chronologically and also according to the categories in our conceptual framework. The collected empirical material from documents and interviews have been categorized and coded in themes – education, research and societal interaction – taken from the theoretical section. Following the procedure of Ailon-Souday and Kunda (2003) of ”making sense” of this data we had a three main procedure of analysis. The first one involved coding (Ailon-Souday & Kunda, 2003, p. 1079; Strauss, 1987). The
interviews and documents were carefully read through in an attempt to, as Ailon-Souday and Kunda (2003) wrote, "verify, discard, combine, or modify coded groupings" (p.1079). Each category was coloured in different colours and thereafter given a computer file where additional information were copied and pasted into it. The second step was to arrange the coding chronologically in order to receive a historical view of CST and thereafter was to read the material once again and identify underlying themes (categories) which was then labelled education, research and societal interaction (see Table 3) (Ailon-Souday & Kunda, 2003). The final step was to create an additional document where we sorted the quotes from the interview material and documents chronologically, in phases and in the different coding categories (research, education and societal interaction) in order to receive an overview of the development in terms of activities and outcomes of CST (see Tables 4, 5 and 6). This was done after our chronological description of the empirical case. Moreover, in order to increase the reliability of the analysis sources, a qualitative document analysis of 426 electronic and printed document (see Table 1) was made in order to support the interview information (such as quotes, activities and events). With this approach, we could provide a more rich description of the historical development (Bowen, 2009)

3.2. Empirical context: Chalmers sport and technology

Chalmers is an internationally known Swedish university of technology, specialized in certain parts of the natural sciences and engineering, ranked on the Leiden list (www.leidenranking.com). Chalmers has extensive contacts with companies, and within Sweden, it has the most contacts with companies, as measured by company grants to research (Ljungberg et al 2009). What we are interested in became Chalmers Sports and Technology (CST), which the university now describes as “a platform where researchers engage with universities, industry, public policy, students and society to undertake advanced sports-related research” (Chalmers tekniska högskola, 2017).
Chalmers has had annual seminars, to stimulate new ideas and network, and to create a forum for inspiration to the faculty as Chalmers. In October 2011, the Chalmers annual seminar focused upon sports and technology. Professor Jan-Anders Månsson from Swiss Federal Institute of Technology in Lausanne, held an inspirational talk about the potential to influence sports technology⁴. 150 people participated in this seminar. This 2011 seminar is seen as the starting point to a series of later different activities, related to sports more generally. A few persons were highly interested, and they arranged a series of workshops, called “sport cafes”, in relation to swimming, sailing and equestrian sports. The purpose was to bring in persons outside academia. The idea is that these meeting points – often over a lunch or meal and a speakers – are places where athletes, coaches, companies, public organizations and the general public can meet researchers and students to adopt advanced sport-related research. Spanning a range of scientific disciplines, this initiative aims to improve performance and safety for athletes in the chosen sports⁵. Finnsgård (2015:4) argues there was an explicit choice to take a few sports “within which Chalmers had committed faculty with both a background and connections”.

4. Bringing together Engineering and Equestrian Sport

4.1 What knowledge-intensive services did the university co-produce? And with whom?

This section provides an overview of the knowledge intensive services, which we here describe as activities that the university organized. The timeframe is between the years 2011 to 2017, and only reports activities to bring together engineering and equestrian sports. This section first provides a chronological overview, where we provide insight into key eventss, in terms of who had the ideas, where resources were obtained, and how goals were formed for

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⁵ http://www.chalmers.se/en/centres/sportstechnology/Pages/default.aspx accessed 2017-05-03
academic engagement during this time period. We then provide two tables. One table summarizes all the activities, categorized as being primarily research, education, or societal interaction. The second tables summarizes who they are engaging with, e.g. our categorization of the main types of organizations, derived from the specific partners.

After the Chalmers workshop on sports more generally in 2011, there was an attempt to mobilize faculty to participate. One of the first on-going activities was a student thesis project, within a larger project on “Horses Welfare”. This project focused on smart textiles and horses, running 2011-2012, and was developed from collaboration between researchers interested in the two sides of the equation:

> Around 2011 2012…somewhere… X and I started to talk about if we could do something since…since we had noticed announcement where you could apply for grants within equestrian sport…I have experiences of horses since I was nine 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 though about it a little bit of how we could use it…somewhere there it all started

At this early stage, the initiative primarily relied upon individuals’ interest in the sport, but in a context where the organization had identified that sport could be an interesting area for the future. Sailing and swimming were seen as sports where more obviously the materials could be improved through engineering. Researchers who were involved in the Equestrian sport initiative from the start told us that others sometimes had trouble to see the connection between horses and sport technology, and they had to convince CST to include equestrian Sport. They were inspired, but given there was initially no official support, starting up activities required their own personal engagement, which they tried to do between their regular job assignments. In this period, there was alot of discussion of what they could possibly do, and also a key question of but “if the ”horse-world” was interested…was the sport-world interested?” In other words, even if they could initiate some activities, was anyone interested in what Chalmers could provide?
Chalmers as an organization had decided to have ‘sport cafes’, and workshops, in the different sports, held at the university. This type of interaction was the model here as well, with some support of ideas and energy from a person higher up in Chalmers. The researchers and students who arranged the initial workshop in 2012 were mostly all also active in equestrian sport. What surprised both them and the organization was the extensive interest in the event. Around 300 participants came to the initial workshop. Subsequently, this model for interaction was repeated, with 8 horse cafes / workshops held at Chalmers during the 7 years of our case study. These workshops include light refreshment, and the speakers come from Chalmers as well as from the equestrian world – such as veterinarians and trainers.

The Chalmers researchers report that they have developed networks and made many contacts among representatives of different types of actors involved in this sport, through these types of meetings. They hope this shifts some of the focus, because research related to horses has been traditionally dominated by biology and veterinary issues, as well as agricultural issues. It is very different to focus upon sports technology and the sport. In March 2018, the Chalmers website describes their approach as follows: “Equestrian sports involve two athletes – the rider and the horse – but only one of these can tell us how they feel. Chalmers works on behalf of the horses’ welfare by developing materials, measuring instruments and measuring methods that do not cause horses stress or pain”. The website further describes their particular areas of competence are Light-weight composites, Sensors and big data, Smart textiles, Hydrodynamics, and Injury prevention.

Many of the activities are carried out by students, and the activities are at intersection between education and research, in that they are part of student thesis projects at bachelor and masters levels. The projects have both an educational goal – for the student to run an independent research project and contribute to the existing body of knowledge. Additionally, they give the students the opportunity to test their ideas in real-world settings.

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6 [https://www.chalmers.se/en/centres/sportstechnology/research/equestrian-sports/Pages/default.aspx](https://www.chalmers.se/en/centres/sportstechnology/research/equestrian-sports/Pages/default.aspx), Accessed 2018-03-03
project – but also following the national engineering tradition, the projects should be related to a ‘real-world’ problem. According to a person who has been heavily involved as both researcher and university management in the overall CST initiative, these projects are “multidisciplinary, making discoveries in technology and engineering simultaneously” on different levels, bachelor, master and advanced (Finnsgård, 2015, p. 6). He moreover argues that these types of projects enhance the students’ learning, creativity by giving them an opportunity to combine engineering knowledge and problems with their interest.7

During these years, quite a few bachelor thesis projects and master thesis projects have been completed, and new courses. As an example, at one point in 2016 the equine sport initiative had approximately 20 active projects.8 Chalmers has also developed an advanced level course in ”Sport technology”, which is given yearly at the advanced level. In 2016 some researchers started with an initial idea of starting the course “Equestrian Sports and Physics”, a 7.5 credits course which involves concepts related to position, speed, acceleration, power, movements, energy and so forth, all related to horses and equestrian sport. Autumn 2017 the course will be held at Gothenburg University10, but open to Chalmers students.

In terms of research and commercialization, some activity has occurred, and some of it is interdisciplinary collaboration between different research disciplines. There have been presentations at conferences, publications and patents application. A few examples follow. in 2013 an interdisciplinary collaboration between different research disciplines, including veterinaries and biology as well behaviourists was initiated along with engineering. In 2014, an article about smart textiles in equine sport was published in Journal of Veterinary Behaviour (McGreevy et al., 2014). Some projects have had a variety of activities, such as using new technology to identify cracks in hoofs, including papers (Sundin et al, 2014),
student projects, and a patent application.\textsuperscript{11}

Reaching out to a wider audience – and also getting media attention later became more important in the activities developed and delivered.

The story behind Chalmers engagement in Gothenburg Horse Show and the ‘Chalmers fence’ can be seen as one activity – or better described as a project with many activities – which has received the most media attention. Gothenburg Horse Show is the largest indoor horse jumping show in the world, but includes international show jumping, dressage and shows, as well as a very large Eurohorse event for commerce, workshops, clinics, etc.

Being visible at large events like Gothenburg Horse Show was in line with a bottom-up attempt by Chalmers – and later a top-down strategy – to try to connect to the CST to the wider public\textsuperscript{12}. This idea of visibility began as a fun idea back in 2013. During 2013, 2014 and 2015, Chalmers researchers and students had a more informal attendance at Gothenburg Horse Show / Eurohorse. The researchers were interested in seeing what kind of contacts that could be created. Chalmers as an organization became more interested too, to show how Chalmers was involved in sports. In the first three years, they had limited resources and attendance based on volunteers.

During a summer lunch 2015,\textsuperscript{13} the participants decided that Chalmers should create a ”smart fence” to demonstrate at the next Gothenburg Horse Show. The initial idea came from a person at Chalmers highest management, who is also engaged in the sport and supports the notion of equestrian sport. The fence should be ‘smart’ in that it gathers and integrates measurement data into the fences used in show riding. This would be a visible way to

\textsuperscript{11}https://www.hippson.se/artikelarkivet/forsknings/astrofysiker-hovslagare-ska-stalla-sakrare-diagnos.htm accessed 2017-05-03
\textsuperscript{12}Gothenburg Horse Show is one of the world’s three biggest indoor competitions in equestrian sport and is an event that takes place each year. http://www.gothenburghorseshow.com/en/ accessed 2017-04-23
Each year it hosts 90,000 visitors who share a common interest – horses and equestrian sports. Eurohorse is the absolute high point of the year for all horse and equestrian sports enthusiasts. Enthusiasts travel from all over Sweden to attend EuroHorse. In addition to sharing a genuine interest in horses, they are dedicated, committed and have plenty of purchasing power. https://en.eurohorse.se/?_ga=1.196195244.1073044040.1458307893 accessed 2017-04-23
\textsuperscript{13}http://chalmersstudentkar.se/sv/nyheter/chalmershindret—ett-nytt-hopp-för-hästsporten accessed 2017-05-03
combine students from different backgrounds, and to combine the students’ interest for horses, their engineering and design knowledge, and also show the audience at Gothenburg Horse Show what you can combine an interest of technology with horses.\(^{14}\)

Hence, the degree and type of commitment changed from 2016. The purpose from an organization perspective was to use these to communicate and interact with the public through a big stand, through presentations by students, researches, companies and other actors related to equine sport technology, a press conference and presentation of a collaborative student project, the Chalmers fence.\(^{15}\) At Eurohorse 2016, 2017 and 2018, Chalmers as an organization paid for a large stand, also staffed by students, as well as workshops. These activities should enable the visitors to take part of results through presentations, posters, documents and discussions.

So how could Chalmers organize knowledge-intensive activities, which lead to the smart fence? The project leader was a researcher at the physics department at Chalmers. A project group consisting of eight students from seven different educational programmes at Chalmers developed it. The fence was equipped with sensors that register the distance between the pole and the horse’s hooves. The result was displayed to the audience during the competition, also with the idea this could increase the audience’s experience. The design of the fence chosen after a contest and after that, 8 students were selected to a project group.\(^{16}\) The project was partly an employment (10 %), and partly a student project, where the assignment was to develop, construct, build and test the fence together with riders. The project started in October 2015 and the final product was presented at Gothenburg Horse Show March 2016. The fence

was kept confidential until the presentation at Eurohorse\(^ {17} \). In 2017, a new student project group of ten students from eight educational programs developed and modified the fence at Gothenburg Horse Show, in order to also use sensors to register the distance to the horses’ take-off point. These projects should help in another aim for the industry, namely to use measurements to select and breed horses less prone to injury, as suggested by Swedish Warmblood Association\(^ {18} \).

Chalmers has in the more recent years had less focus on internal activities like horse cafes and instead gone out to meet the public, and also focus on projects of interest to the public watching equestrian sports. Chalmers has been visible at other major events, such that the Chalmers stand, fence and dressage app were visible at the European Championship\(^ {19} \) for equestrian sport in Gothenburg 2017 and Gothenburg summer tour 2017\(^ {20} \). They have also developed other projects for use in shows. Another Chalmers student project developed the dressage-app, launched at the 2017 Gothenburg Horse Show, and the audience also provided feedback for later student projects.\(^ {21} \) In cooperation between SWT Development\(^ {22} \), Lövsta Future Challenge, the Swedish Equestrian Federation\(^ {23} \) and Got Event AB, the Ecoestrian fence was introduced at Gothenburg Horse Show 2017. It is a fence in partially durable materials of recycled textile and paper which was made through collaboration between a team of researchers from Gothenburg University from Department of Physics, Department of

\(^{17}\) http://www.gars.nu/aktiviteter/chalmershindret/ accessed 2017-05-08


SWB is an organisation that aims to support and develop breeding, raising and education of horses in Sweden


\(^{20}\) National competetion in equestrian sport, jumping. Link in swedish https://gothenburgsummartour.se


\(^{22}\) Turning ideas into reality, developing processes and creating fiber based products – that’s what we specialise in at SWT Development. With our combination of expertise knowledge, entrepreneurship, creativity and inquisitiveness, we move quickly from the drawing board to reality. We are the link between research, production and design, and we move easily between these areas. This makes us unique in Sweden when it comes to developing environmentally friendly, fiber based innovations. The key factor is our mix of staff and our dynamic working method. See: http://swtdevelopment.se/en/about-us/

\(^{23}\) http://www.ridsport.se/In-english/Welcome-to-the-Swedish-Equestrian-Federation/
Biological and Environmental Science, Department of Biological and Environmental Science and HDK - Academy of Design and Crafts\textsuperscript{24}.

For 2011 to 2017, Table 4 summarizes all the activities driven by the university, and which we have categorized as being primarily having the goal of research, education, or societal impact.

Table 4. Timetable of the activities, 2011-2017, categorized as primarily research, education or societal impact

<table>
<thead>
<tr>
<th></th>
<th>Research</th>
<th>Education</th>
<th>Societal impact</th>
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</thead>
<tbody>
<tr>
<td>2011</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Initial seminar 2011 – inspiration</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Sport technology</td>
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</tbody>
</table>
| 2012   | “What can we do?”                              | Initial student project within the horse welfare project | Initial Equestrian workshop September 2012
|        | 2012 – investigate the connection between the horse and technology |                                               | Follow up workshop November           |
| 2013   | Initial interdisciplinary research abroad      |                                               |                                       |
|        | Workshops – themes                            |                                               |                                       |
|        | Informal participation at GHS                 |                                               |                                       |
|        | Initial international interdisciplinary research project within smart textiles in equestrian sport and non invasive method of hoofs | New course in Sport technology (Finnsård, 2015) | Workshop “horse-cafes” with different themes
|        | Participating and presentation of research paper at conference ISES\textsuperscript{25} | Student driven project with the industry | -Hoof s and surface
|        |                                               |                                               | Voluntary work at Eurohorse           |
| 2014   |                                               |                                               |                                       |

\textsuperscript{24} https://www.youtube.com/watch?v=oGacHKQ0G8A
\textsuperscript{25} http://equitationscience.com accessed 2017-04-24
<table>
<thead>
<tr>
<th>Projects in media</th>
<th>Publications of interdisciplinary research result</th>
<th>Student driven projects</th>
<th>Smart textile conference Voluntary work at Eurohorse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial publications</td>
<td>Informal participation at GHS</td>
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<td></td>
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</tbody>
</table>

### 2015

<table>
<thead>
<tr>
<th>More educational initiative and planning of more public societal interaction at GHS</th>
<th>Expanded research with equestrian sport and technology Publication about CST research about sport technology (Finnsgård, 2015)</th>
<th>Students driven projects</th>
<th>Voluntary work at Eurohorse Summer 2015 initial idea of a “smart fence” at GHS 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Informal participation at GHS</td>
<td></td>
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<td></td>
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</tbody>
</table>

### 2016

<table>
<thead>
<tr>
<th>Collaboration with Gothenburg Horse Show Formal attendance at GHS More resources in societal interaction Publicity of student projects More resources on research</th>
<th>Initial idea of a combining physics and horses in a course at GU Presentation of research project (Hanstorp et al., 2016)</th>
<th>More public student driven projects project - Employment of students - The smart Chalmers fence - With companies Approximately 20 active student driven projects</th>
<th>4 Workshops “horse cafes” with different themes Collaboration with Eurohorse - Stand - Presentations - Press releases - Chalmers fence - Recruitment of students</th>
</tr>
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### 2017

<table>
<thead>
<tr>
<th>More societal interaction and participation on</th>
<th>Equestrian Sports and Physics 7. 5 credits autumn Student driven projects - The smart</th>
<th>Collaboration with Eurohorse - Stand</th>
<th></th>
</tr>
</thead>
</table>
| different events | 2017 at GU Transhoof project<sup>26</sup> | Chalmers fence  
• Dressage app  
• Hoof projects  
• European Championship fence | • Presentations  
• Press releases  
• Chalmers fence  
• Dressage app  
• Recruitment of students  

Engagement with equestrian organisations to develop sustainable products (Ecoestrian)  
European Championships 2017 – smart fence project and stand  
Attendance at Gothenburg summer tour June 2017 with different projects<sup>27</sup> |
<table>
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<tbody>
<tr>
<td>Encouragement of engagement – design competitions</td>
<td>More resources on education</td>
<td></td>
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</tbody>
</table>

Table 5: Actors external to the focal university, who have been directly involved in academic engagement; Main category and specific organizations

| Companies from different fields | Technology: SAAB, Qualisis, Hot Disk AB, PressCise  
Clothing companies: PS of Sweden,  
Sustainability and material development: SWT Development  
Equestrian industry: Australian Equine Behaviour Center |
|---|---|
| Non-commercial Organizations | The Swedish Equestrian Federation  
the Swedish Warmblood association  
FEI – Federation Equestre Internationale<sup>28</sup> |
| Event organizations | Got Event AB, Eurohorse  
Gothenburg Horse Show  
Lövsta Future Challenge |

<sup>26</sup>https://www.tidningeninnovation.se/2017/03/varmesensor-upptacker-dolda-skador-i-hasthovar/  
<sup>27</sup>https://www.facebook.com/ChalmersSportTeknologi/photos/a.832411476785835.1073741827.537139852979667/167442439251217/?type=3&theater, accessed 2017-05-08  
<sup>28</sup>http://www.fei.org
Practitioners
- Riders
- Stable owners
- Breeders
- Veterinaries
- Blacksmiths/farriers
- Audience – users (feedback)

Universities
- Gothenburg University
- University of Borås
- Swedish school of textiles
- SLU
- University of Australia
- University of Uppsala

Public policy
- Göteborgs Stad (local municipality and associated organizations)

4.2 What was the actions, motivations and rationale of the actors internal to the university, in these processes?

4.2.1 Researchers

For researchers, we have defined that they are linked to outputs in research and in education, but assume that most academic engagement is primarily linked to research. In this case, their rationale for academic engagement and their intended focus of CST initiative more broadly was to diffuse research knowledge to the equestrian sport and also to generate research questions and problem solving. The boundaries between research and education were fairly blurred.

The individual researchers who have been most engaged have a personal interest in the sport, and can thereby combine different types of knowledge. One of the lead researchers is female, has an interest in horses and also a deep knowledge in physics, and she became a focal point
for the CST equestrian sport initiative. More generally, the motivation of researchers was to combine equestrian sport and technology, because even if they did not initially know which projects to run, they could identify a need for more technology related to horses and equestrian sports.

We have seen how the lead researchers tend to organize many activities into larger projects, and these projects involve researchers, students, and external actors. Because the university is organizing the co-delivery of different knowledge intensive services, the act of engaging in knowledge-related collaboration provides much input about new problems, solutions, ideas, and so forth. As illustrations, researchers from Chalmers and GU have collaborated with various research disciplines such as Uppsala University, the Swedish School of Textiles, the University of Sydney. They have also collaborated with many different actors (as seen in Table 5). They collaborate with different types of industry actors. They have worked with an entrepreneurial company to develop and provide equipment for measuring and testing thermal conductivity, thermal diffusivity and specific heat capacity; with the larger company SAAB to develop software solutions; smaller existing companies in clothing and equipment within equestrian sports to conduct evidence based product evaluations; companies which work with developing processes and fiber-based products to work with material development and sustainability; with organizations and Associations within breeding (SWB), event organisations such as Got event and Lövsta Future Challenge as well as riders, stable owners, veterinaries and national and international sport federations. The projects often focus on solving complex problems in the equestrian sports. Occasionally these collaborations leads to the development of products and services (ex. Apps and smart fence, hoof project) as one of the researcher said “for us it is important that there is some interesting research on the whole, but it is not very common it actually leads to products as well”. Chalmers now states that their
"technological development has become important for equestrian sport and Chalmers often receive requests about to find solutions about horse related problems." 29

Researchers were also early in identifying that they could organize new types of student projects with external actors, and that new types of students might become interested in engineering research.

Early on, the researchers could also see that the equestrian sport initiative at Chalmers could created an interest, and help encourage qualified female students to apply to study at Chalmers.

Within engineering and natural science there is a problem that it is not enough females…it is a societal concern that we can contribute making an effort

Girls are at least as good at engineering and we will loose competence in the society of they do not come to us…we want the best student and if we do no succeed with that it may be a societal concern in the future…30

It is both students and parents that can be interested…make this connection…Chalmers and horses…which they may not have made before…if they had found us in another context”

This is linked to the formation of the projects. The researchers claim that the initiative ha contributed to the recruitment of horse-interested students to apply to Chalmers. Visibility at public events should create awareness, and encourage more to apply, when they become aware that there is a possibility of combining their interest in horses with engineering studies during their education.

“An important part of the projects is to let students combine an interest, studies, develop their creativity, work with real problems and let them feel that they can apply the knowledge they have acquired during their education”

“We have many students that are interested in equestrian sports here at Chalmers, and at other universities that comes…and for them it is a joy to be able to work with horses …and to be able to work with something that you are interested in often makes things much better”

The combination of education and hobby is an important part in the different project, thereby making the student projects some a combination of hobby, studies and work.

The researchers often have a personal relation to equestrian sports; some research has been performed, presented and published in these areas. However, they tend to talk more about how this area contributes to other aspects of the university than doing research.

4.2.2 Students in Bachelor and Masters programs

For students, we generally assume that the expected outcome is to education, but we also know that sports may lead to a high level of general engagement including user innovation.

Student projects are an important vehicle for bringing together ‘Chalmers’ with the actors external to the university. Students usually use existing technology and methods to solve sport related problems in a new way, and examples of topics studied are “Fitting a saddle to the back of the horse”, “Analysis of equine locomotion”, and “Measuring ECG, heart rate, and breathing with smart textiles”. The researchers provide potential projects, and the Chalmers websites and project catalogues particularly encourage students who are riders to apply.

Students are also exposed to a variety of activities, through this initiative, and which goes far beyond course work per se. Students are encouraged to engage in societal interaction through

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31 https://www.chalmers.se/sv/nyheter/Sidor/Chalmershindret.aspx accessed 20170508
32 https://www.chalmers.se/sv/nyheter/Sidor/Chalmershindret-Nyhet.aspx accessed 20170508
informal workshops, events and other mechanism such as involvements of users and
governing bodies in the Swedish equestrian sport. Students are also allowed to participate in
interdisciplinary student project as well as discuss with stakeholders (as mentioned above e.g.
companies, governing bodies etc.) as a way to develop their skills in creativity and problem
solving.

From their perspective, this type of interaction is valuable because it enables them to work
with technological development in “real” projects, with something one feel passionate about
and make use of the knowledge acquired during the engineering studies33:

“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”

“If you put you best foot forward, there is a chance for you to be a part of really fun projects, but also 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” 34

They thus identify a key value in transfer of knowledge and technology through open projects
and involvements of users through the public project such as the “Chalmers fence”,
presentations at workshops and at bigger events such as Eurohorse and Gothenburg Horse
Show.

Students also use their experience to reinterpret what they are studying, as illustrated in the
following quote:

They see someone sitting by the computer or someone wearing a white robe…writing on the black
board…they see a new image and they like aha this was fun and I like this so maybe I can study a technical
education and apply it on something that I like”

“Girls should definitely give technology a chance. It is not only about building computers or machines. An engineering education can enable your chances to spend a lot of time in the stable as well, and make use of your knowledge”

Similarly to the researchers, the students also express that the connection between horses and technology could enable and motivate students, especially female students, to apply for engineering education. This type of knowledge may also open up new types of career paths within equestrian sport and technology.

4.2.3 University managers

We use university managers – whether at the very top or as leaders of the initiative – as proxy for understanding the organizational view of the initiative. During the period studied, the activities started as a loose network, with small resources, to later become institutionalized as a centre at Chalmers. The center CST has fuzzy boundaries, and includes actors internal and external to the university. The university motivates that the center is a network, which provides an advanced platform between different sports, where different key actors can discuss and decide for themselves upon the future direction. Today, the university per se is supportive, such that Finnsgård (2015:4) argues that the “combination of dedication, commitment, and involvement” to sports at Chalmers creates a high level of motivation and engagement for faculty, students, technicians, and administrators to get involved.

Initially, the organization was more informal. There was very limited funding from the university as an organization, partly because it was difficult to communicate the content of the initiative, even though sports had been defined as an interesting area in the 2011 workshop. The informal organization around equestrian sports was created by a few people, and these

researchers and initial students started to discuss, and also put in non-paid (or volunteer work) in many initiatives. One respondent argued that the voluntary work has been the most important aspect of success, and also the largest part of effort, if one counts all the voluntary hours spent on the initiative.

Chalmers was organized in such a way that the ‘Areas of Advance’ could make small investments into new areas, also with the idea of stimulating new networks.

The support from the principal of the Area of Advance. The responsible for educational program, the principals have been positive, the former was a horse enthusiast and had four or five horses…. we received more and more…from being weird and odd individuals that did things illicitly…to receive more support…both in words but also money…

So at one point, the university centrally did notice the bringing together of engineering and equestrian sports, and one might ask why. According to our analysis, three early traits made this initiative of interest to Chalmers centrally. One was that the initial seminar attracted a large and broad audience; a second that key actors and large organizations became involved; and a third that some resources were obtained. In other words, when this initiative became more successful, then the university top management and the board became convinced that initiative was worth investing more into. One reason was that the student projects provided the opportunities for students to work with real problems during their education, and another was that students interested in sports, and especially female students, might apply, leading to recruitment in areas of priority.

Student projects were also a way for the organization to more widely impact society, as illustrated below:

To diffuse research, knowledge and also to individuals that 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
Thus, over time, the recruitment of prioritized targets groups (female students) to engineering became a key motive for supporting the initiative. As one of the principals said "Just think what good advertisement that can do for engineering education when they use the stable as a lab!"\textsuperscript{36}

Moreover, Chalmers recognized that they were interacting with different stake-holder than they generally did. Essentially the need for technology-related research in equestrian sport has led to a new type of collaboration, and with new stakeholders:

“The equestrian sport, I believe is the most successful initiative…here we can collaborate with another type 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 to receive an interest for technology”

Publicity is also related to education. University managers argue that the initiative has given the students an opportunity to be innovative and productive:

To let the students create a technical fence gives them a opportunity to be creative, and also show the audience [at Gothenburg Horse Show] that is possible to combine technology and horses\textsuperscript{37}

Finally, the equestrian sport initiative has given the university branding and image through social event, such as workshops and the attendance at sports events:

Is a very successful initiative that is very fun, and now it is at Gothenburg Horse Show, a Chalmers fence that can measure how high the horses ‘jump …it gives us a lot of good will…and recruitment of students.

The university as an organization provided a low level of support initially, for a set of informal activities and later provided more resources. The main benefits from the central level appear to be finding new real problems for students and attracting new groups of students, which can be done through activities which raise the visibility of the university. In terms of


\textsuperscript{37} https://www.chalmers.se/sv/nyheter/Sidor/Chalmershindret.aspx accessed 2017-02-02
media and social media, the Chalmers fence is arguably one of the most visible results from Chalmers in past decades. Additional organizations have also recently followed Chalmers lead and started to invest in innovation in equestrian sports, including technologies.

6. Discussion

Our case study is of the phenomenon of the university initiating academic engagement with society, and we do so through the empirical case of bringing together engineering and equestrian sports. We have organized our discussion according to the five propositions that we identified in relation to our conceptual framework, and previous literature.

Our first proposition is that the university can organize new processes in a new area to co-produce the three knowledge intensive services, but research related ones are likely the basis for interaction. We do demonstrate that the university can develop new areas. Our conceptual model has enabled us to explain how and why the focal university can organize new processes in this new area to co-produce the three knowledge intensive services. We have also identified a wide range of external actors brought into the knowledge-related collaboration.

However, in contrast to our expectation, we do not find that research related activities are the main basis for interaction. Instead, the main vehicle for interaction with external actors is student projects, specifically related to thesis projects at bachelor and masters levels. To understand this, one needs to better understand the key researchers. They are active in organizing a variety of knowledge-intensive activities, interacting with many external actors, and across all three types into larger projects. A good example is the Chalmers fence. By organizing many activities into a larger project, a number of related activities and projects are run. This brings together the identification of problems from external stakeholders as well as new solution to these new problems relevant to equestrian sports.
Our second proposition is that researchers involved are likely to have certain characteristics - male, scientifically productive, higher seniority, and more government grants. The leading researchers are scientifically productive, and include both male and female researchers, but we find a high proportion of female researchers. Earlier research has found male researcher to be more motivated to engage in academic engagement due to their prominent positions to mobilize resources (Etzkowitz & Leydesdorff, 2000; Perkmann et al., 2013).

Another key characteristic – which we did not expect for the involved researcher – is a personal interest in the sport. Previous research within sport have found that innovation in sports creates a high level of engagement and social interaction, and needs to integrate the user perspective (Baker, McDonald, & Funk, 2016; Potts & Ratten, 2016) (Shah, 2000. This may be an explanation of the high level of engagement and why the researchers were willing to engage in informal, collaborative and voluntary activities.

The third proposition is that students involved are likely personally engaged in the sport. We have found this here also (Potts & Ratten, 2016). Moreover, the students involved are likely to be female (and in an engineering education still dominated by male students).

The fourth proposition is that university managers are likely not very engaged or interested. The reason is that academic engagement can be characterized as not very organizationally embedded and instead autonomously driven by individual researchers. We found that this was initially true at an early phase, when the researchers and students engaged in more informal societal interaction externally, and also internally through interdisciplinary collaboration. However, the university as an organisation has gradually taken a more active role, and

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38 We do not have a comparison with commercialization, so we cannot discuss about higher seniority and more government grants.
provided some resource but still relying on driven individual researchers and students. Chalmers calls CST an “area of advance” and developed the platform, in order to meet goals such as attracting and encouraging new target groups, branding and image. This shift from individual to organizational level occurred due to their assessment that the interdisciplinary student driven projects attract motivated students and seemed to generate better results, with live cases in new areas.

So, contrary to expectations, why did this university became more interested in this specific academic engagement, including committing more resources and allowing organizational embeddedment? There seem to be two key rationales. One is that certain activities (especially the Chalmers fence at Gothenburg Horse Show) lead to a high level of media visibility. This is in line with research which suggests the university prioritizes activities which give a more positive image for the university or researchers, enabling goodwill and recruitment (Ankrah et al., 2013; Dietz & Bozeman, 2005). A second rationale is that all actors internal to the focal university claim that these activities will attract new types of students to engineering, specifically females interested in horses. In Sweden, equestrian sports is very large in Sweden, and is dominated by female athletes at an amateur level whereas the top international athletes are both male and female.

7. Limitations and future research

One limitation of our case study approach is that we are bound to a detailed understanding of one complex phenomenon. We have proposed and applied our conceptual framework to analyze the processes underlying the development of this specific case study of knowledge-related collaboration, involving actors internal to the university and external to the university.
Bridging engineering and equestrian sports is the empirical focus of our case, but our study and analysis are limited to one area of impact, and at one university in Europe.

One topic for future research is how to more generally understand different expressions of these types of processes. Our case study describes how and why this informal network later becomes more organizationally embedded and less dependent upon the individual researchers – leading to results somewhat different than we expected. Future research could identify a range of structures or ways of being organizational embedded, as well as whether some structures are more likely to be permanent than other structures for academic engagement.

A second topic for future research is now to better understand the processes underlying sports innovation, to address the issue of how and why “the evolution of a sport technology innovation would be useful to study” (Ratten, 2016, p. 247). Future research could explore processes underlying specific projects related to sport, innovation and technology, in the context of academic engagement with society.

Finally, future research could better draw upon streams of literature in respectively academic engagement and impact. Molas-Gallart and Tang 2007 study impact and finds that productive interactions are characterized as variety and decentralization; adaptation to stakeholder demands; importance of new interactions; type of interactions evolve; and fuzzy stakeholder boundaries. While their analytical tool emphasizes other dimensions than those we have chosen to focus upon, their tool could be applied more systematically to describe the overlap between the knowledge-intensive services of research, education and impact.

**Conflicts of Interest**

The authors declare no conflicts of interest.
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