**Modernization status: It’s complicated**

– Challenges in collaboration between statisticians and systems developers

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**Abstract**

*Facing the future, official statistic offices are under pressure to produce more in a shorter time, while sustaining the same quality. IT-Innovations, and collaboration between statisticians and systems developers, are key to achieve more efficient production of statistics. The question remains, how do we develop together? How does the statistician (Emma) properly convey what she needs, if she does not know what is technologically possible? How does the systems developer (Magnus) ensure that he understands her correctly, so the solution fits the problem? Even more so, how do we demystify modernization in an organization?*

*Emma, who is a sociologist, and Magnus, who is a systems developer, collaborated during the Statistics Norway’s first Hackaton, and realized they must learn from each other. This article advocates to “bridge the breach” between producers of statistics, and IT-developers who are creating their tools. What are statisticians’ concerns and fears in a modernization process? What are the concerns of systems developers? What are the pitfalls? Using a vivid language, the text is based on a conversation between a statistician and a systems developer, in a bottom-up perspective. The discussion is relevant for all producers of statistics and IT-staff.*

***Keywords:****IT and statistics, modernization, coding in the dark, technological apathy, unicorns*

# 1. Introduction

Emma, who is a statistician, and Magnus, who is a systems developer, collaborated during the Statistics Norway’s first Hackaton. Emma and Magnus teamed up with other systems developers, a graphic designer and a master’s student entangled in the mysteries of machine learning.

Prior to being employed with Statistics Norway, Emma took part in the modernization of an international organization where end users and systems developers were divided by The Pacific Ocean. For her, meeting and working closely with systems developers at Hackaton was like taking a trip to Narnia: “It was a different world, with a different language, and definitely lots of magic”.

Emma came to the team with a clear vision of what she wanted a program to do. Magnus asked her for a *software requirement specification*; a detailed list with drawings of what the intended program should perform. Her vision seemed suddenly not so clear. How could Emma, the end user, properly convey what she needed, if she did not know what is possible? Faced with questions from Magnus like “should we use *React*?” and “how should the UI be?” Emma turned to Google. “What is React?” What is UI?” and eventually: “How to talk to systems developers?”

Magnus had the know-how to create what Emma wanted, but also to design it with more functionality. Thankfully, and eventually, Magnus was able to communicate with Emma in lay terms and safely guide her through “React” and “UI”. The development process went from having a definitive goal, set by someone with little to no technical insight, to become a continuous negotiation in a collaborative process, towards something none of us could have designed on our own.

Separated by profession, but joined in curiosity, Emma and Magnus both realized there was knowledge to be learned directly from each other and began to collaborate. Magnus’ daily work consists of coding and creating the web applications and systems that Emma will be using after the ongoing modernization project at Statistics Norway. Emma will be the end user of the products Magnus is creating so she started showing him the inner workings of daily statistics production, explaining how she works both efficiently and incredibly inefficiently.

This paper reflects discussions between a statistician and a systems developer aiming to outline the challenges in developing new IT-solutions to modernize the production of statistics. Even when we follow well designed project management theories and frameworks for development, we face challenges. Discussing popular management trends are avoided here to give a bottom up perspective from those working at both ends of a production line in governmental statistics. The focus here, is the people involved with their prerequisites and behavior. What are statisticians’ concerns and fears in a development and modernization process? What are the concerns of systems developers? What are the pitfalls?

**1.2 What is the problem? Is modernization the answer?**

National statistic offices (NSI) are under pressure by limited budgets and the expectancy to produce statistics faster while sustaining the same quality. Other organizations are collecting data and producing statistics in innovative ways, challenging NSI’s roles. Facing the future, some form of modernization is essential for NSIs to meet the needs for statistics that are relevant, current and reliable.

IT-Innovations are often labeled as the solution to reduce cost and increase efficiency. Statisticians have throughout the years produced statistics using everything from typewriters to SQL programming and are now striding towards using real-time data streaming, automation and even machine learning. For new IT-solutions to be useful in producing statistics, it entails a successful development process of creating and adjusting these solutions. Statistics Norway are currently building a system from the ground up with new technologies, automations and more streamlined solutions to produce statistics.

# 2. Challenges

Are new systems simply enough? Magnus demands that statisticians rethink how to create statistics in order to meet the needs of the population for relevant, current and reliable statistics. Today’s technological possibilities require statisticians to be more involved and re-think how things are done. It demands knowledge, involvement and flexibility and can be quite daunting.

## **2.1 “If it ain’t broke, don’t fix it”**

A statistician might not see a system needing to be fixed if the programming language is old or the web application is not using the latest Java library. Systems developers or leadership will see the need for improvements or change of systems. How does a developer convince a statistician that building a system with new automations and more streamlined solutions will benefit them?

When something has been working for years and staff have learned to use their tools well, change might seem unnecessary and even unproductive. Modernizing by switching out technological tools can create uncertainty if statisticians wonder what program they will continue to use. Will we stop using SAS or SPSS? Which programming language will we use? What is our role in a process aiming for more automation? Do we lose quality assurance with automation?

This can be compared to someone telling you that your current car needs to be replaced, but you are happy with your current car. You get great mileage from it and you drive it well. You know how to maneuver it, you have memories from driving it and you have improved the car yourself, by saving destinations in the GPS and updated the interior. By getting a new car you lose all your saved GPS-shortcuts and the steering wheel will be unfamiliar and different, so you feel as having to learn to drive again. It is then expected that the new car will make you drive faster and better.

## **2.2 Ordering in the dark**

How can Emma, or Emma’s leaders, order a tool, when they do not know the technologies that are available? The car dealer decides a model for her that he thinks covers her needs. She did not design the car and it was pre-manufactured. She was not included in the process of manufacturing the motor, the chassis or any other part.

What if you were asked to give input on how the car could work more efficiently for you so that you can get from A to B faster and more secure than in your previous car? What should the car do? How should the engine be built? What type of shock system would you like? What type of bearings would you like on the crank arm? For a person not closely familiar with the mechanics of a vehicle, or programming, this is an unfamiliar language: The questions are difficult to the point of uncomfortable when Emma is not able to answer.

User driven innovation to the extreme would be if hundred statisticians ordered their own car, it would result in a hundred different cars. This example is rather simplified, but by stepping into the roles of a *buyer* and a *provider*of IT-solutions, both can feel separated from each other and a constructive discussion regarding design is difficult.

Also, when designing systems to be utilized in the production of statistics there is a need for quality assurance by statisticians. A focus on statistical quality in every step of the development process is necessary. Will the system be able to have all the functionality a statistician needs? Systems developers can be fascinated by the notion of having as much as possible automated to increase efficiency. At the same time, transparency is important to check the validity and reliability in what is being produced.

## **2.3 Coding in the dark**

As a coder, Magnus expresses a concern for the development process if he is too detached from the end users. Statisticians have an in-depth knowledge by daily using their tools. Magnus is concerned that he lacks sufficient contact with the staff at the data collection departments and statistical analysis department. What if Magnus creates something that is not exactly what they need because he could not really understand what managers, or the users wanted? He still feels obligated to complete a request, so he makes something, and just hopes for the best.

How many links are there between a coder and the end user? Magnus counted about four links between him and Emma. With many people involved and links of communication you risk losing information in the translation between every step. In some of these links there could be team leaders or managers that do not work directly with statistics. For Magnus, the IT-department feels like a separate entity within the organization. He does not consider himself as a systems developer employed at a statistics office, but a generic developer that could work anywhere. How is this beneficial to the organization? Perhaps Magnus could be a “statistics production developer”? Feeling more connected to the profession and domain you create its tools for, gives you a feeling of ownership and a better understanding.

## **2.4 Power and fear**

A lack of specific instructions for Magnus result in a high degree of decision making over the result. Magnus has previously disliked when a good *software requirement specification* is lacking because it gives him unwanted power over the result. Perhaps this could be embraced instead? Accept the fact that the user cannot tell him what they do not know and work with the user instead. Systems developers are building programs brick by brick, but they could also be facilitating a creative collaborative process with the statisticians. Perhaps developers need to ask the right questions instead of demanding that users or management feed them with the correct specifications?

By requiring a specific *software requirement specification*in the beginning of an innovative process we limit the end user to a very linear form of ordering a product. If the instructions are too rigid you might lose valuable input from the developer that could have created a more functional product. When you order something very specific, and the users know exactly what they want, the developer will be confined within the end user’s imagination. Collaboration throughout the design process appears to be key in balancing who decides the outcome.

Lack of communication in a development process could also lead to a fear of the unknown for the statisticians, especially when there is mention of increased automation. What if the car dealership told you that they want to provide you with a car that drives itself?

## **2.5 Language and trust**

Systems developers have their very own language. How do we successfully translate cross-departmentally and communicate effectively? When working together some important elements needs to be in place for us to communicate without too many misunderstandings. We need to create a safe space for sounding silly. If Emma wants to explain how she needs “this particular box” to work, and things should “pop out and magically appear” while waving, pointing and making clumsy drawings, then there should be room for this. When Magnus asks Emma in Narnia-language if she could point out the specifications for the product, he might as well have spoken Greek. If developers become more involved in the “ordering process” and the end users demand explanations of the Narnia-language, it could benefit working as a team and not two separated entities.

For statisticians and systems developers to understand each other and create statistics for the future, we need to have space and time to talk together in real time, alongside user stories and product requirements.

## **2.6 “Did you turn it off and on again?”**

A statistician reports a problem and a developer investigates. The developer fixes it fast and easy. The statistician is satisfied. The problem happens again. The second time the problem is caused by something else, requiring a time-consuming fix. The statistician might say: “Well, can’t you just fix it like Gyro Gearloose did last time?!” Magnus tries at the best of his ability to convey the difference to the user, but the conversation is stuck in a technological language not understandable to others than the developers themselves. The statistician becomes frustrated because their tool broke again, but now “it takes forever to fix”. The developer gets frustrated with the statistician not accepting his explanation. Complaints are made on both sides; walls are built, and the separation grows.

These situations can create a divide between systems developers and statisticians. One day the developer and statistician are placed in a project team. They are asked to “modernize” and improve a system together. They are told to work in agile teams that are horizontal across disciplines and adopt SCRUM and other project theories to fix their communication problems. They are required to do daily standups, write “user stories”, scope things down etc. From previously the statistician and systems developer are still skeptical to each other challenging the development process.

## **2.7 One size, fits all?**

Not only do developers and statisticians come from different educational backgrounds, every individual is also vastly different. NSIs are big organizations with many numerous generations at work. Some staff have recently completed their education, and some have been with the office for 40 years. There are large variations in technical competency. Some might be “Excel-heroes" while others prefer to code in SAS or R.

Statisticians have shown a great flexibility and willingness to change over the years. Production of statistics becomes more and more technologically infused. It demands a certain technological sufficiency to be able to produce statistics today. We have gone from counting and punching numbers on a typewriter, to using advanced programming, and even machine learning. The technological development moves at a fast pace with a myriad of programs, applications, and ways of using them.

### **2.7.1 Technological apathy and reluctancy**

While some are eager to learn new technologies and have the courage to jump into new projects, some might be reluctant to do so. They might have great skills in some programs, and it works for them. The excel-heroes might be best used exactly in Excel. Specific knowledge can be lost if people are squeezed into a program they do not perform well in. Perhaps the brightest analyst is not able to learn SAS-code or utilize R. Imagine that Emma spent her whole professional life learning to repair and perfect the inner workings of a Volvo. Would it be wise to provide her with a Tesla she knows little about? If Emma was provided a Tesla, perhaps she would try to fill it with gasoline.

Some statisticians might experience what we could call *technological apathy*. Something along the lines of: “There are constant changes and I am not going to understand this anyway, so why really bother with this new tool?” or “It will not be useful and improve my efficiency, so I am not interested.” There is a healthy fear in this, since not all that is new, is great.

Perhaps, if everyone felt ownership over modernization instead of sending one representative from their department into the black box: “the modernization project” they might be more curious and positive to how their work will change in the future.

One step could be that if the excel heroes are given the chance to participate in the design of the system, this might ensure that a new system has a user interface that is made easy and intuitive for them also, not just the expert users that are often the only ones included in development projects. Aiming to create dynamic solutions so that the system will be tailored to different levels of technical competencies, can be beneficial to modernize everyone.

## **2.8 Standardization and workarounds**

If a system is implemented and it does not properly fit the task it is meant to solve, we face the issue of workarounds. Staff need to get their jobs done and in order to do so they can be inventive. Emma worked in an organization that made “fake zip codes” for every international account, due to a system requirement of five-digit zip codes. This created endless problems for both customers and employees, and staff had to track which fake zip code belonged to which country. Time was spent creating workarounds and training new staff to perform these unofficial workarounds. Workarounds risk becoming the unofficial “best-practice” where a simple technological fix would have solved the issues and prevented frustrations, time and money.

If statisticians are copying data into excel or SAS, doing their calculations, and then pasting the data back in the new system, have we modernized then?

Modernization also needs a change in behavior where standardization and best practices have to be established. How do you enforce the change of behavior to the new system? Do you “turn off” the old? When do you go too far limiting the autonomy of the statisticians?

When workarounds become general practices, you can end up having a less productive solution than intended, when time spent using workarounds is included. With personal ways of producing statistics quality, documentation and assurance becomes a nightmare. If this one issue had been discussed and included in the flexible design of an existing program or in an innovation process, these workarounds could have been prevented.

## **2.9 Relying on the unicorns**

The unicorns are exceptionally skilled individuals that have both feet planted within the statistical sciences and the IT-world. They are often asked for assistance, they know how to code, but also how to produce statistics. They can translate to colleagues when questions appear, advice, and make good decisions based on knowing both fields. These unicorns help drive organizational change and support staff on both sides.

The unicorns become informal translators, teachers and problem solvers for both the statistics staff and the IT-staff. Relying on the work of these unicorns to modernize governmental statistics, is a risky way of developing new IT-solutions. There’s always a risk of the unicorns burning out, since they get many questions, and might become headhunted, for their unicorn-qualities.

## **2.10 What if the developer was the user?**

User interface and functionality is always at its best when a developer makes a program, that he plans to use himself. There are no language issues, no misunderstandings and no emotional limitations to being creative. There is no fashionable demand to be “modern”, so simplicity and creativity takes precedence. If we could translate these benefits to the situation when the developer and the user is not the same person. Magnus wants to get to know the statisticians, so he can imagine using his system while he creates it. To do so it will be beneficial to see how statisticians perform their daily work and perhaps attend some internal statistics training. This might seem as an extra cost and wasted time, but we advocate that this is an investment when creating great systems for a very specific group, such as statisticians.

## **2.11 Projects or forever?**

Statisticians and systems developers are being teamed together in different projects. They will be collaborating, not by placement in the organization, but by placement in a project. To set the stage for collaborative design processes, face to face collaboration is key along with enough time to understand each other. Why are we organizing our office around profession rather than by who needs to cross-collaborate?

To make robust organizations there has been a shift towards “generic” solutions where it is easier to replace the systems developer and the user, while the job still can be done at the same level of efficiency. By moving towards generic systems and generic roles for both statisticians and systems developers, have we created silos that create distance and prevent collaboration?

# 3. What now?

When modernizing at a large scale which Statistics Norway is working towards, not only upgrading technologies and computer power, but rethinking the process of producing statistics, we face some challenges highlighted here. Since we struggle with language, separation, and an unclear understanding of what modernizing entails, the statisticians risk falling into the feeling of ordering in the dark and the systems developers of coding in the dark.

In national statistic offices there can be different forces driving modernization. The IT-department clearly sees the need for modernizing production tools and streamlining behavior using these tools. Statisticians with specific knowledge in their fields with preferred methods and systems, might be skeptical of increased standardization and automation. Due to not establishing what problem modernization will solve, the distance between statisticians and IT, our different languages and lack of trust makes working together as a united organization towards modernization difficult.

There is a valuable aspect and a driving force in the discussions between statisticians and systems developers who are imagining the future from different angles. Going forward it is important to create room and space for conversations and collaboration between us to challenge and utilize each other. Due to Magnus and Emma not being able to further stake out a course forward, the paper ends here.