Visible: discovering the impact of research conducted by universities of applied sciences

Coombs, S.K.

CHAPTER 1

INTRODUCTION

I think it is pretty safe to say that I am a rule follower. Let me explain. I am not a sheep that blindly follows because that is what I am told to do. In fact, I greatly dislike doing something just because I was told to do it. My brain needs to know and understand the framework into which things fit. I need to know why things are being done a certain way. In life, if the rules make sense, I can then use them and if they do not, I can adapt accordingly. In science, this is, of course, different. You cannot always pick and choose what you can or cannot follow. However, that need to know why something is done in a particular way remains the same. That framework is essential to begin with. Apparently, this is the case for many neurodivergent people (Nerenberg 2021).

It is because of this need to understand rules and follow them that I started this journey towards answering the following questions. What are the requirements for evaluating the research impact created by Dutch Universities of Applied Sciences' (UASs) research? How can these rules be applied within the context of the goals of Dutch UASs? Too many people were asking me questions I could not answer, about the rules I did not know. Consequently, the goal of this dissertation is to discover what the rules for evaluating the impact made by UAS research are, and how we can implement these rules in real-life within the current policy and organizational landscape. By doing so, it is my intention to assist in uncovering the impact created by UASs and making it visible to the rest of the world.

In the rapidly evolving world of academic inquiry, the pivotal role of universities in fostering research and driving innovation is undeniable. Particularly, the emergence of research in UASs offers a fresh perspective on addressing real-world challenges. While traditional universities often emphasize theoretical knowledge, Universities of Applied Sciences champion practical applications of this knowledge. However, the research landscape of applied sciences in these institutions is relatively nascent, making it a fertile ground for investigation.

The relative newness of research at UASs presents its own set of challenges. As with any emerging field, it grapples with nuances and intricacies that are distinct from the well-trodden paths of conventional research. These institutions confront issues that may have been resolved or are perceived as non-issues in mature research disciplines.

A pressing challenge for Universities of Applied Sciences lies in effectively conveying their research's significance. It becomes crucial for these institutions to showcase the tangible and intangible impacts of their research on society at large, bridging the gap between academic pursuits and societal benefits. Against this backdrop, the central research question emerges: How can research impacts be evaluated in the context of the goals of UASs? Furthermore, in the context of Dutch UAS research, it becomes essential to ensure that our evaluation mechanisms are congruent with overarching policies and are workable for the researchers involved. How can this evaluation be embedded within the evaluation process and policy context of the Netherlands Association of Universities of Applied Sciences (NAUAS) ? This study aims to address these questions, discovering what the rules for evaluating the research impact made by UAS research are and how we can implement these in real life within the current policy landscape.

EXPLORING THE PLAYING FIELD

Understanding the evaluation of research impact, especially within the realm of UAS, is a multi-dimensional issue, marked by both its depth and complexity. However, before we can dive into the evaluation component, we need to first understand the context. This includes the relative short history of Dutch UAS's research, the evaluation framework currently being used, and the strategic agendas in which the Netherlands Association of Universities of Applied Sciences (NAUAS) have stipulated a desire to create research impact within specific themes.

A Brief History of Dutch UASs

Traditional universities have been an established element of Dutch society since 1575 with research playing a central role in these institutions since 1800. Nearly 200 years later, in 1960, research became the primary purpose of traditional Dutch universities with the introduction of the Law of Scientific Education (Wet op het wetenschappelijk onderwijs) (van Gageldonk 2017).

The history of Dutch Universities of Applied Sciences is much shorter than that of traditional universities. The oldest examples date back as early as 1842 (Delft) and 1876 (Wageningen). Agricultural, Nautical, Music and Arts schools, as well as other institutes with a strong connection to societal needs and business that were initiated in the nineteenth century are also understood to be predecessors of the UASs of today. These institutions were seen as separate entities from traditional universities and were clearly linked to both business and societal organizations. They were not, however, officially accepted as part of the higher educational system until much later. Indeed, it was not until 1986 that Universities of Applied Sciences as we know them today became part of the binary educational system of the Netherlands (van Gageldonk 2017).

In the years between 1970 and 1990 there was much debate around the positioning of the institutions that would become the UASs. The debate centered on questions such as: should traditional universities attempt to offer degrees in minor professions, or should that be the purview of UASs; should the practical educational institutions be seen as comparable to traditional universities and offer recognized bachelor or even Master's degrees; what kind of research responsibilities should a UAS be permitted. During this period, cooperation between the two institutional structures was encouraged but impossible to accomplish as the differences in size, autonomy and maturity in research practices were too divergent (van Gageldonk 2017).

In 1986, the passing of the Law on Higher Professional Education granted UASs the right to conduct research but did not remove the obstacles that made accomplishing research difficult. One such obstacle was the lack of qualified researchers. At that time, teachers at UASs were hands-on instructors from the field, positions that required only the basic education of a Bachelor's degree. With 50 per cent of teachers holding a Master's degree and only 5 per cent holding a Ph.D., they lacked the research background necessary to actualize quality research (van Gageldonk 2017).

An additional obstacle was related to the lack of funding. The only funding available was that which was gleaned through contracts with industries or other partners rather than support from the institution or the predecessor to the NAUAS, the HBO-raad. Without consistent comprehensive funding, conducting research was not possible with the result that, after 1986, many of the smaller institutions merged to form larger ones in anticipation that it would result in additional funding. While this attracted more students, it did not result in the funding from the Ministry of Education that was necessary for research (van Gageldonk 2017).

This situation is similar to the challenges and evolutionary processes that other countries with Universities of Applied Sciences are wrestling with (van Gageldonk 2017). According to the Organization for Economic Cooperation and Development (OECD), Universities of Applied Sciences reached a level of "recognition and legitimacy" that meant they were considered qualitatively equal to standard universities in 1991 (OECD 1991, 66). However, it was not until the end of the decade that legislation concerning research in Dutch UASs was addressed.

The Higher Education Act of 1993 in the Netherlands brought both pillars of the binary system, UASs and traditional universities, together in one law. This Act stipulates that the aim of both UASs and traditional universities is knowledge transfer. It specifically states that UASs of the Netherlands can conduct research applicable to the education offerings of their institutions. While it was initially thought that this knowledge transfer was accomplished through the professional development of teachers and staff, and through the education of students, it has evolved over time to also include research (de Weert and Leijnse 2010).

It was not, however, until 1999 that visible changes in the research function at UASs occurred. Not only did a strengthening economy free up necessary funding for higher education, changes at the European Union level also had an effect. Between 1999 and 2000, member countries of the European Union worked together on the Bologna Declaration. This new policy established a harmonious degree system throughout the Higher Educational Institutions of the EU as well as agreement on the need to stimulate research in every level of this system. The Lisbon 2000 Agenda highlighted among other things, the need for greater financial support for research and education (de Weert and Leijne 2010). In that agenda the European Commission declared that higher educational institutions were essential for strengthening the knowledge triangle of Education, Research and Innovation. Because of the existing strong ties European UASs had with business, they were seen as key players in ensuring research was done in response to the needs of business (Maassen and Sternsaker 2010). While this had an effect on all EU UASs, for UASs of the Netherlands this meant not only more funds for research but also the introduction of 'Lectoren', often translated as professor, equivalent to university professors, and a consequential professionalization of UAS research in the Netherlands (van Gageldonk 2017).

In 2001, the introduction of professors into the employment pool of UASs was made possible by the combination of a sudden influx of funds and an external review by the Inspectorate for Education that indicated the level of inadequacy of the quality of research in UASs. On the advice of the Inspectorate for Education, the Ministry of Education and Sciences and the HBO-raad entered into a covenant agreement that required the Universities of Applied Sciences to retain professors. The funding for this new position was to be distributed by an independent group contracted by the HBO-raad. Known as the Stichting Kennisontwikkeling HBO, or SKO, this group was responsible for assessing if a UAS could begin a research centre. Based on their evaluation, UASs would be given the funds needed to install a lector for a four-year period. The ex-ante evaluation process included a framework of 11 criteria wherein the specific goals and tasks of the proposed research centre were considered. Requests for them had to include an area of expertise and how the research centre, in measurable terms, would work towards improvements in education and the professionalization of the research skills of teachers and staff (van Gageldonk 2017).

In 2005, as agreed upon in the covenant of 2001, the SKO commissioned Consort, an external consulting company to evaluate how the professors had fared thus far. This three-part evaluation included: the size and financial situation of the research group; a measurement of the knowledge transfer; and a quick scan to give an indication of how a lector interacts with their environment. The quick scan raised concerns about both the quality of the evaluation and the evaluation results itself. Not all professors were included in the evaluation and those that did participate found the quality of the questions unsatisfactory and unclear. Many were concerned that they were being evaluated using indicators that were not applicable to their work and that they had no influence over. Consequently, the SKO sought assistance from a professor at the Hogeschool Utrecht, Frans Leijnse, to assist in understanding how to proceed. His findings were that of the three-part evaluation only the quantitative financial information could be used; the measurement of knowledge transfer and the quick scan were methodologically unacceptable. Important stakeholders, such as the SKO and the HBO-raad themselves, agreed (van Gageldonk 2017).

In response, the SKO set up a workgroup, primarily composed of professors, that confirmed that the methodology used during the evaluation process was incorrect. They further determined that there was insufficient understanding of knowledge transfer, and how it was to be evaluated or even considered as part of the evaluation process. Although this underlined the lack of clarity on the basis of the evaluation there was agreement that an evaluation process was required for professors (van Gageldonk 2017).

As a result, in 2006, the SKO advised the government that an external accountability tool was needed for professors that took into consideration the type of research done by UASs in the Netherlands. They suggested that the number of indicators required at the national level should be limited. UASs should have the freedom to choose the indicators that best evaluated the quality of their research group. These indicators were, in fact, developed by the research group themselves. They further recommended that the evaluation take into account the current national discussion over societal impact. This evaluation used purely quantitative indicators such as size of the research group and finances, to evaluate the same group of professors that had been used in the controversial evaluation the previous year in order that a change could be monitored.

A review by the OECD that same year found research within Dutch UASs lacked quality. They suggested that introducing a new UAS specific funder would not only help financially but would help to create competition between UASs and thereby increase the number of professors and the quality of their research (OECD 2008). In 2008, this funding became known as RAAK Pro under Stichting Innovatie Alliantie (SIA) (van Gageldonk 2017).

Concurrent with the SKO's evaluation, the HBO-raad initiated the development of a quality control system for research by initiating a strategic research workgroup. This requirement was included when the Covenant between SKO and the HBO-raad was extended in 2004. With this extension, the decision was made that the SKO would cease to provide financing for the professors, and daily costs would be transferred to the UASs where they were employed. In addition, the responsibilities associated with the professors, including evaluation, were transferred from the SKO to the HBO-raad which was the first time that a workgroup specifically for research and its quality was introduced by the HBO-raad. The workgroup sought input about the evaluation system from members of the UASs themselves as well as calling upon the expertise of groups such as the KNAW (Koningklijke Nederlands Akademie van Wetenschappen, Royal Netherlands Academy of Arts and Sciences), the NWO (Nederlandse Organisatie voor Wetenschappelijk Onderzoek, The Netherlands Organisation for Scientific Research), employer organizations, and the Ministry of Education, Culture and Science (van Gageldonk 2017).

Introduced at the beginning of 2009, the quality control instrument used by the HBO-raad became known as the *Branchprotocol Kwalititeitszorg Onderzoek* (Sector Protocol for Quality Assurance in Research, BKO). Instead of an ex-ante approach as taken by the SKO, the Netherlands Association of Universities of Applied Sciences chose an ex-post evaluation made up of three components. The first component was an independent external national validation committee that would approve the quality control system of UASs once every six years. The second component was made up of an independent evaluation committee that would evaluate a research group or group of research groups every six years. And the final component was an annual report describing the developments of research at UASs by the HBO-Raad. The BKO contained a description of UAS's research including the fact that it was something relatively new for Dutch UASs, and that the focus was on societal impact, and relevant scientific practice rather than publication-based evaluation. It also stipulated that this evaluation should require minimal administrative time. What it did not include were indicators or criteria other than that the research had to be methodologically sound (van Gageldonk 2017).

The BKO

Currently in its third iteration, the BKO remains the evaluation tool utilized by the NAUAS. This national research evaluation framework is a general research evaluation conducted at research group level. Like its predecessors (2009-2015, 2016-22), the current BKO evaluation is conducted every 6 years. Initially conducted by a committee made of both peers and stakeholders, today the evaluation is done by the 'Evaluation Committee of Quality Assurance in Research'. The purpose of the BKO is to provide a monitoring evaluation tool for accountability that is complementary to the institutional quality assurance systems. Using indicators the research groups are asked to conduct a critically reflective self-evaluation narrative report on the results achieved within the context of the ambitions and objectives the individual research group has set out. The report discusses how the research is organized and carried out, the output of the last six years, and the ambitions for the next six years.

Initially, the BKO was considered summative (van Drooge 2016) and consisted of 5 criteria. However, with the intention of emphasising the formative character of the BKO, this iteration incorporated the fifth standard of "regular and systematic evaluation of research process and results" into the other four: the research profile and program; the impact of the research; the quality of the research; and the organization of the research unit (NAUAS 2022).

It is Standard 2 that is of particular interest for our journey. These standard states: "The research unit makes transparent what its contribution is to the development of Professional Practice and society at large, of Education, and of the Research domain" (NAUAS 2022, 7). Here, it is stated that research impact affects:

- "Professional practice and society at large. Research carried out by universities of applied sciences is rooted in professional practice and strongly linked to an application context. The questions are prompted by professional practice (real life situations) in both for-profit and not-for-profit sectors. The research generates knowledge, insights and products that contribute to the solution of problems in professional practice and/or to the development of this professional practice and/or to society at large;
- Education. The research at Universities of Applied Sciences is strongly connected with other higher professional education activities. This broadly occurs along two routes: the connection with education and the professional development of teaching staff (from lecturer to lecturer-researcher), and;
- The Research domain. The research at Universities of Applied Sciences contributes to knowledge development within the Research domain concerned."(NAUAS 2022, 7)

This is to be done through the selection of qualitative and quantitative indicators. The indicators of the BKO are to substantiate the self-evaluation through the use of 'basic indicators' used by all UASs as well as optional indicators that are defined by the UAS themselves. These optional indicators are aimed at illustrating the research impact of the group within the Knowledge Triangle of Professional Practice, Education and Research domain and should give details into the output, use and valuation of the research.

The basic indicators are broken down into 2 categories. The first category is the research input in which the research group is asked to indicate the total research income per year including primary, secondary, tertiary, and other sources of funding. The second category is that of research staffing. Research groups are asked to indicate the total number of people, Full-Time Equivalent (FTE), and number of PhD degree holders within their group. This is further differentiated by functions such as professors, lecturers and other research staff, PhD candidates, Professional Doctorate candidates and support staff.

Table 1.1 provides the matrix of the optional indicators as well as the examples given in the current BKO.

	Output	Use	Valuation
Professional practice/Society	-Professional journal papers -Lectures -Workshops -Prototypes -Measurement instruments -Learning community	-Implementation in a policy or professional practice -Participation in professional practice in research -Consultancy activities -Participation in public debate	-External assignments -Follow-up assignments -Satisfaction of commissioners/partners -Being asked for advisory boards as a speaker, expert in the media, etc. -Awards from the discipline
Education	-Course modules -Research oriented curriculum -Minors -Teaching materials	-Degree programmes that use the research output -Students participating in the research oriented curriculum	-Student satisfaction -Lecturer satisfaction -Assessment of research ability
	-Graduate theses placements -Reports	-Research minors -Lecturer participation in research -Participation of professors/researchers in committees/management of a degree programme	-Satisfaction of supervisors (e.g. placement supervisors) in the industry
Research Domain	-academic/ scientific publication -Expert meetings, patents, licenses -share of open access publications	-Citations -use of research data -use of knowledge products in research of third parties -reviews -income from patents, licenses	-Awards of grant applications for knowledge development or valorisation -Academic/scientific awards -Being asked for academic/scientific advisory boards/editorial boards, as a speaker, expert in the media,etc.

Table 1.1: Matrix of Optional BKO Indicators as Found in the BKO Itself (NAUAS 2022, 21-22)

The Research Themes

At the beginning of this journey towards learning the rules for evaluating the research impact of UAS research, the strategic agenda of the NAUAS 2016-2022 stipulated that their research aims to impact ten specific areas of society.

- Health: Care and Vitality;
- Education and talent development;
- Resilient society: in community, city and region;
- Smart technology and materials;
- The Built environment: sustainable and liveable;
- Sustainable transport and intelligent logistics;
- Sustainable agriculture;
- Water and food supply;
- Energy and energy supply;
- Art and creative industries; and
- Business: responsible and innovative.
  (NAUAS 2016)

Reflecting the Sustainable Development Goals (United Nations 2015) and Grand Challenges, as well as reflecting the Dutch Research Agenda these ten areas were believed to also reflect the work being done by researchers at Dutch UASs (NAUAS 2021). The strategic agenda of 2023-2028 has welcomed the addition of two more themes: Security; and Tourism and Hospitality, to better reflect the current research interests of the researchers under the NAUAS (NAUAS 2022). However, neither document discusses how this impact within the themes is to be evaluated.

The Knowledge Triangle

The tripartite Knowledge Triangle (KT) comprising Education, Research, and Innovation emerged initially to grasp the intricate connections among Higher Educational Institutions, the business sector, and society at large (Sjoer et al. 2012). This framework departed from the conventional notion of a unidirectional flow of knowledge absorption, akin to valorisation (Etzkowitz and Leydesdorff 2000). Unger et al. (2020) defined KT as "a network of actors and policy domains (education, research, innovation) spanning the arena for collaborative activities with the goal of offering integrated approaches across these three domains" (808). Innovation serves as the bridge to the business sectors or Professional Practices (Unger and Polt 2017). They argue that sustained and systematic interactions among these spheres are vital for optimizing the impact of investments in all three domains. Furthermore, a functional relationship among research, education, and innovation is deemed crucial for tackling societal challenges.

Despite potential challenges in the dynamics of the KT (Maassen and Stensaker 2010), Dutch research policies have evolved in alignment with the described conceptual framework (Unger et al. 2020). In June 2005, the "Lectorsplatform," a network of lecturers, released a memo introducing their interpretation of the KT, known as the KOP-model: Kennis (Knowledge), Onderwijs (Education), and Praktijk (Practice) (Miedema et al. 2013). The interconnectedness of these elements was considered a pivotal criterion for achieving high-quality UAS research (van Gageldonk 2017). This interpretation remains the cornerstone of Dutch UAS research today, as evident in the NAUAS report "Meerwaarde in het hbo" (Added Value in Higher Professional Education) (Franken et al. 2018). Figure 1.1 provides an English translation of this KT interpretation, illustrating the cyclical flow of knowledge through the Triangle in both directions. Interventions and interactions among the three components of the Triangle extend from Education and Research to Professional Practice. Professional Practice encompasses organizations, businesses, and other stakeholders constituting society. While interactions involve an exchange among the various components of KT, interventions originate from Education or Research toward Professional Practice (Miedema et al. 2013).

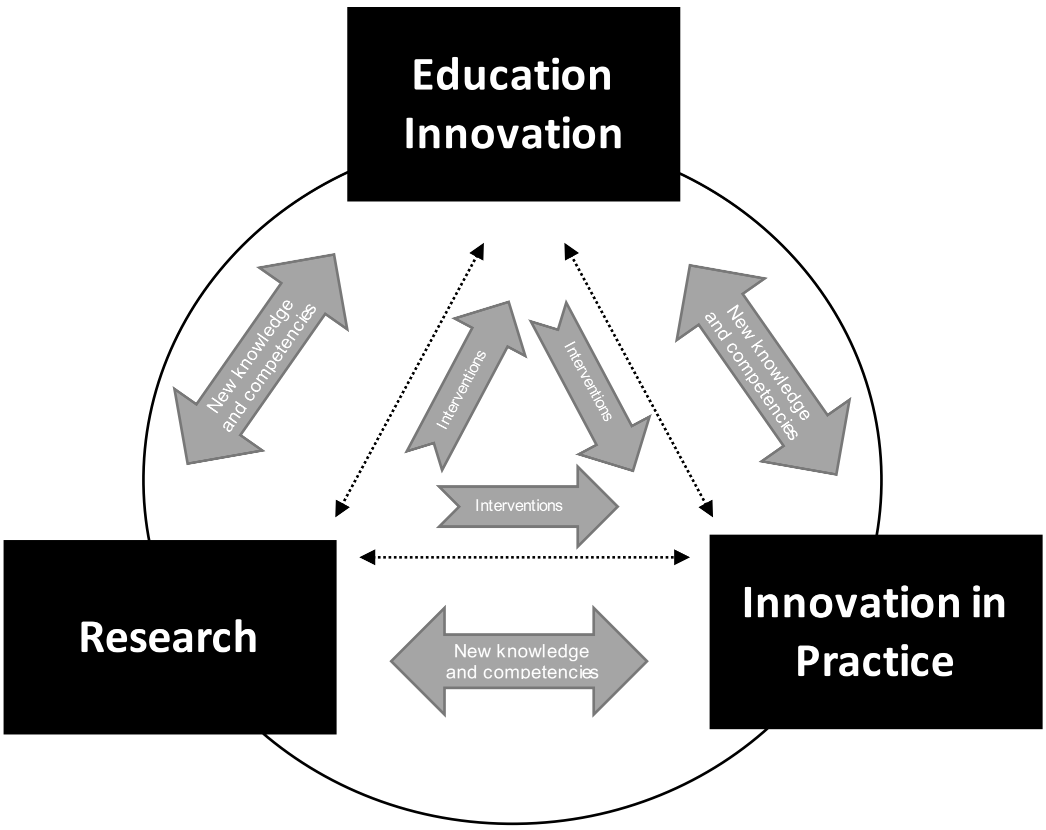

Figure 1.1: Knowledge Triangle of Dutch UASs (Franken et al. 2018, 11)

EVALUATING RESEARCH IMPACT

The KT provides a foundation for understanding UAS research's collaborative and applied nature and forms the basis of much NAUAS research policy including the BKO and its impact evaluation component. Research impact evaluation, in its essence, aims to determine the significance and influence of academic pursuits on society. However, specificities arise when seeking a 'robust' methodology. 'Robustness' here implies a method that is comprehensive, replicable, and less susceptible to biases. While substantial literature exists on research impact evaluation, few delve into its applicability to UAS contexts. General universities often take centre stage, possibly due their longstanding tradition in research.

Impact

A prominent observation from existing literature is the lack of universal consensus on defining 'impact' (Bornman 2012, Greenhalgh et al. 2016) and the methodologies best suited to evaluating it (Budtz Pedersen et al. 2020, Reed et al. 2021). The NAUAS makes use of the term *Doorwerking*[1]. The direct English translation of “effect” says little about what the word actually implies. A less direct translation could be “Influence”, which better reflects what the term Doorwerking suggests: the subtle and less subtle changes that occur throughout the research process similar to the ripple effect when a stone is thrown into a body of water or an ecosystem in which minute developments create a succession of changes for adaption. This is much the same as Sivertsen and Meijer’s (2020) ‘Normal’ impact.

Sivertsen and Meijer (2020) make a differentiation in types of impact between ‘Normal’ and ‘Extraordinary’ impact. Normal impact extends beyond productive interactions, where interactions between researcher and stakeholder create ‘scientifically robust and socially relevant’ impact (Spaapen and van Drooge 2011). Instead, Sivertsen and Meijer suggest that Normal impact is simply generated through interactions at a personal or organizational level that occur through decisions made and activities participated in on a daily basis. They suggest that this Normal impact is the most common form of impact, but it is Extraordinary impact that while rarest, is the most frequently evaluated. Extraordinary impact is the impact written about in case studies and narratives because of its positive widespread effect on society (Sivertsen and Meijer 2020).

Lykke et al. (2023), building on the work of Sivertsen and Meijer, refer to Normal impact as micro impacts. They suggest that rather than focusing on impact as the outcome of a causal link between scientific breakthroughs and societal changes, micro impacts continuously occur in the interactions between research and throughout the research process, and facilitate an unexpected and unplanned effect. Budtz Pederson and Hvidtfeldt (2023) go on to say that it is these micro impacts (distinct events, communicative impulses, or material artifacts) that may eventually lead to macro level impact. It is these micro impacts that Dutch Universities of Applied Sciences would like to evaluate but it is the macro impacts that are most often referred to in research impact assessment literature and in the suggested indicators of the BKO.

This confirms that the evaluation field is in flux, with evolving metrics and criteria (Reed et al. 2021). While this vastness offers flexibility, it also brings ambiguity, especially when looking to standardize criteria across various research fields.

The Research

The research done by UASs has been referred to as, among other things, Applied, Triple Helix, Third Mission, Entrepreneurial, Mode 2 or Edison’s Quadrant research (Bornmann 2012). The

[1] The term doorwerking will be used throughout this dissertation. While it is translated into English as ‘effect’, its acutal meaning is more nuanced and a better description of what Universities of Applied Sciences wish to evaluate.

literature does offer insights into evaluating the impact of Mode 2 research. The NAUAS's initial BKO stated that the research done by Dutch UASs can be considered Mode 2 research (NAUAS 2007). This theoretical framework initiated by Gibbon et al. (1994) in their book, *The New Production of Knowledge,* suggests that in addition to traditional, fundamental research (Mode 1 research), a new form of knowledge production is being created, i.e. Mode 2. Mode 2 research is described as transdisciplinary, heterogeneous, heterarchical and transient (Gibbon et al. 1994). Among other things, this knowledge production is generated within the context of applications and utilizes a broad range of theoretical perspectives to solve problems. The results of this are shared through formal channels and informal interactions with participants (Gibbon et al. 1994) which is solution-driven and context-specific, often engaging multiple stakeholders. Transdisciplinary research also finds mention, with its emphasis on transcending disciplinary boundaries (Gibbons et al. 1994). The term Mode 2 was specifically created by Gibbon et al. (1994) because terms such as 'applied', 'technological' or 'research and development' were insufficient to describe the research or knowledge production being done outside of traditional knowledge production (Gibbon et al. 1994).

The applicable, problem-solving nature of UAS research is also reflected in Stokes' Pasteur's Quadrants theory (1997). Stokes' theory of technological transfer suggests that knowledge production is composed of four quadrants. He describes three of these quadrants as categories of research: pure basic; use-inspired basic; and, pure applied research, to illustrate the three different ways in which knowledge is produced. There is no information regarding the fourth quadrant. Both the AWTI and the NAUAS have suggested that research undertaken by UASs falls into the "Edison" quadrant (de Weert and Leijnse 2010). This is characterized by pure applied research that seeks to solve a specific problem rather than to understand any broader scientific phenomena resulting from what is being discovered (Stokes 1997). However, it has been questioned as to wheather this accurately describes the research taking place at UASs (Kyvik 2012).

Gulbrandsen and Kyvik (2010) have said that while policy has used terms like 'basic' and 'applied', the differentiation between these two forms of research maintains the idea that research is a linear process. In fact, the heterogeneous nature of research makes definitions and concepts such as Mode 2 and Pasteur's quadrants insufficient in explaining the type of research occurring. Kyvik and Lepori (2010) suggest that the term used to refer to the research taking place at UASs is inconsequential. Be it Mode 2, design and development, practice-oriented research, design research, or applied research, the term 'research' at UASs has come to represent two distinct processes; a narrow interpretation for statistical purposes, and a broader one that describes the scholarly activities taking place. They conclude that what is important is that UASs participate in research activities 'to strengthen the scientific basis of professional practice' (Kyvik and Lepori 2010, 9), that 'the scientification of the knowledge core through the establishment of a research capability'(Kyvik and Lepori, 2010, 10) is required for professionalization, and should be part of UAS's core business to improve both education and professional practices as well as contribute to regional development (Kyvik and Lepori 2010). Gibbon et al. (1994) and Stoke's theories do not recognize the importance of the region and education in UAS research. Research that is initiated for the development of regional needs, and research that strives to improve education and professional practice are key to UAS research (Jongbloed 2010).

Brouns (2016) takes the contribution of the professional practice a step further in her explanation of research done by UASs. She prefers the term, Praktijkgebonden (Practice Related). She suggests this term reflects the non-linear nature of UAS research. Additionally, she argues it emphasizes the continued role of professional practice throughout the research cycle, and the valuable combining of the scientific knowledge of the researcher and these experiences. Regardless of its name or title, it can be argued that what is important is that the research contributes to the linkage of the KT.

The type of research being done in UASs in response to these challenges and problems is also not strictly basic/applied. As previously illustrated, the types of research being done by these institutions cannot be limited to a concise definition. Rather they are complex interactions between requests for problem solving from professional practice, and problem solving as a reaction to observed and experienced problems encountered by the researchers themselves.

It can be proposed that the research conducted by UAS is comparable to Carayannis and Campbell's (2009) concept of Mode 3 and Quadruple Helix Innovation Systems (Meister Broekema 2023). Mode 3 research builds on the traditional academic knowledge production of Mode 1 and the collaborative, transdisciplinary knowledge production of Mode 2. Adopting a systems analysis approach, Mode 3 emphasizes integrating diverse knowledge sources and contextualizing knowledge to address real-world problems, given the multi-layered, multimodal, and multimodel nature of knowledge production practice. Carayannis and Campbell (2009) expand on Etzkowitz and Leydesdorff's (1998, 2000) 'Triple Helix' by introducing a 'Quadruple Helix' model. This model not only involves collaboration between government, industry, and academia but also includes the active participation of civil society or the public. Emphasizing the importance of diverse stakeholders in fostering innovation, this model mirrors the dynamic interplay between various knowledge types in an ecosystem of partners and stakeholders, akin to the dynamics observed in UASs.

UASs Beyond the Netherlands

A research impact evaluation approach applicable to research conducted by UASs in the Netherlands can also be internationally applicable. Countries including Austria, Belgium, Croatia, Czech Republic, Denmark, Estonia, Finland, Germany, Greece, Ireland, Lithuania, Norway, Portugal, Spain, Sweden, and Switzerland, all have a binary educational system with traditional universities and Universities of Applied Sciences (UAS4EUROPE 2017). While not homogeneous in execution, UAS4Europe, a network of European UASs working together to further professionalize UASs and their research, recognizes the following four criteria as the essence of UAS research:

- "Focus on practical applicability: research at a UAS focuses on practical innovative solutions for companies, governments, and societal organisations. More important than scientific publications in magazines or books, UASs primarily want to bring concrete solutions to the workplace.
- Demand driven and targeted research: through its close contact with the labour market, UAS education directly addresses and responds to a (future) demand from either the business world, organisations and/or government as applied research is demand driven and applied to changes within society.
- Collaborative and multidisciplinary research: UAS researchers and world actors work closely together with a view on building synergies most commonly found in collaborations or clusters with multiple companies or institutions, which are active in the same domain and complement each other (co-creation).
- Connected to education: applied research outcomes are brought back to, and used in the development of the curricula, in order to offer state of the art knowledge to students and make them reflective practitioners with the right set of skills for the labour market. " (UAS4EUROPE 2017, 8)

These pillars reflect the Knowledge Triangle of Research, Education and Professional Practice. Like so many other research institutions, the framework of the KT is of particular importance to Dutch UASs.

These ideas provide a foundation for understanding UAS research's collaborative and applied nature. Initial literature assessments suggest a growing need to tailor evaluation mechanisms to these distinctive research modes (Reed et al. 2021).

The Actual Evaluation

Research impact evaluations set out to determine if there is a causal relationship between research and positive or negative effects of research. They can take place along diverse scopes of time, social or special scales, and across realms of impact such as economic, environmental, health, or policy (Reed et al. 2021). They typically revolve around certain foundational components: the theoretical typologies of the evaluation; their underlying assumptions; the methodologies; and tools employed for the evaluation.

Several theoretical typologies for impact evaluation have been identified in the literature (Mostert 2008). A literature review conducted by Reed et al. (2021) has suggested that the purpose of the evaluation, be it external or internal in design are one of two ways in which impact evaluation frameworks can be categorized. The external evaluation or summative design, focuses on being held accountable through providing evidence of achievements and claims of impact. The internal or formative design, instead, focuses on taking responsibility for creating impact and monitoring, learning and adapting to ensure that evaluation takes place. The level of aggregation must also be taken into consideration. The impact can be evaluated at the level of Discipline, Institution, the Research group, the Research Line or Project Level (Mostert 2008). Also of importance, is when the evaluation takes place: Ex Ante (beginning before the research); Ex Post (following the research); or in Real-Time (throughout the research) (Budtz Pedersen, Følsgaard Grønvad and Hvidtfeld 2020).

Using these theoretical typologies as a starting point, models and frameworks for the evaluation of research impact are constructed out of different methodologies that aim to better understand the process of knowledge translation, implementation and impact creation within the context in which they take place. These different approaches make different assumptions about the purpose of research, how knowledge is produced, the role values play, and the mechanisms used to create and evaluate impact (Budtz Pedersen, Følsgaard Grønvad and Hvidtfeld 2020).

As indicated in Raftery et al. (2016), research impact evaluation approaches have five 'philosophical assumptions' on which the approach is based. Be it Positivist, Constructivist, Realist, Critical or Performative, specific assumptions are made regarding the links between research and impact, how knowledge is produced, its purpose, and its relevance, as well as the mechanism of impact, and how these things should then be evaluated (Greenhalgh et al. 2016, Penfield et al. 2014, Raftery et al. 2016, Budtz Pedersen, Følsgaard Grønvad and Hvidfeldt 2020). These assumptions act as the lens through which research is viewed and help to form and enhance the methods and tools used to evaluate its impact (Raftery et al. 2016). Table A.1 of the Appendix describes the various perspectives and assumptions held when evaluating research impacts as discussed by Raftery et al. (2016) and visualized by Greenhalgh et al. (2016).

Beyond the philosophical assumptions, Reed et al. (2021) have used Grounded Theory Analysis to identify five types of research impact evaluations clustered around frameworks, methods and approaches found in research impact evaluation literature. These types include experimental and statistical methods, systems analysis methods, textual, oral and art-based methods, indicator based approaches, and evidence synthesis approaches. Table A.2 of the Appendix presents the types of research impact evaluations and the examples of commonly used methods and approaches, including examples of diverse frameworks that fall under these types. The first three types include related evaluation methods whereas the last two types include the related approaches.

Different frameworks focus on different aspects of impact and in so doing require different methods and tools to accomplish this. A literature review conducted by Budtz Pedersen, Følsgaard Grønvad and Hvidtfeld (2020) has identified the most common tools used in research impact evaluation frameworks be they qualitative or quantitative. Table A.3 of the Appendix identifies these tools and provides a summary of their purpose. These tools include case studies (narrative approaches), surveys, peer review, Impact plans, theory of change and logic models, stakeholder/user evaluations, and many more options (Budtz Pedersen, Følsgaard Grønvad and Hvidtfeld 2020).

In a study into research impact conducted by Greenhalgh et al. (2016), it has been suggested that the most commonly used tools in many current evaluation methodologies include:

- A logic framework: This allows for a visualisation of the input activities and output and outcomes of impact (Greenhalgh et al. 2016). The presence of a logic model almost exclusively correlates to methodologies with a positivist philosophical assumption (Raftery et al. 2016);
- Case studies: Case studies aid in explaining the process and interactions that come as a result of knowledge production impacting society; and

- A narrative: Narratives are often required to help explain the feedback loops and non-linear nature of impact as well as why certain outcomes expected to make impact fail (Greenhalgh et al. 2016).

Interviews, surveys and document analysis are also used with frequency to apply the logic model (Raftery et al. 2016). Raftery et al suggests that the frameworks and methods used are influenced by the aim of the evaluation (Raftery et al. 2016). Guthrie et al. (2013) take this further by saying that the current tools used for evaluation fall into two categories based on what they wish to accomplish. One set of tools are those required to create "formative, flexible tools able to deal with cross-disciplinary and multidisciplinary assessments" (Guthrie et al. 2013, 9). The second set of tools are those required for creating an evaluation that is "scalable, quantitative, transparent, comparable, free from judgement, and suitable for high frequency, longitudinal use" (Guthrie et al. 2013, 9). In order to create a framework that incorporates these two options, two or more complimentary tools are required (Guthrie et al. 2013). (Two tools that fall outside either of these groupings are data visualization and logic models (Guthrie et al. 2013).) Table A.4 of the Appendix lays out the commonly used tools for research evaluation, including societal impact, as discussed by Guthrie et al. (2013, 9).

What is clear from each of these literature reviews is that one must be aware of the following 5 W's before proceeding:

- ⇒ Who are we evaluating? Researcher, research group, institution?
- ⇒ Why are we evaluating? Summative verses formative?
- ⇒ When are we evaluating? Ex-ante, ex-post, real-time?
- ⇒ What are we evaluating?
- ⇒ How are we evaluating?

The "what" and the "how" go hand in hand and are in many ways dependent on each other. It is the "what", the definitions of impact, the context of research, the process of knowledge production that influences the way in which research impact evaluation takes place and the "how" required for doing it. In order for the "how" to be effective, there needs to be an understanding of what is being evaluated as well as the details of how the tools and frameworks function and are constructed to ensure that what is desired can be accomplished with the chosen 'how". Numerous frameworks exist for research impact evaluation, each originating from distinct paradigms and making use of these tools. The various literature reviews suggest that the "how " should always be a combination of qualitative and quantitative data to provide a robust evaluation that takes multiple perspectives into account to facilitate responsible research and innovation.

In order to evaluate the research impact created by UASs we must first understand what we are evaluating and be able to answer the other 5 W's before being able to decipher the "how" of this evaluation. It is essential that we know what we are striving to evaluate and take careful consideration in understanding the purpose of the tools and possible frameworks best suited for the job. The challenge then lies not only in deciphering and understanding the vast existing knowledge but also in innovatively tailoring it to the unique characteristics of Universities of Applied Sciences. To date this has not yet been done. This is the crux of this dissertation.

THE UNDISCOVERED TERRAIN OF UAS RESEARCH EVALUATION

The academic landscape of research evaluation is vast and varied, with much knowledge accumulated over the years. However, specific areas remain uncharted, especially when navigating the unique context of UASs.

The most evident omission in the literature is the lack of studies explicitly focused on evaluating the impact of research conducted by UAS. While a plethora of articles dive into the intricacies of evaluating research impact for general universities, UAS remains conspicuously absent from the discourse. This gap underscores a critical need for dedicated studies in this niche area.

Understanding research in UAS is paramount because of its distinctive nature. Drawing inspiration from models like Pasteur's Quadrant, Mode 2 and 3 research and transformative innovation, one can discern that UAS research straddles the line between pure and applied research. Unlike traditional 'ivory tower' universities that often function in theoretical realms, UAS takes a grounded approach. It not only implements established theories to solve real-world problems but also collaboratively engages stakeholders from inception to conclusion. This direct application to societal issues and multidisciplinary lens differentiates UAS from its counterparts.

Research impact evaluation, by its very nature, is context-sensitive (Budtz Pedersen, Følsgaard Grønvad and Hvidtfeld 2020, Reed et al. 2021). Yet, most UAS have looked towards traditional universities for evaluation guidance. This emulation might lead to incongruities since the contexts are distinctly different. Traditional university research often occurs in isolation from societal applications, while UAS research is deeply entrenched in practicalities. Applying a one-size-fits-all evaluation approach might therefore not do justice to the unique contributions and challenges of UAS research.

Given these observations, several questions arise. Specifically, what are the requirements for evaluating the research impact created by Dutch UAS research? How can these be applied within the context of the goals of Dutch UASs? This dissertation investigated these questions in detail.

In conclusion, the current state of academic knowledge about research evaluation casts a wide net but seems to miss the peculiarities of Universities of Applied Sciences. Addressing this gap is not just an academic exercise but is crucial to ensuring that the value and impact of UAS research are assessed appropriately, giving due credit to its distinctive contributions to academia and society.

THIS DISSERTATION ON UAS RESEARCH IMPACT EVALUATION

The journey through this dissertation is divided into two interconnected parts; identifying the rules, and exploring how the rules can be implemented within the specific context of the Dutch UAS research and policy.

Chapter Two presents a comprehensive literature review aimed at identifying the rules for UAS research impact evaluation. There is a clear deficit in the literature: the absence of a theoretically grounded method for evaluating the impact of UAS research. Much of the existing knowledge on research impact evaluation appears to be more oriented towards conventional universities. This chapter identifies recommendations based on a thorough assessment of diverse research methodologies presented in the impact literature. The foundational concepts, or rules including the need for formative, real-time evaluations, the significance of the realist and performative assumptions, the need for co-creation in evaluation and the debated relevance of logic models offer important insights for future UAS impact evaluation.

Part of the strength of this dissertation lies in its application and testing of these above-mentioned rules. By critically analysing the current evaluation tools, juxtaposing them with the actual desires of UASs, and field-testing new evaluation methods, this work offers the start of a tangible alternative for a more accurate, context-specific means of evaluation. This is the role of Chapters Three, Four and Five where the results of Chapter Two are used to assess what takes place in practice and how this stands up against what we have discovered to be the recommendations for evaluating the impact created by UAS research. Through the use of Principle Component Analysis, specifically Factor Analysis, conducted on questionnaire results, Chapter Three examines the inner working of the research group by making use of the ‘basic indicators’ of the BKO to examine the roles and functions of the research group members. Making use of questionnaire and workshop results, Chapter Four examines the desired impacts of UAS researchers and the outputs they create to facilitate this impact. By doing so we hope to provide a better understanding into not only what impact researchers want to create and what output they produce but also whether the BKO provides the correct tools for evaluating the impact of UAS research. Chapter Five presents a case study in which one of the frameworks that follows several of the recommendations is tested. In this chapter we use Contribution Mapping to follow the actors, activities, outputs, and alignment efforts in a UAS project to help identify contributions to doorwerking.

This dissertation strives to provide scientifically grounded recommendations about UAS research impact and its evaluation for those associated with a University of Applied Sciences, be it as a researcher, administrator, or policy-maker. It provides the tools and knowledge required to ensure that the research impact of UAS research is recognized, celebrated, and most importantly, accurately evaluated. After all, accurate evaluation is not just about validation; it’s about refining our practices and ensuring that our research genuinely makes a difference in the real world. Transparency in research impact evaluation is not just a fiscal responsibility; it is a testament to the value that Universities of Applied Sciences bring to the table. By accurately evaluating and showcasing the impact of UAS research, we can demystify the academic process for stakeholders and the public alike. It ensures that the knowledge generated is not just housed within academic silos but is actively contributing to societal betterment.

Furthermore, as traditional universities and Universities of Applied Sciences take on new forms and formats, there is a growing need to establish the uniqueness and importance of the latter. UAS research, with its practical orientation, bridges the gap between theoretical knowledge and real-world application. By accurately evaluating and emphasizing this aspect, UAS can position themselves as essential contributors to practical solutions for contemporary challenges.

A clear, robust evaluation system also benefits the research of UASs. It gives a structure to align their efforts, ensuring that they not only create tangible outcomes in the communities they serve but also contribute to the academic discourse. In an age where accountability and real-world impact are emphasized, having a sound evaluation system in place for UAS research is no longer a luxury; it is a necessity. This process contributes to making the impact of UAS research visible and aids in bettering the impact on society in the future. In doing so, it reaffirms the value and significance of Universities of Applied Sciences in today's academic and societal landscape. Let us get started and find out what these rules are for evaluating the research impact of Universities of Applies Sciences.