

5 EXAMPLES OF INTERDISCIPLINARY RESEARCH COLLABORATIONS

**INVOLVING SOCIAL SCIENCE AND HUMANITIES
RESEARCHERS FROM DANISH UNIVERSITIES**

Prepared for a workshop organised by Copenhagen Business School (CBS) and the Think Tank DEA on the role of social sciences and business humanities in addressing societal challenges

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Digitisation in the service of the business community

Example 1

The projects MADE and MADE Digital represent a major nationwide effort to preserve jobs in Denmark and to ensure and strengthen digital development, a cornerstone of which is interdisciplinary collaboration between a wide range of universities and other educational institutions.

By Simon Kratholm Ankjærgaard

Cross-curricular, inter-disciplinary work is nothing new for Professor Torben Pedersen from the Department of Strategic Management and Globalization at CBS, but he must admit that MADE and MADE Digital, two projects being carried out on a national scale, are the largest, most comprehensive endeavours he has participated in to date.

The purpose of MADE, which stands for Manufacturing Academy of Denmark, is to strengthen manufacturing in Denmark through research, innovation and education, as stated on the academy's official website, made.dk.

The idea is originally a flower in the industrial garden. Together with Danish companies they feared that the future of Danish manufacturing jobs was in jeopardy if working together across sectors, subjects, scientific fields and institutions did not succeed – across the entire country.

“MADE itself represents the initial, more reactive phase, its starting point the preservation of manufacturing and jobs in Denmark. And then there's MADE Digital, the more proactive part, which involves – with help from and across a large number of educational institutions – finding out how Danish companies can exploit the growth of digitisation. This project applies widely to Danish companies – providing us with the opportunity to closely examine their inner workings and propel them toward greater, more profitable digitisation. CBS is deeply involved in both MADE and MADE Digital,” explains Pedersen.

“It is very exciting to work with companies, a wide range of universities and independent Danish research and technology organisations from the across the country. The Technical University of Denmark and Aarhus University, for example, deliver the technical skills and solutions, while we help make everything work. We do the initial analysis of the business case and look into what the advantages of the individual changes are for the company, just as we're involved in implementing the changes,” he continues.

THREE PROCESSES IN CLOSE COLLABORATION

CBS' commitment to MADE involves roughly three different phases, clarifies Pedersen. “People at CBS begin by talking to the companies about how they can successfully make new or other digital solutions. Especially small and medium-sized enterprises have difficulty coping with the jungle of digital solutions, for example, 3D printing or robots or something else altogether.

In other words we identify the digital potential,” he says, continuing:

“So we involve technical experts from, for example the Technical University of Denmark. They work together with the company to develop the technical solutions. People at CBS then work simultaneously on the business case, which focuses on the financial aspects of the digitisation that the company is working toward. We look at the economic potential and what it means for the existing business model.”

The last stage is the actual implementation.

“We look at which employees are necessary. We look at how the organisation and the staff must perhaps change – as well as whether some responsibilities should be moved around. This is what will make it possible to preserve jobs on Danish soil,” states Pedersen.

SUPERB COLLABORATION

Pedersen thinks that this collaboration across sectors and scientific fields has been highly exciting and rewarding.

“This entire nationwide project arose due to worry concerning Danish business and industry – for example that the Danish skill base would simply become too watered down if something wasn’t done right away, including strengthening digital development,” adds Pedersen, concluding:

“We’ve felt this sense of worry as an undercurrent throughout the entire project, but in a very constructive way. All of the involved parties – from the business community to the education and research sector – have shown a deep understanding of the importance of building skills and collaboration in order to find the right solutions. The companies have been incredibly open, allowing us to take an extremely close look – and that’s been a huge benefit for us researchers, both the technical ones and those of us that focus more on the financial and organisational aspects because the work that we do makes an impact in a completely different way.”

MADE partners

Copenhagen Business School
Aalborg University
Technical University of Denmark
University of Southern Denmark
Aarhus University
Business Academy Midwest
Lillebælt Academy of Professional Higher Education
Copenhagen Business Academy
University College of Northern Denmark
Dania – Academy of Higher Education
VIA University College

Sponsors

Confederation of Danish Industry
The Manufacturing Industry
Industrial Employers in Copenhagen (IAK)
The Danish Industry Foundation
Innovation Fund Denmark

Collaboration ensures that the whole will be greater than the sum of its parts

Example 2

A collaboration between the Technical University of Denmark (DTU) Nanotech and CBS could potentially save the lives of millions of people. The former is developing equipment for the rapid diagnosis of blood poisoning while the latter is thinking commercially so the product can be brought to market.

By Simon Kratholm Ankjærgaard

Nine million people die worldwide each year from blood poisoning, also known as sepsis. This alarmingly high figure, however, can be reduced significantly if earlier diagnosis and treatment is made possible.

Fortunately there is hope. An interdisciplinary collaboration spearheaded by DTU and CBS is currently in its first year of a four-year project, Smartdiagnos, which is aimed at developing a product that allows healthcare staff to detect blood poisoning much earlier than is the case today – consequently saving lives. Responsibility for the technical part of the project lies with DTU Nanotech, while CBS is responsible for ensuring that the products can be sold in the market.

“Essentially, this is about getting the technical side and the commercial side talking very early in the process,” explains CBS Associate Professor Jens Geersbro.

DTU Associate Professor Anders Wolff has primary responsibility for the project.

“DTU Nanotech has previously worked jointly with DTU Food on developing rapid tests for, among other things, salmonella. That’s why we looked at whether there were other applications for this knowledge – which is why it was an ob-

vious step to look at how we can improve diagnosis of blood poisoning. It’s all about timeliness and survival,” he says, continuing:

“For each hour that passes, the chance of survival drops by eight percent. And, in all honesty, the options available to us today are not especially good. Blood samples and blood cultures must be taken and carried out – and then two to six days later you get the results. And sometimes the test doesn’t even show blood poisoning, even though it is there”.

With DTU Nanotech spearheading the way, and in collaboration with foreign universities, laboratories and biocentres, work is currently being done to develop two products that will revolutionise the field in terms of the rate of diagnosis, efficiency and performance. One of the products is intended for use in laboratories in the healthcare industry, while the other is being developed for point-of-care use in, e.g. intensive care units and emergency rooms.

“We’re talking about two different markets,” Wolff explains, “because who would be performing the diagnosis using our products differs. This is why our ambition is to stand here in four years with two products that can be sold either to the people undertaking diagnostics in the lab or to the people who will perform the diagnosis at the site where the patient arrives.”

FROM MANUFACTURING TO MARKET

After DTU defined the project, Wolff and his team began looking for relevant partners. Since it is an innovation project that also takes into account the social benefits and the potential for economic growth, it was a clear-cut choice for DTU to contact CBS, which has the ability to consider commercialisation from the beginning.

“At the end of the day, we’re responsible for looking at – and ensuring – the business case behind all of this,” emphasises Geersbro, adding:

“But we’re a research institution, so we don’t just contribute with commercial insight; in that case, this would just be a consulting project for us. We run a parallel research project and have our notepad in hand. We observe, analyse and conclude based on the entire process. This gives us much greater insight into how universities that span national borders, disciplinary borders and the sciences collaborate.”

On a practical level a steering group has been set up between the various partners that communicates twice a month, preferably via Skype Meetings, where relevant knowledge is exchanged and the next steps are discussed, developed and decided upon.

“Where it becomes interesting is when the technician uses technical jargon and we have to convert it into market thinking,” says Geersbro, emphasising that collaborating between different sciences and research institutions is nothing new. “But there has been increasingly more focus on it. There’s no doubt about that,” he says.

THE IMPORTANCE OF REALITY CHECKS

Both DTU and CBS conduct research, but on the receiving end of the collaboration and product development is a real customer in the real world. DTU spearheads the effort to make the best, most revolutionary product, while CBS works on predicting its sales potential but also on analysing the needs customer have – or may not even know they have yet.

“A key part of our work is to study and create the need necessary to ensure that, in three years’ time, we have not just one but two markets for the product that DTU is spearheading efforts to create,” states Geersbro.

DTU also focuses on important, worthwhile reality checks.

“We constantly encounter companies that have their own systems, boxes and processes. Some companies will use some of their own materials instead of what we provide and you have to accept that. Others have processes that make it difficult to use our products as originally intended and designed for, which is why we also have to enter into a dialogue with them and reconsider,” adds Wolff.

To date the collaboration has been a good experience for both DTU and CBS.

“The collaboration has worked really well. It’s a publicly funded project and involves a great deal of administration, which is why having DTU in the game has been a plus because they have extensive experience and are so big,” mentions Geersbro.

“This is the first time we are collaborating with CBS, and working with them has been a great idea because we think in entirely different ways. We’re the technical people; they think about commercialisation and communication. This brings out entirely new perspectives and actually ensures that the whole will be greater than the sum of its parts,” concludes Wolff.

Partners

DTU Nanotech & National Food Institute
Copenhagen Business School
Tataa Biocenter
Scandinavian Micro Biodevices
Cube Dx GmbH
Unilabs
University of Skövde
Charles University, Prague
Danube University Krems
Deutsches Institut für Normung e.V.

[Read more at smartdiagnos.eu](http://smartdiagnos.eu)

Cross-disciplinary venture ends as think tank

Example 3

Lawyers, philosophers, economists, social scientists and plant biologists. With support from the University of Copenhagen a cross-disciplinary endeavour has culminated in the think tank Plants for a Changing World.

By Simon Kratholm Ankjærgaard

It all actually started when Professor Michael Broberg Palmgren, a plant biologist with the University of Copenhagen who works on Thorvaldsensvej in Frederiksberg at the Department of Plant and Environmental Sciences, felt frustrated. For years he had worked with colleagues and students to map plant genomes, but applying all that accumulated knowledge for the benefit of society must surely be possible?

“We were sitting there with so much knowledge,” explains Broberg Palmgren. “We had, so to speak, reached the ceiling and knew all the plant genomes. We needed completely new perspectives on our work – and on what our work could be applied to.”

An opportunity arose when the University of Copenhagen launched a large, highly ambitious programme called UCPH Excellence Programme for Interdisciplinary Research.

“It was a very forward-looking initiative designed to stimulate collaboration across the university’s many faculties, which historically had been notoriously highly isolated with their own processes and their own language,” explains Broberg Palmgren.

The programme made it possible to apply for funding for cross-curricular, inter-disciplinary programmes – but it simply had to involve research that spanned across disciplines. “Biologists working together with plant biologists was of no use. It had to be broader and stretch across many more and highly different faculties,” he explains.

He applied for and received a grant in 2013 to execute a project with the overall heading Plants for a Changing World. And nothing less.

“I brought together researchers in the field of law, philosophers, economists and other social scientists – as well as plant biologists and botanists – into the project and our first, crucial step was to find a common language that we could all speak. Only then could we begin to focus on the aim of the project: finding new solutions for the future of industrial agriculture,” he says.

IS THERE A MARKET? IS IT LEGAL? CAN IT BE DEFENDED?

Four years after receiving the Excellence Programme grant the project has materialised into a think tank on the future of agriculture.

“One of the first things that the social researchers and philosophers said to us biologists and botanists was that we had focused much too narrowly on the technical opportunities. We had not considered what the societal needs were,” explains Broberg Palmgren.

“That led to very important and very exciting discussions about sustainability, plant cell cultures and industrialisation. Among other things we discussed concepts like sustainable intensification, i.e. how we can get more from less. There are several different models for doing this but in the meeting between different disciplines, faculties and sciences, new opportunities and perspectives emerged,” clarifies Broberg Palmgren.

Input from the other faculties and researchers challenged the traditional way of thinking and working among the plant biologists. For example they asked consumers how much more they were willing to pay for a cucumber grown using new methods,” mentions Broberg Palmgren, continuing:

“Experts on the law questioned what lay within and beyond the law. Meanwhile philosophers and social scientists shed light on the needs and ethics but also on the implications and advantages for society if and when the new approaches are taken into use.”

LOOKING AT OTHERS' NEEDS FOR THE FIRST TIME

Professor Broberg Palmgren and his team focused on the extent to which they would be able to deliver the new products, research-based output, tests, analyses and conclusions.

“This was the first time that we took the needs of others into consideration in our work before we delivered the final product. It was new for us to ask whether what we were doing truly had a future outside the walls of the faculty. It was very, very rewarding – and very forward-looking of the University of Copenhagen because in reality it was a high risk project that no one knew the outcome of in advance.”

Rolling out products had not been an issue. In addition to a large number of articles and discussions, completely new proposals have come to light based on the botanists' technical and academic knowledge combined with the observations and perspectives of economists, legal experts, philosophers and sociologists, who diligently incorporated reality and the outside world into the projects.

“The cultivated plants we have have lost their many natural traits, and many of those losses can be repaired so that the plants become stronger, just like their wild ancestors, and do not require such intensive care. Yes, we actually have to go back to previous eras. We call it rewilding, which is why it is also necessary for ecologists to dare to do more in terms of genetics,” concludes Broberg Palmgren.

He also advocates the further development and promotion of genome editing to induce mutations in plants not suitable for eating so they can be cultivated and consumed. This will create greater biodiversity in Danish agriculture and help remedy problems concerning fertilisers and pesticides.

“We suggest, for example, that cultivating more plants would be beneficial. We have very few cultivated plants and we have squeezed every last drop possible out of them, but there are over 300,000 species of wild plants out there with completely unknown potential for more sustainable agriculture.”

UCPH Excellence Programme for Interdisciplinary Research

In January 2013, the University of Copenhagen's UCPH Excellence Programme for Interdisciplinary Research, whose aim is to strengthen collaboration across fields, disciplines, sciences and faculties affiliated with the University of Copenhagen, awarded eighteen projects a total of a half a billion Danish kroner based on the assessment of an international evaluation panel.

From research to invoicing

Example 4

Analysing encrypted data has now become possible, opening up new opportunities that economists can help identify, according to the Center for Research in the Foundation of Electronic Markets (CFEM).

By Simon Kratholm Ankjærgaard

Data security is one of the hottest topics in the increasingly digital world we live in. That's why it was quite a breakthrough when computer scientists at Aarhus University began acquiring the ability to analyse encrypted data. Prior to this data had to be decrypted, i.e. returned to its original, completely open state, before it could be analysed.

There is a direct connection between this market breakthrough and CFEM, which is, among other things, a collaboration between computer scientists and economists at Aarhus University and economists at CBS, including, for example, economist and CBS Professor Peter Bogetoft.

“At CFEM computer scientists and economists are working together in an entirely new and very interesting way,” he explains, continuing:

“With the ability to analyse encrypted data, it is possible to identify entirely new markets. This is something we economists can help the computer scientists with. At the same time, the computer scientists get an opportunity to develop entirely new algorithms that ensure anonymity and data security while also being used for very specific purposes.”

“When you're in the business world, you're very careful about sharing data – for competitive reasons. You don't want your competitors to gain access to your data – yet the dilemma is that you really want to gain access to theirs,” explains Bogetoft, who provides three examples of where it makes sense and is useful to analyse encrypted data.

“For example, there are 1,500 beet growers with the right to grow beets in Denmark but they live far away from the beet sugar refineries. In the effort to determine whether it was possible to sell the rights to others who grew beets closer to the refineries, we used – and analysed – encrypted data. The beet growers gave us their relevant but confidential information, as did the refineries. This made it possible to undertake an encrypted auction on production rights,” he explains and then talks about the second example.

“You can also see it from a consumer perspective. Take the electricity market, where consumers are no longer bound to one supplier but instead can choose freely between multiple suppliers. The consumers' previous companies, however, are reluctant to share their confidential information, but by putting the encrypted data in an algorithm it is possible for us to couple the individual consumer's needs with the right energy company – and none of the competing companies have see the others' data.”

The last example involves the banking sector, where it can make sense for two or more competitors to share vital, but encrypted data on the consumer groups they wish to gain greater insight into. The more data that are available, and the more companies that supply data, the better the documentation becomes and the better the decisions that can be made. “We are working specifically on a model for encrypted credit ratings in the banking sector,” says Bogetoft.

THEORIES THAT INSPIRE ACROSS DISCIPLINES

In collaboration with computer scientists and technicians, economists will provide calculation models for what various sectors, such as banking, can earn off of the ability to analyse encrypted data.

“How can we ensure that this becomes a winning situation for all involved parties? This is how economists can contribute. The computer scientists come up with concrete solutions, but it is important that they are involved from day one with the companies or sectors interested in the ability to work with encrypted data. Basically it is a question of customers trusting our technicians, but also whether the technicians and computer scientists can provide a realistic time perspective,” says Bogetoft, adding:

“At the same time, it requires that companies have some degree of willingness to take risks. They have to dare and they have to want to follow new, bolder paths.”

According to Bogetoft there is a correlation between the theories used by economists and computer scientists.

“Computer scientists use more economic theory, including game theory, and I hope that we can inspire each other going forward,” he states, concluding, “And that also applies to the practical allocation of tasks and resources. At present the technical development of algorithms clearly exceeds market thinking and marketing. I think that the distribution between development and marketing should be fifty-fifty, but we’re researchers and not sellers. After all, it is very interesting when three parties agree and inspire each other, in this case companies, economists and computer scientists.

There could be a risk that we meet and have three mutually unintelligible languages but that hasn’t been the case in practice. We are already working on several projects – and new ones are on the way. It’s really a question of participating all the way from researching to invoicing.”

Focus areas

CFEM focuses on three scientific areas that are essential to the relationship between the design and implementation of new electronic markets:

- Game theory and mechanism design
- Operational research and algorithms
- Encryption

Innovation takes flight

Example 5

Drones are the future, which is why it is essential for Danish companies to get their wings on now. At the University of Southern Denmark cross-disciplinary assistance is available through the project Innovation takes flight.

By Simon Kratholm Ankjærgaard

There is not a great deal of experience in this area, which is why it almost exclusively involves looking forward. Moreover the area is filled with complicated but also interesting and inspiring intermediate results. It is about creativity, idea development, software, sensors, market relevance and new business models.

We are talking about drones. And about the cross-disciplinary project Innovation takes flight, which is based at the Centre for Integrative Innovation Management, known casually as C*12M, at the University of Southern Denmark. The project, funded by the Danish Industry Foundation, will support the development of drones by both start-ups and established companies in order to gain market access.

“We recruit companies that are deeply interested in developing their drone solutions. This is done through an application process, where companies interested in our knowledge and in working with us to closely describe their ideas, skills and resources,” explains Professor Mette Præst Knudsen, who heads C12M.

At present, collaboration has been established with ten companies and the cross-disciplinary assistance provided by the University of Southern Denmark takes into consideration each company as a whole, covering the entire process from thought to idea development to technical development for the final market, including development of new business models directed at new business areas.

The project is divided into three main tracks: market development, which is C12M’s domain; technology development and clarification, which is the responsibility of the University of Southern Denmark’s drone centre, UAS; and the network components, which belong under the UAS Test Center.

“The cross-curricular, inter-disciplinary aspect is the whole focal point of the project and working together. When we’ve selected the relevant companies, we sit down with them and representatives from all three tracks to jointly identify what assistance each company should be offered,” says Præst Knudsen, continuing:

“We are largely heading into unexplored territory. At this point we are really only just discovering how drones can be applied. We don’t have much experience to look back on, which is why we have to look forward and develop things together. That’s what our collaboration does up close – also physically. We hold a great deal of joint meetings. They are necessary for solving the tasks and challenges we face.”

TECHNICIANS MUST UNDERSTAND THE MARKET - AND VICE VERSA

There is a variety of companies and they are in very different places in the process. This was a completely conscious choice to ensure the right challenges and to test the companies’ ideas and innovative potential.

“Some companies have gotten far, while others haven’t. We start by jointly identifying their needs in several areas at the same time– both the team at C12M, at the drone centre and at the UAS Test Center. What can the individual branches of the project provide? This is possible only because we work so closely together,” says Præst Knudsen, adding:

“In this context, the be-all and end-all is that we can understand each other – and that we respect each other’s expertise and contributions. Those of us in the marketplace have to understand the technical aspect, while the technicians have to have an understanding of the work we do to develop business models and to identify business areas.”

Staff involved in the project must continually ask themselves and each other where they are in the process and what kind of help the individual companies have a need for.

“We’re constantly on the lookout for opportunities and solutions, both technical and also more business and network oriented. That is of course why we permit ourselves to call it an innovation process,” explains Præst Knudsen, who admits that at times it can be highly time consuming and very detailed, but always beneficial for the company and with a focus on the solution.

“That’s what makes it all so interesting – and that makes working across various departments at the University of Southern Denmark so relevant. We have an end customer who is interested in a product that we have supplied vital knowledge about,” states Præst Knudsen, who has the greatest respect for the ten companies currently entrusting the University of Southern Denmark with developing their drones.

“We commit ourselves to being available to the companies that we need to help – and to each other across the three tracks, but I also have to raise my hat to how open the companies are to us. They provide us with insight into their corporate culture, structure and inner workings. Typically this involves working with their business secrets and their future revenue base. That requires trust all the way around,” she says, concluding:

“We need to be quite close to the companies and tone down our academic approach, in the name of innovation, so they can feel that we are on their side. It is a question of recognising their needs, their market and their production – as well as delivering the right technical know-how and the right business models. Which is why our cross-disciplinary efforts fit perfectly, because we are experts within each of the three tracks.”

Participating companies receive:

- Clarification of the company’s idea, skills, challenges and more
- Development of application scenarios for the company’s idea
- Match of the company’s idea with potential customers
- Technical development based on their specific technical and market needs
- Development of a commercialisation strategy – so they are ready for the market
- Evaluation of the process

During the course of the project the case companies will be given the opportunity to participate in networks with Danish and international drone companies, continuing education and technology-based seminars.