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

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CHAPTER 4

EVALUATING THE RESEARCH IMPACT OF DUTCH UNIVERSITIES OF APPLIED SCIENCE: AN EXAMINATION OF THEIR THEMES; THEIR OUTPUT; AND DESIRED IMPACTS

ABSTRACT

Universities of Applied Sciences (UASs) of the Netherlands, like many publicly funded institutions, wish to make their impact on society visible. Policy of the Netherlands Association of Universities of Applied Sciences (NAUAS) indicates that the NAUAS wish to make impact in specific themes. The purpose of this article is to assess the question of how the research impact of the ten themes of NAUAS policy can effectively be evaluated. To do so, this article will closely examine how Dutch UAS researchers view their work within the initial ten themes, the impact they wish to create in those themes, and the output created during this process using data gathered from a national questionnaire and workshops. We will reflect on these results against the backdrop of the specific UAS policy aims around impacts, *doorwerking* (effect or influence), and the broader impact literature.

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INTRODUCTION

The impact of research has become an international topic of discussion by governments, higher educational institutions, and funders with the result that institutions are increasingly considering its importance and the need for evaluation (Ravenscroft et al. 2017). Universities of Applied Sciences (UASs), institutions for higher education that focus on professional practices worldwide, are no different. UASs have, for decades, impacted society through educating future professionals (van Gageldonk 2017). Now, with an increased emphasis on research, UASs are striving to highlight other impacts on society.

The mandate of UAS research is to specifically impact society through focusing on practical applicability, being demand driven, and applied to societal changes. It is collaborative, multidisciplinary, and connected to education by the incorporation of the results into curricula (Universities of Applied Sciences for Europe 2017). In response to this increased emphasis on impact, UAS associations in several countries, including Belgium, Finland, Denmark, and the Netherlands, are striving to construct means to allow the systematic evaluation of research impacts.

Research conducted by Coombs and Meijer (2021) into the appropriate means of UAS impact evaluation has suggested that the philosophical assumptions underlying such an evaluation must first be considered. Seen as the lens through which you view the research, and which influences the way links between research and impact are viewed, appropriate assumptions for UAS research are said to be either a realist or performative assumption. Research impact studies from a Realist assumption aim to explore the context-mechanism-output-impact configuration and strive to address the variability in knowledge uptake through the research. Mechanisms of impact are believed to be achieved through interactions between policy makers, practitioners, and resources. A performative assumption, however, is based in Actor-Network Theory. Evaluation of research impact is believed best accomplished by assessing the greater effects of interactions between research and society through mapping the actors, activities and resulting changes that take place over time (Greenhalgh et al. 2016). The theoretical requirements suggest that pertinent evaluation is conducted in real-time and is formative in nature with the goal of learning and improving. These requirements stress the need for a framework that follows the messy process of practice-oriented research without constricting it with a logic model which connects objectives, input, output, and impacts in a linear way. This evaluation framework should be done in co-production with stakeholder involvement from the outset. The culmination of these requirements emphasizes the importance of understanding the context and process of research done at UASs to evaluate its impact (Coombs and Meijer 2021).

The Netherlands Association of Universities of Applied Sciences (NAUAS), known in Dutch as the Vereniging Hogescholen, currently strives to impact society in twelve research themes (NAUAS 2021). In its publication *Onderzoek met Impact* (2016) ('Research with Impact'), the NAUAS outlined the initial ten areas of society on which UASs aim to collectively create impact. Reflecting the Sustainable Development Goals of the United Nations (United Nations 2015), these themes include health, education, society, built environment, transport, agriculture, energy, the arts, business, and technology. It is intended that these themes follow the Dutch Research Agenda and reflect the current research trends within Dutch UASs (NAUAS 2016). Table 4.1 provides an overview of these themes and the corresponding short name by which they will be referred to throughout this article. These themes are intended to be broadly recognized areas in which UASs conduct sizeable amounts of research and are to be dynamic (NAUAS 2016). In its current strategic research agenda of 2022-2025, the NAUAS has added two additional themes. These are Security, and Tourism and Hospitality (NAUAS 2021). These new themes were introduced after this study was conducted and, consequently, are not included in this article. The NAUAS strategic agendas call for the evaluation and monitoring of the impact of these themes (NAUAS 2016).

The research questions this article addresses are: 1. how Dutch UAS researchers view their work within the ten themes; 2. What impacts do UAS researchers wish to create? 3. What types of outputs do they create to achieve this impact? Through answering these questions, the purpose of this article is to assess the larger question of how the research impact of the ten themes of NAUAS

policy can be evaluated in a meaningful way. We will reflect on these results against the backdrop of UAS policy aims around impacts, doorwerking, and the broader impact literature.

Netherlands Association of Universities of Applied Sciences Theme Name	Corresponding Abbreviation
Health: Care and Vitality	Health
Education and talent development	Education
Resilient society: in community, city, and region	ResilientSoc
Smart technology and materials	Materials
The Built environment: sustainable and liveable	BuiltEnv
Sustainable transport and intelligent logistics	Transport
Sustainable agriculture, water and food supply	Agriculture
Energy and energy supply	Energy
Art and creative industries	Art
Business: responsible and innovative	Business
No Domain	

Table 4.1: Netherlands Association of Universities of Applied Sciences Theme Name and Corresponding Abbreviation Throughout Article

'Impact': A Journey

Defining 'Impact' has been an evolutionary process for Dutch UASs in much the same way as it has been for the rest of science (Riley et al. 2018). While it may at first appear to be a word game, the definitions and intentions of the word have ramifications for evaluation. They, also, reflect the maturity of practice oriented research in the Netherlands as they move from accepting words and definitions that are common but do not reflect the fullness of UAS research, to using terms and definitions that reflect the nature and practice of it.

Today, the most frequently used term when referring to impact in Dutch UAS policy, if not in discussion, is the term *doorwerking*. The term doorwerking is directly translated into English as 'effect'. The NAUAS has defined effect as: "The influence of both the research process and the research results on Education, Professional Practice and the Research domains" (NAUAS 2022, 22). This is a difficult word to do justice to in the English language, but the inference of the word is more detailed than what that relatively traditional definition conjures up. It includes all the subtle implicit and explicit changes/effects that occur during both the research process and dissemination of its output. Andriessen (2022) speaks to it as similar to the growth of a seed that slowly grows in each direction, and where value is created throughout the subtle, non-linear growth process (Tielen, 2022).

This is very different from the term that Dutch UASs originally used. Initially, the term used was 'valorisation' (de Jong 2016). The 2009 definition of 'valorisation' adapted by the Ministry of Economy states:

> "Valorisation is the process of creating value from knowledge by making knowledge suitable and/or available for economic and/or societal use and translating that knowledge into competitive products, services, processes and entrepreneurial activity" (Nederland Ondernemend Innovatieland 2009).

In 2012, the word 'competitive' was removed to soften the economic implications of the definition (de Jong 2016).

On an international level, the term 'valorisation' primarily applies to the economic value of research impact (van Drooge et al. 2011). While valorisation is seen as a legitimate component of research impact, the current focus tends to overlook the non-economic component of research impact (van Drooge et al. 2011). The policy and support focus around impact has until recently been

on the entrepreneurial output. Centres of Entrepreneurship have been set up to facilitate spin-offs, incubators, and the like, through which valorisation is achieved (OECD 2018). De la Torre et al. (2017) argue that by focusing on the economic value, full engagement in the broader spectrum of impact is neglected.

Further limitations of this economic focus have been identified by Etzkowitz (1998) who suggested that it implies a one-directional flow of knowledge from science to society rather than an exchange of knowledge between science and society. However, the idea that knowledge flows in a single direction has been superseded by the concept of the Knowledge Triangle (KT) of Education, Research, and Innovation. Van Vliet echoes this concern by suggesting that, in principle, the word valorisation as defined by the Ministry, can be used by UASs. However, it primarily reflects only a portion of the role UASs fulfill in impact creation (van Vliet 2022). The KT acknowledges the interconnectedness of Higher Education, the Business sector and society at large (Unger, Marsan, Meissner et al. 2020). The KT forms the foundation of UAS research and much of the policies of the NAUAS (Miedema, van der Sijde and Schuiling 2013).

The NAUAS continued to use the term valorisation until approximately 2015 (NAUAS 2015). However, with the introduction of 'Research with Impact' the term valorisation was no longer considered appropriate. Instead, 'Research with Impact' made use of the term impact**.** Echoing the work of productive interaction (Spaapen and van Drooge 2011), this policy document generally referred to research impact as "the interaction between knowledge out of the real-world and knowledge for the real-world" (NAUAS 2015, 10).

Current thinking in UASs, reflected in policy, does not make use of either valorisation or impact, instead it uses doorwerking. Taking productive interactions further, the word conjures up visions of an ecosystem in which minute developments create a succession of changes for adaption. It is the continual interactions through people and output (Brouns et al. 2023) resulting in knowledge transfer between the areas of research, practice and education, that create doorwerking (Andriessen 2019).

Placing this idea in the broader impact discourse, the process focus of doorwerking is much the same as Sivertsen & Meijer's (2019) 'Normal' impact. Sivertsen and Meijer 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). However, 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.

Lykke et al. (2023), building on the work of Sivertsen and Meijer (2019), 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 continually occur in the interactions between research and throughout the research process, and facilitate an unexpected and unplanned effect, be it positive or negative (Derrick et al. 2018). Budtz Pederson & 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, and which have implications for the evaluation process (Lykke et al. 2023).

The Potential Effect of the Themes

The activities, interactions, and relations between the three areas of the KT, and thus the impact of the research, are believed to differ between themes (Lykke et al. 2022). Other factors contributing to the differences include what the researchers themselves wish to contribute to society, the impact they wish to make and how they accomplish this in output. Theme specific elements may be required of a research impact evaluation of the ten themes, to reflect the shared

values of these specific themes (Williams 2020). It is, therefore, necessary to garner more information concerning the themes and how they function, in order to best serve them, and avoid modifying the practices of UAS researchers to conform to the evaluation. This speaks to the importance of avoiding perverting evaluation by creating a situation in which researchers feel compelled to act and produce in a specific way (Gläser and Laudel 2007) which does not reflect the reasoning behind the NAUAS's ten chosen themes. Rather than being chosen to steer research in a certain direction, the themes are intended to reflect the work already being done by UAS researchers. (NAUAS 2022). It is not the goal of the NAUAS that researchers choose projects based on their compatibility with a specific theme. The expansion of the NAUAS themes to include Security, and Tourism and Hospitality exemplify this. Nevertheless, the practice of working with themes may in fact cause these changes to occur as researchers attempt to fit into the specified themes. This is a continuous battle; to showcase the impact UAS research has on society in a way that does not alter how researchers conduct themselves and their research (Whitley 2007).

METHODS

By examining the impact and output of UAS research at a theme specific level, we can investigate commonalities and differences between these themes. These differences may be addressed when integrating the themes into the evaluation process of Dutch UASs. To assist in assessing this, we conducted a mixed methods study. Data for this study was drawn from both a questionnaire and a set of workshops conducted with the purpose of learning more about practice-oriented research, its researchers, impacts and outputs, and the themes.

Questionnaire Sample

The sample consisted of 467 respondents. Respondents represented 31 of the 36 UASs in the Netherlands. Of the 467 respondents, 434 respondents indicated the impacts they wish to create. 355 respondents indicated what output their research produces. 293 respondents indicated the theme in which they felt their research best fit and the multiple themes into which they felt their research could fit.

Table 4.2 indicates the specific questions asked and the number of respondents per question.

Question	N=467	%
Please indicate one theme where you feel your research best fits.	N=293	62,7
Please indicate all the themes where you feel your research fits.	N=288	61,7
What kind of impact do you want your research to have?	N=434	93
What kind of output does your research produce?	N=355	76

Table 4.2: Questions/Respondents

Questionnaire Design

Building on the work of the Rathenau study, *Praktijkgericht Onderzoek bij Lectoren van Hogescholen* (Practice-Based Research by Professors at Universities of Applied Sciences) (de Jonge 2016), we developed a questionnaire in which we sought to gain further understanding of not only how the networking and research functions of the professors' work, but also how the research group as a whole works with their various functions, and the context and process of their research. We explored research, teaching, networking, collaborating, evaluation, and internal organizational matters such as management. This approach also reflects the insights of Kyvik (2012) in his work on the roles and functions of Norwegian researchers, as well as Zuckerman & Merton (1972) and Blaxten, Hughes & Tight (1998), who discuss the various roles and functions of academics. The questionnaire was extensive, beyond the scope of this particular paper, and investigated the activities of the researchers forming these research groups as well as information about tasks, motivations, functions, backgrounds, and desired impacts (Anonymous forthcoming).

Importantly for this component of our study, we also asked questions concerning the respondents' theme(s), desired impact, and the output they create during their research. Components in the questionnaire were inspired by the questionnaire conducted by the Rathenau institute (de Jonge 2016), while also reflecting input from exploratory conversations with 33 researchers and support staff. Questions were verified and pretested with ten researchers (one per theme) prior to distribution. The results of this questionnaire give greater insight into the impact and output of UAS research as well as the legitimacy of the ten themes stipulated by the NAUAS.

Participants were asked into which of the NAUAS's ten themes they felt their research **best** fit. They were then asked to indicate **all** possible NAUAS themes into which they felt their research could fit. In addition, they were asked if there was a theme not included in those of the NAUAS into which their research better fit. We used these responses to specifically examine the practicality of the themes, the impacts researchers desire to make, and the output they create to aid in impact creation. These responses assist in determining how the evaluation of the impact of research conducted by Dutch UASs can be embedded into the evaluation process of the research themes as set out by the NAUAS. Figure 4.1 provides the exact questions asked and illustrates the distribution of respondents over the themes, including those who did not indicate a theme.

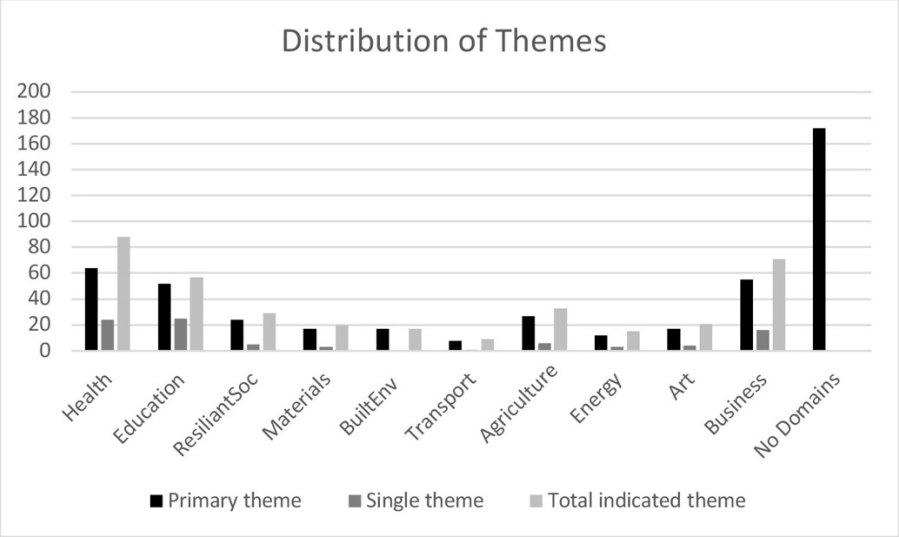


Figure 4.1: Overview of Respondents and Theme Choices

We asked respondents to indicate the desired impact of their research. The options were based on policy vernacular with a text box for other options and explanations as required (Guthrie et al. 2013). Specifically, researchers were asked to choose the types of impact for which they strive. Figure 4.2 illustrates the specific types of impacts and number of corresponding respondents.

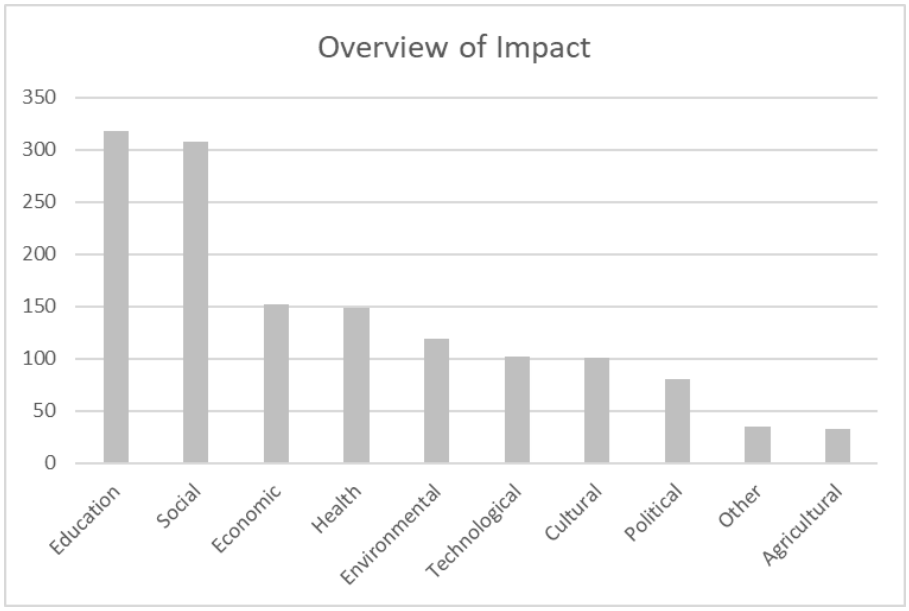


Figure 4.2: Overview of Questionnaire Results Concerning Impact

Respondents were asked to specify what types of output their research produced. Options of output were based on diverse sources of information including interviewee input, the Dutch national database for UAS research output, the HBOKennisbank, and the project database from the largest UAS research funder, Regieorgaan Stichting Innovation Alliantie (SIA) (Regieorgaan SIA 2021). Figure 4.3 illustrates the 45 types of output and number of corresponding respondents. An option of 'Other' as well as a textbox for additional personal options was made available. The order of types of output was randomly presented in the questionnaire.

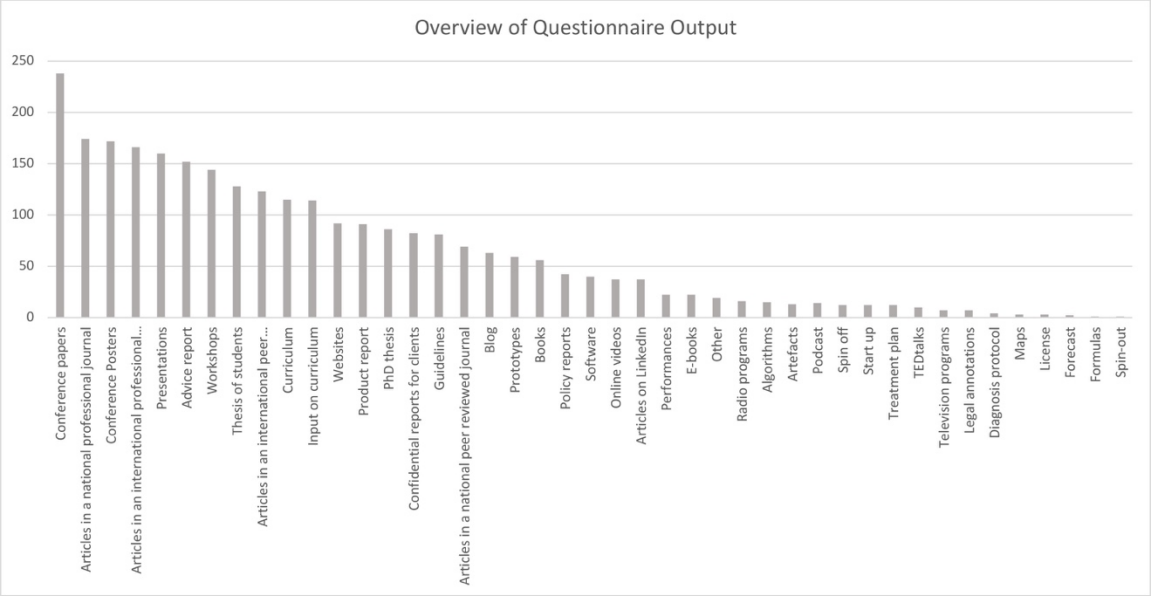


Figure 4.3: Overview of Questionnaire Results Concerning Types of Output

Respondent Recruitment

Currently, five of the 36 Dutch UASs affiliated with the NAUAS make use of a Current Research Information System or other centralized registration system for researchers. Consequently, a list of all researchers affiliated with a lectorate was collected primarily through institutional websites. All 36 UASs under the NAUAS were included regardless of the size of their research staff. A list of 2700 researcher names and email addresses was collected through the public

websites of the institutions, open repositories, or Google. When possible, the list was checked by a member of the research support staff from the specific institution. Participants were recruited directly through an email invitation that explained the aims of the study and provided a link to the online questionnaire. Participation in the online questionnaire was voluntary, anonymized and in compliance with the ethical rules of the research institutions involved. Questions were not made mandatory to encourage participation. The questionnaire was issued in May 2019, and again in October 2019.

Workshops were conducted to verify, discuss, and gain further understanding into the results of the questionnaire.

Workshop Sample

The total number of participants was 21 from 8 different Dutch UASs. There were two participants for each of the ten themes and one additional participant engaged in the healthcare theme giving that theme 3 participants.

Workshop Design

Each of these workshops, which were focused on the ten themes of the NAUAS, began with an introduction to the study. Participants were then given the opportunity to consent to participate. Written consent was also obtained. Further to introductions, a more in-depth presentation was made about the research project and findings concerning the evaluation of research impact created by UAS research. Opportunity for questions and discussion as initiated by participants was available. Participants were then led through a series of structured activities designed for data collection. Pertinent to this component of our study, participants were asked to identify the theme in which they felt their research best fit. Based on this decision, participants were asked the types of research impact their theme wishes to create and what they felt was the most important research impact for the theme. Finally, they were asked to indicate the types of output they produce during their research. Participants were given the freedom to write their answers as they deemed appropriate. When participants felt it was applicable, participants placed their answers in one of four quadrants: HEI (Higher Education Institution) activities, individual Research, Educationally Driven, and Practice Oriented.

Workshop Procedure

Initially, five multi-themed live workshops were organized. As a result of the Covid-19 pandemic and subsequent restrictions, only three of these workshops could be held in a physical space. To allow each theme to be represented at least twice, two additional individual or paired workshops were held online. Participants were initially recruited through the questionnaire and when necessary, were specifically asked to participate in accordance with the theme they felt best suited their research. This was to ensure each theme had a minimum of 2 participants. Participation in the workshops was voluntary and in compliance with the ethical rules of the research institution. Workshops were held between February 2020 and November 2020. Table 4.3 presents an overview of the workshop, the number of participants and the themes represented.

Workshop	Participants	Themes
1	6	Health, Education (2), Agriculture, Art, Business
2	5	Health, ResilientSoc, BuiltEnv, Energy, Art
3	7	Health, ResilientSoc, Materials (2), Agriculture, Energy, Business
4	1	Business
5	2	Transport (2)

Table 4.3: Workshops, Participants and Themes Represented

Workshop results concerning outputs are presented in Figure 4.4. Here responses are displayed in replica of the workshop results. When indicated by the participant, the results have been placed in the appropriate quadrant, including when participants felt that their answer was applicable

to more than one quadrant. Results without a specific quadrant can be found clustered on the right-hand side of the figure.

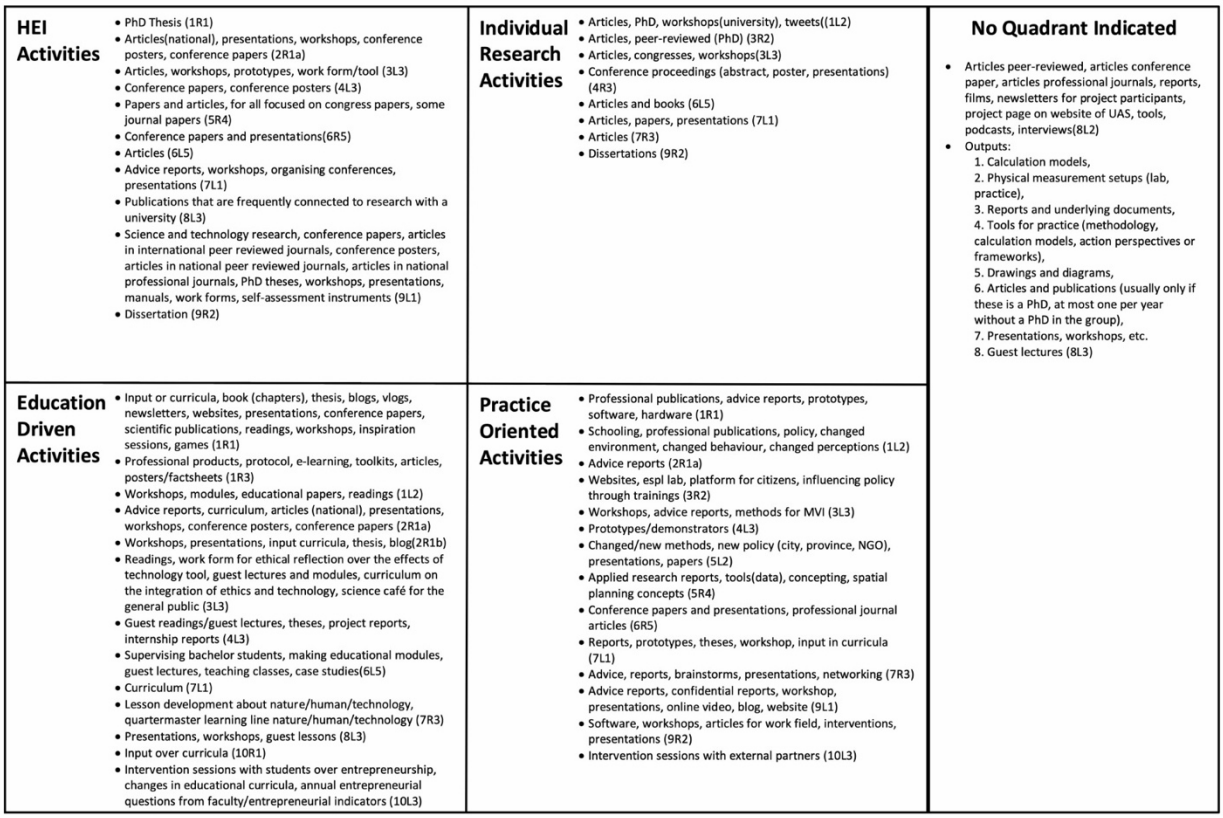
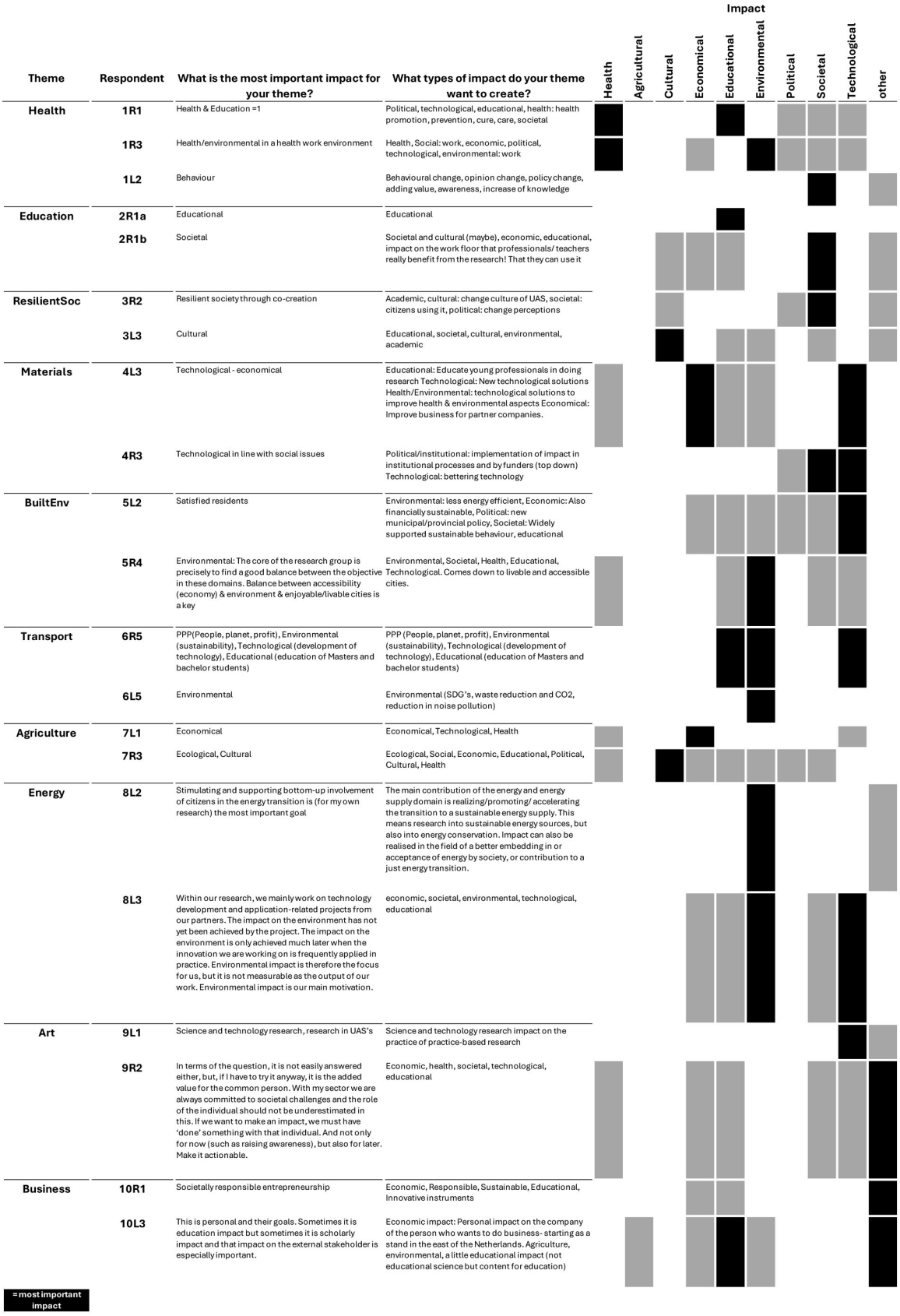


Figure 4.4: Overview of Workshop Results on Outputs

Workshop results of the questions concerning the types of impacts participants wish to create in their theme, and what they view as the most important impact for them, and their theme can be found in Figure 4.5 in the participant's own wording. Moving from left to right, this figure states the ten themes, the corresponding participant per theme and their exact answers. These answers have been plotted along the types of impacts asked in the questionnaire. Grey squares are all the impacts wished to be created. Black squares are those impacts believed most important. It indicates that, for example, while Educational impact is often mentioned with a series of other impacts, when specified, it relates to teachers benefitting from research, and students knowing how to conduct research. Hence, there are diverse connotations and contexts relating to educational impact, each depending on different outputs.



Theme	Respondent	What is the most important impact for your theme?	What types of impact do your theme want to create?
Health	1R1	Health & Education =1	Political, technological, educational, health: health promotion, prevention, cure, care, societal
	1R3	Health/environmental in a health work environment	Health, Social: work, economic, political, technological, environmental: work
	1L2	Behaviour	Behavioural change, opinion change, policy change, adding value, awareness, increase of knowledge
Education	2R1a	Educational	Educational
	2R1b	Societal	Societal and cultural (maybe), economic, educational, impact on the work floor that professionals/ teachers really benefit from the research! That they can use it
ResilientSoc	3R2	Resilient society through co-creation	Academic, cultural: change culture of UAS, societal: citizens using it, political: change perceptions
	3L3	Cultural	Educational, societal, cultural, environmental, academic
Materials	4L3	Technological - economical	Educational: Educate young professionals in doing research Technological: New technological solutions Health/Environmental: technological solutions to improve health & environmental aspects Economical: Improve business for partner companies.
	4R3	Technological in line with social issues	Political/institutional: implementation of impact in institutional processes and by funders (top down) Technological: bettering technology
BuiltEnv	5L2	Satisfied residents	Environmental: less energy efficient, Economic: Also financially sustainable, Political: new municipal/provincial policy, Societal: Widely supported sustainable behaviour, educational
	5R4	Environmental: The core of the research group is precisely to find a good balance between the objective in these domains. Balance between accessibility (economy) & environment & enjoyable/livable cities is a key	Environmental, Societal, Health, Educational, Technological. Comes down to livable and accessible cities.
Transport	6R5	PPP(People, planet, profit), Environmental (sustainability), Technological (development of technology), Educational (education of Masters and bachelor students)	PPP (People, planet, profit), Environmental (sustainability), Technological (development of technology), Educational (education of Masters and bachelor students)
	6L5	Environmental	Environmental (SDG's, waste reduction and CO2, reduction in noise pollution)
Agriculture	7L1	Economical	Economical, Technological, Health
	7R3	Ecological, Cultural	Ecological, Social, Economic, Educational, Political, Cultural, Health
Energy	8L2	Stimulating and supporting bottom-up involvement of citizens in the energy transition is (for my own research) the most important goal	The main contribution of the energy and energy supply domain is realizing/promoting/ accelerating the transition to a sustainable energy supply. This means research into sustainable energy sources, but also into energy conservation. Impact can also be realised in the field of a better embedding in or acceptance of energy by society, or contribution to a just energy transition.
	8L3	Within our research, we mainly work on technology development and application-related projects from our partners. The impact on the environment has not yet been achieved by the project. The impact on the environment is only achieved much later when the innovation we are working on is frequently applied in practice. Environmental impact is therefore the focus for us, but it is not measurable as the output of our work. Environmental impact is our main motivation.	economic, societal, environmental, technological, educational
Art	9L1	Science and technology research, research in UAS's	Science and technology research impact on the practice of practice-based research
	9R2	In terms of the question, it is not easily answered either, but, if I have to try it anyway, it is the added value for the common person. With my sector we are always committed to societal challenges and the role of the individual should not be underestimated in this. If we want to make an impact, we must have 'done' something with that individual. And not only for now (such as raising awareness), but also for later. Make it actionable.	Economic, health, societal, technological, educational
Business	10R1	Societally responsible entrepreneurship	Economic, Responsible, Sustainable, Educational, Innovative instruments
	10L3	This is personal and their goals. Sometimes it is education impact but sometimes it is scholarly impact and that impact on the external stakeholder is especially important.	Economic impact: Personal impact on the company of the person who wants to do business- starting as a stand in the east of the Netherlands. Agriculture, environmental, a little educational impact (not educational science but content for education)

Figure 4.5: Overview of Workshop Results on Desired Types of Impact and the Most Important Impact

RESULTS

Themes

Questionnaire Results

Figure 4.1 indicates that a considerable number of respondents did not indicate a theme (n=172). It also shows the number of respondents per theme, the number of respondents within each theme that indicated only one appropriate theme and the number of times a theme was indicated as a possible theme.

It is interesting to note the discrepancy in respondent numbers per theme, with Health being represented most frequently (n=64) and Transport being the least (n=8). While Health and Education have the largest number of representatives, they also have the largest number of respondents who suggest their research fits exclusively in those themes. This is plausible given that the professional curricula for nurses and teachers are within these themes. Similarly, in the business themes, many respondents felt that this was their primary theme. While there is no profession directly connected to the business theme, it may be broad enough to host many topics. This characteristic is disproportionate to the number of single theme representatives in the other themes.

Most respondents indicated that they do not feel connected to a single theme. Four respondents indicated that that they felt their research fit into all the themes: 3 from Education, and one from Transport. It is interesting to note that no respondents felt that they exclusively fit into the Built Environment theme. We can conclude from this that researchers feel that they are either not represented by these themes or are represented by multiple themes. There are very few who indicated they fit perfectly into a theme.

Some researchers who did answer the questions indicated a single primary theme. This was particularly true for themes Health and Education where 38% and 48% respectively of the respondents, felt they exclusively fit in those themes. Most respondents, however, indicated that they fit into various themes. Given the mandate of UAS research to flow back into education, as well as the importance of education within the KT, it is particularly relevant to note that Education was one of the most selected themes.

The NAUAS has stipulated their desire to make impact in ten specific themes. These themes are believed to reflect the research trends of Dutch UASs. When asked into which primary themes they best fit, and all the themes into which they could fit, approximately 2 in 5 respondents did not respond. Possible reasons for this lack of response could be because of the positioning of the questions towards the end of questionnaire, however, it could also reflect how these researchers view the themes. It is possible respondents have not answered this question because they do not feel that their research fits into any of the given themes.

Workshop Results

The overlap in possible themes was further discussed by workshop participants. Some participants found it extremely difficult to hone in on one theme. Passionate discussions of the themes resulted in the conclusion that some research may serve many or all the themes rather than one specific theme. Researchers and their groups may also serve more than one theme. Workshop participants were asked to fill in the theme they considered most appropriate for their research. This resulted in discussions in the first and second workshops as to how to decide what was the most appropriate theme. Some participants were easily able to indicate where their research best fit, others found this to be a challenge. They stated that they serve each of the themes dependent on the context of the research they engage in. Participants of the second workshop went as far as to say that the NAUAS decision to make use of what they referred to as Dutch Research Council or European Union domain names means that many of the research topics worked by UASs do not fit into these constructs. This, they suggest, is especially true for research that serves each theme, depending on the project. Participants who found it difficult to identify one theme participated in the workshop using the themes in which they had most recently conducted research. It is within this chosen theme that participants were asked to answer questions concerning impact and output. As indicated in

Figures 4.2 and 4.3, researchers in the workshops confirmed the results of the questionnaire. They feel exclusively bound to a single theme within the context of a project and not at research group level.

Impact

Questionnaire results

Figure 4.2 shows the results of the questionnaire responses concerning desired impact. As indicated, Educational impact (318) is the overall most desired impact. This is understandable considering it is a critical part of the KT and practice-oriented research itself.

Social impact (308) was the second highest overall desired impact followed by Economic impact with 152 respondents. Agricultural impact (33) is by far the lowest scoring desired form of impact. 'Other' answers given included Academic impact (3) and Organizational impact (3) as well as Sustainable impact, Professional impact, impact for Practice, and Business impact.

Several respondents indicated the desired impact depended on the project. "It depends on the project and its scope. All these impacts are relevant, but you can't address them all in the same project, because in some cases it is not related!" One person suggested that 'impact' was too strong a word and that 'awareness' was more appropriate.

Workshop results

One participant in the second workshop said it was insufficient to raise awareness. Instead, in answer to which impact is most important for his theme, he stated that his theme is committed to social challenges where the role of the individual is central, and impact is created by doing something with that individual to create a long term added value.

Figure 4.5 provides an overview of the workshop answers to the question "What are impacts your theme wants to create?" and "What is the most important impact for your theme?". The workshops provide a more diverse overview of desired impacts. It is interesting to note the prevalence of certain types of impact that themes want to create regardless of the theme itself. This includes Educational impact, which was suggested 13 times, a minimum of once per theme. Economic impact was indicated 8 times, once in all themes except for ResilientSoc and Transport. Also, Technological impact was mentioned 9 times, Environmental 9 times, Health 7 times, Political 7 times, and Cultural 5 times. Once again, Academic impact was indicated twice as an "other" form of impact, both in ResilientSoc but also in separate workshops. Agricultural impact was indicated once.

Answers to what the most important impact is for a particular theme were diverse. Some themes, like Health, Materials, and BuiltEnv share the same answers of Health impact, Technological impact and Environmental impact respectively. However, most participants have divergent ideas and took the time to explain what they meant. Several participants stated the importance of the stakeholder in making impact possible and influencing the type of impact created (6R5, 8L2, 8L3, 9L2, 10L3).

One workshop participant stated clearly that the specific desired impact is dependent on the goals and stakeholders. This was further discussed during the workshops in which not only themes were an issue at project level but also the desired impact. While the results of the workshop utilized the policy vernacular at times, participants were also clear that these terminologies are often not specific enough for the type of impact they are trying to create. Participants in Workshop 1 went so far as to state that these terminologies are insufficient for evaluating the impact of research because they miss the impacts created through daily interactions. This corresponds to the concept of doorwerking or micro impact that has become important to Dutch UASs.

The results confirm the focus of Educational impact while at the same time, more specific forms of impact became apparent such as Technological and Environmental impact. Also, the importance of project-based stakeholder engagement affects the desired forms of impact. This is presented in Figure 4.5.

Outputs

Questionnaire Results

As can be seen in Figure 4.3, the highest output overall is Conference Papers (238) with just over half the respondents indicating it as output. The top five outputs were Articles in a National Professional Journal (174), Conference posters (172), International Professional Journals (166), Presentations (160) and Advice Reports (152). As Figure 4.3 illustrates, there are 11 outputs named more than 100 times. These include: Educational related output such as Theses Supervision of Students (128); New Curriculum (115); input into Curriculum (114); or PhDs (86). However, there are also 21 forms of output mentioned less than 25 times, including Entrepreneurial Output such as Spin offs (14), Start ups (12), Licenses (3), Patents (3), and Spin-outs (1).

From these results we can conclude that Entrepreneurial based outputs are limited. Researchers put much more emphasis on the professionalization of their peers through conference output and reports. Surprisingly, Educational outputs are not as prominent as would be expected from the frequency that Educational was indicated as a desired impact. This may be because curriculum remains the primary responsibility of teaching staff and a researcher's role in education is often dependent on the distribution of their hours (Anonymized forthcoming). It may mean that educational impact of research is conveyed through people (researchers) that are teaching rather than through outputs.

Workshop Results

Workshop participants also presented a variety of outputs. As seen in Figure 4.4, articles in either scientific or professional journals as well as contributions to conferences were found in each theme. Educational output is, however, not always included in the themes, and Entrepreneurial output is not mentioned at all. It is interesting to note that several themes in the workshops indicated that prototypes are created as research output (Health, ResilientSoc, Materials and Agriculture). Also, social media output such as blogs, vlogs, websites, and films were mentioned by Health, Education, ResilientSoc, BuiltEnv, Energy, and Art. It is important to point out that only half of the workshop participants indicated a form of Educational Output. The form of this output was through thesis/dissertation supervision, input into curricula, modules, or guest lectures. Several themes, such as Transport and BuiltEnv did not indicate any form of Educational Output.

These results confirm the results of the questionnaire and again point to the relevance of more specific social media-based outputs that can be more difficult to capture (Tahamtan and Bornmann 2020). Once again, Educational output and Entrepreneurial output are underrepresented.

DISCUSSION

The purpose of this study was to explore how researchers see their work within the ten themes of the NAUAS as well as to explore the impact they wish to create and the outputs they use to help facilitate this impact. In doing so the aim was to assist in answering how the research impact of the ten themes of NAUAS policy can be evaluated in a meaningful way. To accomplish this, we conducted a questionnaire concerning the themes, impact, and output. To triangulate the findings, we also presented workshop results in which participants were asked about these same subjects and where we discovered that: choosing a theme is not an easy task; stakeholders play a key part in both the themes of the research and the desired impacts; desired impacts and the outputs created appear to differ greatly; and outputs appear to reflect the KT but not always in the way we would expect.

Question 1: How Dutch UAS researchers view their work within the ten themes

Our results show that few researchers are comfortable in one theme but recognize that their research can fall under multiple themes. Understandably, some researchers have difficulty choosing appropriate themes. The inability to specify a theme may be the effect of conducting

multidisciplinary research. Multidisciplinary research is an important pillar of the research conducted in UASs (Universities of Applied Sciences for Europe 2017), which by its nature encompasses different expertise and disciplines to find the solution to a problem (Guimarães, Pohl, Bina and Varanda 2019). In doing so, multiple themes are brought together, and consequently, the research can be viewed from multiple perspectives. While the themes of the NAUAS align with the policy of the SDG's and grand challenges, as well as the Dutch Research Agenda, the multidisciplinary nature of UAS research makes choosing just one of these themes virtually impossible. This means that for the evaluation of impact within the themes, the ability to indicate more than one theme is needed.

Further, many researchers appear to feel that the relevant theme is dependent on the project and the stakeholders involved. In order for the Themes to be best included in an impact evaluation, a project level evaluation may serve best for capturing the themes in which the research takes place rather than at the research group level. The formation of research groups is not proactively centred around the themes. Multiple projects take place within a research group with different research group members and stakeholders and thus also in different themes. As suggested by both the workshop members and questionnaire respondents, the applicable theme or themes may be dependent on the stakeholders or project initiators. Consequently, their themes changed per project. The possibility to indicate the doorwerking of the research group, institution, or a higher aggregation level on a research theme then becomes difficult to pinpoint. Assessing impact at the aggregation level of research groups or higher makes the impact of individual projects invisible. Moreover, this also tends to make it more difficult to specify theme specific impacts. As a result, the evaluation may become too general or abstract to be meaningful. Consequently, room for multiple themes will need to be taken into consideration when evaluating.

There are many tools that can be used for evaluating the impact of these themes as presented on the website doorwerkinghbo (https://doorwerking-hbo-onderzoek.nl/). However, it is important to consider the right tool. Recent research by Lykke et al. has suggested that the evaluation of micro impacts may be better suited to contribution analysis (Lykke et al. 2023). While the use of narratives and indicators are frequently used tools for research evaluation (Guthrie et al. 2013) they may not do justice to the minutiae of daily practice of micro impact creation through the research process and thus also not the doorwerking (Lykke et al. 2023). Contribution analysis sets out to visualize the interactions that take place between society and research which may lead to an effect on society and taking the wide array of factors, actors and interactions into account when evaluating the links between research and impact (Riley et al. 2018). Contribution analysis at project level may be of assistance. At the research group level, it would be interesting to create a collective overview of the micro impacts they want to produce and do produce. From such collectives of micro impacts, different narratives can emerge and indicate how the research group operates as a whole. While narratives are often seen as subjective stories, by using contribution analysis as a basis for that narrative a solid foundation on which macro impacts are created can emerge.

Question 2: What impacts do UAS researchers wish to create?

In relation to expected impacts, evidence pointing to the necessity of an impact evaluation occurring at the project level is the role stakeholders play in creating impact. Similar to the discussion concerning the appropriate themes being in part reliant on the stakeholders included, impact, with the exception of Educational impact, is also dependent on the stakeholders involved, and stakeholders are project related.

Brouns et al. (2023) have identified stakeholder contribution to practice oriented research as one of the primary ways in which impact is created. These stakeholders and the projects they contribute to are situated in networks. These networks, be they simple or complex, are typically built and expanded upon over the course of the project, increasing the potential impact on not only the stakeholders, but the networks in which they are embedded (Brouns et al. 2023). Research into the roles and functions of Dutch UAS research groups has suggested that the networking between these stakeholders and the research group falls primarily on the shoulders of the professors (Anonymous, forthcoming). This can make the link to Professional Practice fragile as one person appears responsible. Nevertheless, it remains an important means of impact. It has recently been suggested

by Bowen et al. (2022) that a mixed methods network evaluation can be an important tool in impact assessment. Similarly, Teirlinck and Spithoven (2015) have suggested this is particularly important for applied research. The fact that stakeholders are already involved creates impact. And, as the projects and stakeholders change so does the desired form of impact.

The impact that does not appear to change is the importance of Educational impact. This is a natural conclusion given the nature of UAS research (Anonymized forthcoming). As previously suggested, not only is Educational impact the original purpose of Universities of Applied Sciences, it is also one of the core principles of practice-oriented research. However, discussion in Workshop 3 suggests that a connection between research and education is not always possible. For some, the research undertaken, and the subsequent findings are too specific to be included in curricula. The inability to link research and education may be attributed to the diverse "types" of research that take place in UASs to find answers to the problems they encounter (Kyvik and Lepori 2010). This presents a dilemma concerning the KT and ensuring (or not) that the circulation of knowledge throughout the KT continues even when the research does not directly appear useable in curricula. At this point, student participation in the research process itself becomes of greater importance and stresses the importance of taking the various diverse forms that research can flow back into education. This underlines the fact that sometimes the role of the researcher is to help faculties educate future researchers and ensure that they have the tools required for doing research themselves. Other times researchers are directly connected to creating new curricula where the methodology and results of specific research is used.

Question 3: What types of outputs do they create to achieve this impact?

The various means through which Educational impact can be created may also account for the relatively low numbers of educational outputs. Given the consistently high numbers related to creating Educational impact, the actual number of respondents that indicated Educational output is surprisingly low. As discussed in the previous paragraph, this lack of correlation may indicate a relationship between the types of research required to be conducted in order to answer the societal issues UASs are tackling. Alternatively, it may suggest that the successful relay of information is reliant on something other than the output. This unknown factor could be the mechanism rather than the output itself as the small amount of Educational output and the high desire for Educational impact do not correspond. It is possible that this may relate to the roles and functions of the researchers within the research group or project. Research into the roles and functions of UAS research groups suggests that for the knowledge transfer within the KT to occur, a certain combination of people with certain tasks and skills are required (Anonymized forthcoming).

The disconnect between desired impact and output is further seen in other areas such as that of Political, Cultural, or even Environmental impact. However, as one respondent suggested,

> "The impact on the environment has not yet been achieved by the project. The impact on the environment is only achieved much later when the innovation we are working on is frequently applied in practice. Environmental impact is therefore the focus for us, but it is not measurable as the output of our work. Environment impact is our main motivation" (8L3).

This may also be the case for Economic impact and Entrepreneurial output. The output results of this study do not reflect the importance of industry and business for UASs. This, like Education, is one of the cornerstones of the KT, and the impact created in this area is not visible through the output created. The output also does not reflect the involvement of Centres of Entrepreneurship. Given the policy focus on Entrepreneurial output, it would be expected that the study results would reflect the policy. The fact that it does not could suggest that the policy focus reflects the impact discussion which was initially focused on valorisation Economic impact but does not reflect what is happening in practice. While Economic impact was indicated by many respondents, in practice Entrepreneurial output is not a primary output of Dutch UAS research. This is consistent with other studies into the commercialization of research activities. They, too, have found that patents, spin-offs, and other Entrepreneurial output is very limited (Atta-Owusu and Dahl

Fitjar 2021). One specific lector indicated that while his research could result in IP (Intellectual Property) and patenting, he has clearly chosen to work with a complete chain of manufacturers to work together to find a solution to the problem, and prepare them to work together in the future, rather than claiming it for themselves or their institution (4L3). However, the initial results of this study would suggest that UAS researchers are focused more on the paper-based outputs similar to a university rather than focusing on the practical sphere of the KT.

While Academic impact was infrequently mentioned by both participants and respondents, the desire to create impact in the profession through research output is evident. Academic impact created through peer reviewed output continues to be the primary form of knowledge development and output for universities. However, as indicated by a respondent from the third Workshop, knowledge development as produced by universities is not the goal of UAS research. Nevertheless, Article output is surprisingly high given the focus of practice-oriented research. The order in which choices were given in the questionnaire options was explicitly done in random order to avoid the perception that paper-based output was of more importance than other forms of output. These results can reflect the fact that respondents either view paper-based output more as output than other forms or that the output of Dutch UAS research really is paper based. Alternatively, it may reflect that the impact on the profession, as indicated by one of the respondents, may be a priority.

Output that can be used to create impact on all three areas of the KT are those related to social media. It is interesting to note how low social media scored in the questionnaire but how relatively prevalent these forms of output were in the workshops. These low scores may reflect the need for more time to lapse to gain popularity rather than reflecting the importance of the output in UASs. Or it may reflect the difficulty in capturing social media output in traditional data infrastructures. Additionally, this may result from an opinion on social media where it is not seen as a form of output (Tahamtan and Bornmann 2020).

This study has suggested that there may be a disconnect between the research outputs and the desired impacts of researchers. However, the full impact on the KT is not visible through output alone. Researchers, stakeholders, and outputs are all individual means of creating impact. The fact that stakeholders are included in this form of research already creates impact. But working together has the potential to exponentially strengthen that impact. In addition, the network that UAS researchers collaborate in is an important form of impact that sometimes requires more work to initiate and sustain and has a greater benefit than that of standard outputs.

CONCLUSION

This study into Dutch UAS research impact evaluation consisted of a comprehensive questionnaire the results of which were further validated by workshops. Through our mixed methods study we have attempted to assess how Dutch UAS researchers view their research in light of the themes of the NAUAS, the impacts they choose to create in those themes, and the outputs they create to achieve these impacts. This was undertaken to better understand how the research impact of the themes of NAUAS policy can be evaluated in a meaningful way.

The results of our study suggests that in order for the impact of the themes to be evaluated, impact evaluation should take place at the project level. Specific impacts and outputs, along with the themes themselves, appear to be best considered at the project level. This approach considers the stakeholders involved and the project output. It is important to state that the outputs are not the micro impacts themselves. Instead, micro impacts are the interactions that take place that may lead to outputs. These interactions do not need to be productive but merely occur or emerge from the research work (Lykke et al. 2023).

Because the temporality of the projects allows a research group to easily fall into more than one theme, a clear vision and policy concerning desired impacts, themes. and stakeholders, would allow the researcher group to make conscious decisions about their impact and create their own narrative. The results of this would assist in reducing the risk of Educational impact being underproduced. In addition, it would allow research groups to make conscious decisions not only

about the outputs they create but the diverse roles and functions present in project groups. A research group policy would also allow research groups to develop their micro impacts into macro impacts.

The current national evaluation framework used by the NAUAS, the *Branchprotocol kwalitietzorg Onderzoek* (BKO), focuses on doorwerking at the research group level. From our results doorwerking is equivalent to micro impacts which take place throughout the research process of a project. This should be considered when aggregating to the BKO research group level.

Impact evaluation at the project level should then be done in alignment with the recommendations for the impact evaluation of UAS research (Coombs and Meijer 2021). These recommendations suggest that an appropriate evaluation of impact made by practice-oriented researchers requires that it be done in co-production with the stakeholders (Coombs and Meijer 2021). Among other aspects, it should also be conducted in Real-time and for learning purposes (formative). Contribution analyses may be well suited for this. Contribution analyses may also help with monitoring the doorwerking of practice-oriented research. It is perhaps in this monitoring that the doorwerking becomes evident. Monitoring can provide insight beyond the indicator of output and illustrate the mechanisms through which the doorwerking takes place. By understanding more about these mechanisms, we can also learn more about how practice-oriented research impacts society.