Born Regional, Going International

Impact case study for the University of Stavanger

1. The University of Stavanger (UiS) in its regional context

With its 474,976 inhabitants, the county of Rogaland in the south-west of Norway has the fourth highest population in Norway, after the metropolitan areas of Oslo and Akershus, and Hordaland, where Bergen is the capital. Rogaland, with its capital Stavanger, has been the national Norwegian hub for innovative industry for several decades, partly owing to the discovery of offshore oil reserves in the late 1960s and the subsequent emergence of the service industry, but equally thanks to a spirit of innovation and entrepreneurship which long predates the petroleum industry. The region has a long history of adapting to and accommodating for shifts and new commercial opportunities. In the 1870s, fishery and the canning industry put the region on the map, and together with the shipping and the agricultural industry, these resources attracted entrepreneurial and innovative powers.

Since the discovery of oil, the regional economy in Rogaland has expanded rapidly and the Stavanger region has become one of the most important centres of the Norwegian economy. Stavanger is a European oil and energy capital with strong industrial and financial clusters. The share of regional employment in both the oil and gas sector and the service industry is more than five times that of the national average. Approximately half of the national employment in this sector is based in Rogaland. Many international companies are located here. National and international alliances enhance the economic, cultural and social interaction of the UiS with the region. The county of Rogaland region, together with neighboring county Agder, is classified as a "Strong Innovator" in the EU Regional Innovation Scoreboard (2018).

The UiS became the fifth university in Norway in 2005. However, our roots go further back. Seven regional higher education institutions merged in 1994 to form the University College of Stavanger. The oldest of these, the Norwegian School of Hotel Management, was founded in 1912. The six others followed in 1920, 1945, 1954, 1966, 1960 and 1989.

The UiS has one main campus near the centre of Stavanger. In addition, NORCE Norwegian Research Centre, (formerly IRIS, International Research Institute of Stavanger, see fact box page 2) and the international centre for innovation, research and business development, Innovation Park Stavanger, are located on campus.

University of Stavanger: Key facts and figures for 2017

Year	2017
Budget	180 m. EUR
Number of staff (FTE)	1422
Number of research staff	907
Number of students	11,727
Number of publications	1043

% level 2 publications	18.5%

2. Regional orientation, strategic development and knowledge infrastructure

The UiS constitutes an integral part of the oil and gas cluster in Rogaland. Through its research centres, the UiS provides a strong infrastructure and a source of human capital for the oil and gas sector. Centre for Oil Recovery (COREC) was established in 2002 as a joint initiative between the predecessors of the UiS and IRIS/NORCE, as well as a number of leading Norwegian and international companies in the oil and gas industry. COREC is now hosted by NORCE in partnership with the UiS. The most significant establishment for oil and gas sector led by the UiS is the National IOR (Improved Oil Recovery) Centre of Norway, which has partnerships with 11 industrial companies and a number of national and international research institutions, organizations and universities.

Rogaland Research → International Research Institute of Stavanger (IRIS) → NORCE Norwegian Research Centre

The history of IRIS goes back to early 1970s. In 1973, Rogaland county municipality in collaboration with Rogaland regional college (one of the forerunners of the UiS) and the municipality of Stavanger established the research institute Rogaland Research (RF Rogalandsforskning) as a foundation which served as the applied research arm of the then regional college. IRIS was established in 2006 as a continuation of the activities of RF with the Rogaland Research Foundation and the UiS as owners. IRIS was a multidisciplinary research institute organized around three research departments: Energy, Environment and Social Science.

In 2018, IRIS became a part of NORCE Norwegian Research Centre AS, together with five other research institutes in Norway. UiS is one of the five main shareholders in NORCE, which is one of Norway's largest independent research institutes (second largest in terms of the number of employees). The research areas of NORCE includes energy, health care, climate, the environment, society and technology.

In addition, the UiS actively supports three regional cluster initiatives supported by the Norwegian government's ARENA programme designed to support immature, but high-potential clusters. Norwegian Smart Care Cluster, for instance, is administered by the UiS through its technology transfer office Validé. In addition, the dean of the Faculty of Science and Technology at the UiS sits on the board of the Norwegian Tunnel Safety Cluster.

Norwegian Smart City Innovation Cluster, which was created in early 2018, provides a great example of how the region works with the UiS and the well-functioning triple helix innovation system in Rogaland. The cluster has emerged out of a series of events where the UiS has played a major part since the beginning. The Stavanger municipality's initiative of transforming Stavanger into a smart city/region gave way to the EU Smart Cities and Communities Lighthouse project "Triangulum" funded by the Horizon2020 programme. Out of the project, the annual expo and conference "Nordic Edge", the largest smart city/region event in the Nordic countries was born in 2015. Recently, Nordic Edge was transformed into an official cluster initiative in 2018. During the evolution of smart city/region idea in Rogaland, the UiS has been involved as a significant stakeholder as a project member, organizer of events.

Norwegian Energy Solutions Cluster, aiming at fostering the transition to low emission society by developing renewable energy and improving existing energy solutions, is another regional initiative, in which the UiS participates through its research groups and Future Energy Hub project.

Apart from these industrial clusters, the UiS has also initiated some research and knowledge-based clusters. The oldest one of these is the Cluster on Industrial Asset Management (CIAM). Norway Pumps & Pipes (NP&P) is a cluster trying to achieve cross-disciplinary knowledge exchange between the oil and gas sector and the medical technology sector. NP&P is an interdisciplinary research and development programme, which aims at transferring knowledge and competence gained in the oil and gas industry to the healthcare sector. Another example within the healthcare sector is Stavanger Acute Medicine Foundation for Education and Research (SAFER), which offers a unique platform combining education and R&D in pre-hospital and acute medical care. Recently, another cluster initiative called Ocean Technology Innovation Cluster Stavanger (OTICS) has been launched.

The Strategic Business Plan developed by Greater Stavanger Economic Development, the umbrella organization created by 15 municipalities[1] in the region together with Rogaland County Council, could be said to indicate the strategic orientation of regional economic development in Rogaland. Six targeted areas for value creation (expertise, infrastructure, innovation, attractiveness, internationalization and public services) in the existing regional clusters of food, energy (oil and gas and renewable energy) and tourism are identified in the plan. The strategic business plan shows resemblance to the strength areas of and future directions of the UiS except for the food sector.

Alongside contributing to the regional innovation system directly, the UiS significantly supports the internationalization efforts of the region. For instance, around 37 percent of its PhD population are foreigners. In addition, UiS researchers collaborate with researchers from 380 different institutions in 60 countries for their publications. The share of internationally co-authored research publications in the UiS' total publication output was 37% in 2017. In addition, around 48% of Level 2 research publications of the UiS were with international partners.

The UiS actively participates in international networks. ECIU (European Consortium of Innovative Universities) membership has resulted in a number of spin-off project initiatives. The EU-funded Horizon2020 project titled "The Role of Universities in Innovation and Regional Development", which is led by the Centre for Innovation Research (CIR) at the UiS, was born out of the ECIU network.

3. Education and human capital development

Consistent with the growing trends in Norway towards the design of interdisciplinary study programmes, the UiS now provides career-oriented courses and professional qualifications in technology, education, health and social care, economics and management, hospitality, art, culture and media. The UiS consists of six faculties – Faculties of Social Sciences, Arts and

[1] Partner municipalities in Greater Stavanger Economic Development: Hå, Finnøy, Forsand, Gjesdal, Hjelmeland, Klepp, Kvitsøy, Randaberg, Rennesøy, Sandnes, Sirdal, Sola, Stavanger, Strand, Time.

Education, Science and Technology, Health Sciences, Business School and Performing Arts. Sixteen departments and three national research centres, the Norwegian Reading Centre and Centre for Learning Environment in addition to the National IOR Centre, fall under these faculties, in addition to the Museum of Archaeology, which constitutes another segment of the UiS with its director acting at the faculty dean level. The university offers a total of ten one-year programmes, 28 bachelor's and 59 master's programmes, in addition to several programmes for continuing education. The number of bachelor's programmes offered has been stable over the past 5 years, while there has been a 35 percent increase in the number of master's programmes offered in the same period.

A study conducted by the Nordic Institute for Studies in Innovation, Research and Education (NIFU) in 2015 shows that the majority of master's graduates from the university are able to find jobs a year after graduation compared with their peers from the older universities. For instance, in 2013, 88 percent of UiS graduates secured relevant jobs compared with 85 percent, 77 percent and 76 percent of graduates from the Norwegian University for Science and Technology (NTNU), University of Bergen (UiB) and University of Oslo (UiO) respectively. Even at the height of Norway's economic crisis in 2015, 76 percent of the university's graduates found employment compared with an average of 73 percent from the other three universities (NIFU report, 2016, p.17).

A large number of the bachelor's and master's theses are written in cooperation with enterprises in both the private and public sector, and practical training and internship are an integral part of many of the study programmes. To accommodate both students and potential collaborating enterprises, the UiS provides a service portal where jobs and trainee positions as well as proposals for bachelor's and master's theses and other more entrepreneurial activities are posted.

As digitalisation is one of the four strategic priority areas for the UiS, besides expanding the offering of study programmes, the university has also placed more emphasis on digitalisation in teaching and learning. As technology is rapidly becoming an integral part of modern education, the UiS has prioritized the institution of technology-rich learning environments of the study processes to help improve the quality of study. Presently, lecturers are mandated to use a blend of traditional and ICT-mediated pedagogical approaches in their teaching whereas digital skills are a key element in students' learning outcomes. In line with this, communication with students and the conduct of examinations take place via digital platforms (UiS Strategy 2017-2020). Furthermore, based on knowledge gained from market research, the UiS is developing online and more flexible modes of studies that will be offered as of 2018. This is, for instance, to serve those individuals who are joining the labour market due to a high demand in the region but at the same time are willing to continue their studies.

4. Research, technological development and knowledge transfer

Since gaining a full-fledged university status, the university has redirected and diversified its research domains beyond its original research activities, that catered mainly to the needs of the oil and gas industry. Among the most recent additions is the PhD programme in Health and Medicine, which was established in 2011 and in fact currently has the highest number of PhD candidates among the 11 PhD programmes (over 18 percent of the PhD candidates at the university).

Research centres linked to the different faculties spearhead the university's research efforts. Most of the projects at the centres are designed to have a multidisciplinary outlook to facilitate cross-fertilization of ideas among disparate disciplines. These research centres maintain research cooperation with local, regional, national and international research partners. Notably, the Centre for Risk Management and Societal Safety (SEROS) was established by the UiS and IRIS in 2009 and today consists of research groups from three departments at the UiS and two departments at IRIS/NORCE. One of the main areas of engagement for SEROS is its participation in the Norwegian Tunnel Safety Cluster (NTSC). This is indeed in line with the growing share of construction industry in the region's economy, which has mainly taken place due to the recently intensifying tunnel construction activities in the region. In 2012, the Centre for IP-based Service Innovation (CIPSI), hosted by the department of Electrical Engineering and Computer Science, was launched. The centre also collaborates with most of the other research centres at the UiS with the purpose of strengthening the applied ICT research at the UiS and IRIS, including the use of Big Data analysis in 'smart cities' (at the regional level).

The university has put great efforts into achieving research excellence, which is reflected in a steady growth in publication outputs. According to a study from 2017 carried out by NordForsk (an organisation under the Nordic Council of Ministers), the publication volume at the UiS has increased at an average rate of 12 percent annually from 1999 to 2014. Similarly, there was a rise in publication points from 739.1 in 2015 to 805 in 2016 and 1,021 in 2017, demonstrating an impressive growth of 26.8 percent over the last year. This trend is in fact also in line with the number of graduating doctorates which has grown steadily over the past years, reaching a record number of 48 doctorates awarded in 2017.

International interdisciplinary research: Norway Pumps and Pipes

In December 2015, the *Norway Pumps and Pipes (NP&P)* initiative was introduced following the example of Houston in the U.S. It is an interdisciplinary research and development programme, which aims at using the knowledge and competencies gained in the oil and gas industry within the healthcare sector. Areas of interdisciplinary research fall within cardiology, stroke treatment technology, simulation and modelling, signal and image processing and risk modelling. On the Norwegian side, the cooperative partners in the initiative are Stavanger University Hospital (SUS), International Research Institute of Stavanger (IRIS, now part of NORCE), University of Stavanger (UiS) and the Greater Stavanger. NP&P aims to reach academic and research communities across the European continent and become a European hub for the programme. Thus, it is expected that this already supra-regional (and supra-national) network continue growing in its outreach across Europe.

In terms of citation rates, the UiS performs better than its old counterparts in the country. Despite having had a few hundred publications, these publications command high citation rates. According to the NordForsk 2017 report, the UiS had the highest percentage share (12 percent) of the top ten percent publications among Norwegian universities in 2011-2014. When segmented by subject fields' share of publication volume, the engineering field dominates with 32 percent of all UiS publications. Coincidentally, the university dedicated over a third of its research efforts to the STEM subjects in 2011-2015. This paints an interesting picture of the UiS' research orientation. Although the university has made

sustained efforts at broadening its research profile, its technology and engineering antecedents are still dominant.

From its early years, the UiS has maintained an active partnership with the Innovation Park of Stavanger (Ipark) and Prekubator AS to bring their breakthrough scientific and technological ideas to the market. Ipark, which is Norway's first science park founded by non-academic sectors, is situated on the university campus. It houses knowledge-based start-ups and other companies that provide support services to these nascent firms. One such service provider was Prekubator AS. It was set up in 2002 to provide technology transfer services to the then University College and other partner institutions in the region. Its function was to ensure the commercialisation of researchers' and students' ideas or discoveries through patenting, licensing or spin-off ventures. To ensure the efficient provision of these services, Ipark AS and Prekubator AS merged in 2016 to form Validé. This new entity manages the intellectual property and venture portfolios of the UiS as well as the Stavanger University Hospital (SUS). While in 2012, the university's total commercialisation (i.e. business ideas, patent applications, licences and new enterprises created) was 39 cases, this figure increased to 60, 78 and 71 cases in 2015, 2016 and 2017, respectively (UiS Annual Report, 2017). It is obvious from these figures that the UiS' commercialisation activities have significantly grown (almost doubled) over a short period of few years. Furthermore, the UiS strives to increase research commercialisation among

Engaged research centers

a) Established research centers

Established in December 2013, the National Improved Oil Recovery Centre of Norway (**NIOR**) provides solutions for improved oil recovery on the Norwegian continental shelf. It is led by UiS and has close cooperation with industry. The overall aim of the Centre is defined as contribution to the implementation of cost efficient and environmentally friendly technologies for improving oil recovery on the Norwegian Continental Shelf. The 4-years of activities of the Centre have been evaluated by the Research Council of Norway as a strong and result-oriented centre. One of the objectives defined for the Centre is education of 20 PhD students and 8 postdocs during the lifetime of the Centre.

Opened in May 2006, Stavanger Acute Medicine Foundation for Education and Research (**SAFER**) is a foundation and a learning center established in collaboration between Stavanger University Hospital, University of Stavanger and Laerdal Medical AS. The purpose of the center is to strengthen acute medical education and patient safety, primarily by stimulating the skills development of the current personnel of the three initiators. It is expected that the training and simulation at SAFER will contribute to increased clinical competence and safety, increased patient safety and thus improved patient performance / survival.

b) New research centers

In 2017 UiS was awarded funds from the Norwegian Research Council for two major research initiatives; one for a researcher affiliated to the Center for Quality and Safety in the Health Services (**SHARE**), and the other for Center for Kindergarten Research (**FILIORUM**). As to the latter, UiS is one of two academic environments chosen and funded by the Norwegian Research Council with the goal of improving the quality

doctoral candidates. To achieve this, the Faculty of Science and Technology in cooperation with Validé introduced a new PhD course in Innovation and Project Understanding in 2015. The aim of this programme, which is compulsory for all PhD candidates in the faculty, is to equip candidates with the entrepreneurial toolkit to harness their research results for the benefit of society.

In the box above

The number of publication points per scientific staff stood at 1.15 in 2017 for the UiS as a whole. The best performing faculties in this respect have been the Faculty of Technology and Science with 2.11, followed by the Faculty of Health Sciences with 1.06 and the Business School with 1.00 respective figures. The share of publications in Level 2 journals for the UiS was 18.5 percent in 2017. The best performing faculties in this regard have been the Faculty of Health Sciences with 32.8 percent, followed by the Faculty of Technology and Science with 17.90% and the Faculty of Arts and Education with 17.20 percent.

Total external income as a share (percentage) of income from the state was 17.30 percent in 2017 for the UiS in total. In this respect, the Business School did specifically well with 57.70 percent respective figure, followed by the Faculty of Technology and Science with 30.80 percent. The University has set the overall target of 25 percent in this regard for the year 2025. Funding secured from the EU and the Norwegian Research Council, taken per scientific staff, amounted to EUR 8,464 in 2017. The Business School was outstanding in this regard with EUR 23,994, followed by the Faculty of Technology and Science with EUR 10,213. The share of international co-publications at the UiS overall organisation level was 37 percent in 2017, with the Faculty of Health Sciences having the highest respective figure with 45 percent, followed by the Business School with 40 percent and the Faculty of Science and Technology with 39 percent.

5. Enterprise development and entrepreneurship

The number of commercialisations per ten scientific FTEs for the UiS as a whole stood at 0.68 in 2017. The best performing faculties in this respect were the Faculty of Technology and Science with 1.68 and the Business School with 0.66 respective figures.

Overall, the number of R&D ideas handled by Validé has increased from 104 to 115 ideas. 58 ideas are registered from the UiS, of a total of 115 R&D ideas (including 21 student ideas). There have been five patent applications originating from the UiS, three licensing agreements were entered into and four companies established. In total, the UiS had seven commercialisations through Validé in 2017.

In 2016 Validé established the pre-seed fund Validé Invest, which has EUR 3.15 million in total assets. Furthermore, Validé's TTO and incubator handled 503 ideas in 2017. A total of 50 new companies were involved in the incubator and two business exits were carried out, which resulted in a sale of NOK 11.4 million shares.

The Plogen programme, initiated by the UiS and administered by Validé, is a regional initiative in Rogaland to support innovation projects and aims to stimulate innovation activities by supporting the development of new research-based products and

Student Incubator LevelUp

In November 2017 in cooperation with the Validé, UiS established the Student Incubator LevelUp to stimulate more student entrepreneurship. LevelUp has also access to the prototypes workshop in the Ipark Innovation Park Stavanger. There are already three student companies linked to LevelUp and this is expected to increase.

services. Established for idea stimulation and development of the innovation culture of the research communities in the region, the Plogen programme currently focuses to increase the number and quality of technology development projects. The programme is jointly funded by the regional stakeholders including SR Bank, the University Fund, Rogaland County Council, Validé and the municipality of Stavanger. EUR 1.89 million have been commissioned that will be used in research and student environments over 5 years.

Data from NIFU concerning the share of business-relevant and business-financed research and development by the Norwegian universities shows that in 2015, the UiS is second only to the NTNU, the leading technical university in the country. As another indicator, according to the U-Multirank data, the share of co-publications of the UiS staff with industry has been 9.8 percent.

6. Vision and strategy going forward

As mentioned earlier, the UiS is located in a region which has seen several changes in businesses and priorities over the past decades. Oil and gas still account for the largest employment rate, but since the financial crisis in 2014, the government and the region have transitioned into what has become known as the "green shift", with more focus on sustainability and climate but also trying to establish a more diversified economy.

The UiS takes part in that change. Our strategy is clearly going in that direction and we are currently addressing how our different research activities are aligned with the UN's Sustainable Development Goals.

Our region was among the first regions to be granted a European smart city lighthouse project in 2015, creating great enthusiasm and engagement. The municipality of Stavanger established a smart city office and has launched many projects and opened its datasets to the public. The Nordic Edge conference, focusing, on smart cities, became the largest conference arena in the Nordic countries within 4 years with around 5000 participants in 2018. The region was also formally acknowledged nationally to have the first industry cluster focusing on smart city. Finally, the university is now establishing a research network coordinating the different scientific domains relevant for developing a smart-city approach. Many other municipalities in the region and other stakeholders are involved in the topics so we are now moving to a smart-region approach.

The UiS maintains a high level of activity related to health and technology. The opening of the new university hospital in 2023 on our campus triggers activities such as plans for offering medical education as part of our Faculty of Health Sciences in close collaboration with Stavanger University Hospital. There are several ongoing activities connected to the development of services and technologies within health care in collaboration with the hospital, primary care sector and businesses.

Digitalization is also gaining an important role at UiS and will change how we teach and train students in many ways by using newer technologies, but also in terms of developing the teaching and learning environment. All universities in Norway are subject to budgetary "efficiency cuts" which triggers increased adaptation of digitalized solutions to how we handle services and practices. Within research there is also a significant development in new research areas to the benefit of industry and public bodies.

Another topic for collaboration is how we work and engage with the region, particularly in terms of student involvement with public and private enterprises. In order to have a coordinated dialogue with stakeholders from the region, UiS formed a *Value Creation Forum*

(Verdiskapingsforum) in 2016, led by the UiS rector. Members of the forum are leaders from both the private and public sector as well as regional members of the Norwegian Parliament. The main goal is to discuss key topics for the region in terms of economic value creation. The forum has four *coordinated action groups*, where the main activity takes place. Participants in the different action groups are typically leaders from various companies and industry confederations. The groups are:

- *Innovation and commercialisation*: the purpose of this group is to strengthen the link between research, industry and entrepreneurial activities, including student entrepreneurs.
- *Development of large R&D projects and cluster development*: the purpose of this group is to contribute to large-scale research and innovation projects receiving regional support and to support the creation of industrial clusters.
- *Innovation initiative*: the purpose of this group is to create connections between innovation initiatives and conferences and arenas.
- *Campus Ullandhaug*: is the meeting place for all board directors and CEOs of the main institutions located on campus.

Annex