Title: *Using FRAM as a Quality Improvement Tool in Health Care*

Subtitle: *What is the difference between a good day and a bad day in the Spine Centre?*

Short description:
A group of doctors, employed at the Spine Centre at Middelfart Hospital, in the Southern Region of Denmark, wanted to get insight into and understanding of why work days dedicated to support the health care teams at the Spine Centre and to prepare preadmission evaluation of patients, sometimes were awful and tiring days and sometimes were life-giving and satisfactory days.

The doctors had heard about FRAM and believed that this method could help them to get insight and understanding.

The type of day they wanted to look into was called "Ad Hoc"-day. Three main functions were identified to characterize these days:

1. *To prepare preadmission evaluation of patients*
2. *To be a hotline for the General Practitioners*
3. *To support the Health Care teams*

After describing the 6 aspects – input, output, control, resources, time and precondition - of the three functions, the interactions between the functions and the possible impact they could have on each other, it was clear to the doctors that there where many possibilities to improve the "Ad Hoc"-day.

The possible actions they decided to look at were:

- *Interaction between the functions 1 and 3*
- *Professional assumptions and attitudes*
- *Hidden or "silent" knowledge*
- *Organisational topics*

I - Jeanette Hounsgaard, Deputy Manager of Centre for Quality – would be very happy to present the result of this work at the FRAM Workshop 2014 in Göteburg in Sweden.

March 15, 2014

Jeanette Hounsgaard

Experiences from Sweden and Denmark with training of staff in using FRAM as a tool in Health Care

Traditionally accident and incident investigations and risk evaluation in health care are done with methods developed in systems that are tractable and loosely coupled, for example RCA, “swiss cheese” and HFMEA. With the evolution of modern health care its processes has become more complex so that they are less tractable and more tightly coupled. This implies that investigations and analysis done with traditional methods in health care might not produce answers that are sufficient.

FRAM is gaining acceptance as a method that can be used in health care. When the method and the models it produces are explained to health care professionals they intuitively understand that a FRAM-model is a better way than traditional more linear models to describe the complexity of the health care processes.

To spread the use of FRAM in health care it has to be taught. We would like to share our experiences with giving courses to health care staff in Denmark and Sweden.

In Denmark the first structured FRAM education was given in May/June 2013 after having tested the use of FRAM on 12 different accidents/incidents from the hospitals in the Region of Southern Denmark. The cases were used to develop course materiel, including a handbook for guiding the health care professionals preparing a FRAM model and FRAM analysis. A two days course spread over a period of 2-3 weeks was developed. The training programme gave the students time to work with their own case in the intermediate time. The course was repeated in September/October 2013. In total 46 health care people joined the two courses. Additional two courses are planned in 2014. At the FRAMily meeting the course agenda and an example of an exercise included in the course will be presented together with the students evaluation.

In Sweden FRAM education has been given before but FRAM has not been used in routine patient safety work. In January to March 2014 a new FRAM education effort is being made with seven teams participating in a three days course spread over a period of six weeks with own work with analysing own cases in the intermediate time. The Danish handbook is used in this course. At the FRAMily meeting we will present the course agenda, the students evaluations of the course and some of the analysis made.

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Title: *Using FRAM as a Quality Improvement Tool in Health Care*

Subtitle: *Ward Rounds in a Geriatric Ward*

Short description:
At the FRAM Workshop 2013 in München, the result of an project[1] *using FRAM as a Quality Improvement Tool in Health Care, was presented. The goal of the project was to reduce the length of stay (LOS) by looking at a specific function "To do a Ward Round" in a Geriatric Ward at Kolding Hospital, in the Southern Region of Denmark.*

The use of FRAM made it possible to get insight into the present way of doing the Ward Rounds and the variability of the output of the function. Aspects with great impact on the variability of the output were identified, for example start and finish time of the Ward Round, preparation for the Ward Round, flow of information, coordination of key activities in the team, data for decision and supervision of new doctors.

The use of FRAM made it possible to address the system with meaningful changes resulting in a reduction of length of stay from an average of 9.6 days to an average of 7.0 days. In addition the variability was reduced from +-2.73 to +-2.05.

After the successful use of FRAM to improve the function "To do a Ward Round", the FRAM was accepted by the staff in the ward as a method for identifying possibilities of improvement. The acceptance was also due to the fact, that when the method and the models it produces was explained to the staff, they intuitively understood the thinking behind FRAM and that it was a better way than traditional more linear models to address the complexity of the health care processes.

After the implementation of the changes to the Ward Round, it was also clear that the changes had an impact on the functions up-streams and down-streams of the function "To do a Ward Round", and the staff decided to develop the FRAM model even further.

We - Pernille K. Langkilde, Nurse responsible for Development and Education, Kolding Hospital, and Jeanette Hounsgaard, Deputy Manager of Centre for Quality – would be very happy to present the result of this next step of developing a FRAM model, at the FRAM Workshop 2014 in Göteburg in Sweden.

March 15, 2014

Jeanette Hounsgaard and Pernille K. Langkilde

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[1] *The implementation project was accepted as a poster presentation at the international conference "International Forum 2013", in April, in London and the international conference "ISQua 2013", in October in Edinburgh.*

A framework to assess the safety impact of airport integration into the ATM system

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Abstract

The implementation of the European Air Traffic Management (ATM) modernisation programme introduces a paradigm shift from an airspace-based to a trajectory-based concept. This results in a change in the physical boundary of the ATM system, to include the apron. While the approach to ATM has been holistic in terms of efficiency, the approach to safety remains aircraft-centric and restricted to the manoeuvring area. It thereby neglects the new safety-critical area of the future ATM system – the apron. This research provides a framework to address this shortcoming.

The framework is based on the Functional Resonance Analysis Method (FRAM), enabling the analysis of the risks associated with apron operations in both the existing and future ATM Concept of Operations (ConOps). Data collection process was based on a preliminary task analysis, computer-based training for front-line operators, observations and semi-structured open-ended interviews. Observations and interviews were performed across 5 airports in Europe and in the US to identify factors that affect local variability of ground-handling operations. Based on theoretical and availability sampling, 40 respondents were interviewed in total, ranging from regular apron agents, leads, supervisors, trainers, apron controllers and airline representatives.

The preliminary results of the analysis unveiled the benefits of using FRAM methodology as a complementary approach in augmenting the knowledge about safe operations and safety culture within an organisation.

High Speed Navigation in the lens of FRAM

Jonathan Nilsson, Fredrik Forsman

High speed navigation in archipelago under adverse conditions in a challenging task. In domains such as Search And Rescue (SAR) and military operations third part safety can be dependent on the arrival of the vessel. In those situations maintaining speed and progress is crucial. By a deeper understanding for the success factors for navigation the development and design of navigation methodology, display requirements and artefacts can be informed. In this study the functions of High Speed Navigation within the boat system of the Amphibious regiment's (AMF 1) Combat boat 90 have been analyzed. The function of navigation has been mapped and focus has been on identifying variability that has a negative outcome on the common ground of the crew-boat system.

Video and audio recordings were captured during a three day long navigation exercise. Two separate crews were observed under various navigational conditions. In addition to the observations the crews were interviewed on their perception of the tasks and functions of navigation. The transcribed data were then analyzed with Functional Resonance Analyze Method (FRAM).

The result shows primarily the normal functions of navigation in the studied context. The functions of navigation is repeated in a cyclic pattern were each torn is a pivot point that starts the following cycle. It also shows that variability in functions that needed transfer of information between the crewmembers occasionally caused a need of creating more space/time by slowing down the vessels speed, sometimes to a full stop. This occurred when the content of the communication was too thin and impeded the maintaining of common ground within the crew.

The study implies that communication and maintaining common ground is a challenge and thus the design of the sociotechnical system of navigational onboard should be an area to pay close attention to.

Author: Marc Werfs
Topic of submission: FRAM for system design
Type of submission: Presentation of ongoing work in industry (without a paper)

Abstract
Disruptive innovations such as cloud computing, mobile devices, big data and social media pose novel challenges for organisations. They are difficult to incorporate, require new business models and alter the expectations of users and customers. The impact of these challenges can adversely affect organisational resilience, unless they are appropriately monitored and managed. The size of the impact is disproportionately large for SMEs.
To tackle the problems that can arise from using cloud computing (and other disruptive innovations), organisations have to continually adapt to the changing world around them. In other words, they need to operate as adaptive socio-technical systems (Werfs & Baxter, 2013). This enables them to respond to failures and degradations in performance, and to anticipate future events, exploiting expected opportunities in markets and heading off problems that appear on the horizon.
Building on the notion of adaptive STSs and our experiences from a one year study with SMEs from the Oil & Gas industry who have migrated software products to the cloud, we will use the FRAM to show effects of disruptive innovations on organisations. After modelling essential functions and their relationships we will create different instantiations of the model to simulate the adaptations needed to successfully incorporate cloud computing into an SME. More specifically, we will be able to explore how existing functions will be affected by cloud computing, if the relationships between functions will be affected, and whether new functions will be needed for the technology to be successful.
There are two reasons for using the FRAM. First, we inform the design of organisations that are ready for disruptive innovations. Through the instantiations explained in the previous paragraph we will be able to identify critical success factors for SMEs that plan to incorporate cloud computing, for example. Second, we investigate potential effects on organisational resilience more systematically, i.e. when organisations respond to degradations in performance or anticipate future events, as some adaptations may make sense in the short term but have adverse effects in the long term. Baxter et al. (2012) describe a case where a developer used cloud computing to help develop an application more quickly. It was only later, when the developer had moved on to another company that problems emerged. The developer had paid for the cloud services using his own credit card. This meant that the company was denied access to the code because they could not provide appropriate authentication details.

References
Baxter, G., Rooksby, J., Wang, Y., & Khajeh-Hosseini, A. (2012). The ironies of automation: still going strong at 30? In the Proceedings of the *30th European Conference on Cognitive Ergonomics*.
Werfs, M., & Baxter, G. (2013). Towards resilient adaptive socio-technical systems. In proceedings of the *31st European Conference on Cognitive Ergonomics*, Toulouse, France, Article No. 28.

Abstract for the 8th FRAM-Workshop on 18-19 June 2014 in Gothenburg
FRAM in comparison to another modelling method for complex sociotechnical systems

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The presented project aims at comparing FRAM (Hollnagel, 2012) with the "traditional" approach to sociotechnical system analysis. To do so, a case study is conducted in a company providing aviation maintenance. The study covers two steps. Step one consists of the "traditional" sociotechnical system analysis. For this purpose the KOMPASS method (Wäfler et al., 2003) is applied. This method provides operationalized criteria for the analysis and design of work tasks regarding work systems, individual work tasks, and human-machine function allocation. Data is collected by semi-structured interviews and shop floor observations. The KOMPASS analysis also aims at gaining information about potential functions to be subsequently analysed with FRAM.
In step two the FRAM analysis is applied to the same work system. By the means of semi-structured interviews, shop floor observations and focus groups the functions with their variabilities and interdependencies are described.
Finally the insights gained with the two analysis methods are compared.

References
Hollnagel, E. (2012). FRAM: The Functional Resonance Analysis Method. Modelling Complex Socio-technical Systems. Ashgate: Farnham Surrey UK.
Wäfler, T., Grote, G., Windischer, A. & Ryser, C. (2003). KOMPASS: A Method for Complementary System Design. In: E. Hollnagel (Ed.). Handbook of Cognitive Task Design. Mahwah, NJ: Lawrence Erlbaum, pp. 477-502.
Olten, March 2014

DISCRETE EVENT SIMULATION OF A FRAM MODEL IN SIMPY

Eric A. van Kleef, M.Sc. Delft University of Technology

During the latest FRAM workshop the idea was discussed of making a simulation out of a FRAM model. A simulation makes it possible to study the possible behaviour of the modeled system.
In a discrete event simulation, starting and stopping times of a process are calculated. The FRAM-functions can be seen as processes in a DES. The paper shows how preconditions, time, and resources can be interpreted as the aspects determining starting and stopping time of the function.
Functions can not only be executed or not, but it is also possible to have a function that is executed ‘a bit’. This closely resembles the notion of fuzzy logic. The aspects precondition, resource, control, input and output are therefore implemented as fuzzy boolean variables, allowing for variation in the output. This is a representation of functions being executed with some variation. The larger the deviation from the ‘standard’ result, the lower the value of output.
Preconditions, resources, control, input can be output from another function. As the output is represented by a fuzzy boolean, those other aspects are fuzzy booleans too. The paper proposed a way to interpret input parameters that are fuzzy variables.
Instantiations are represented by different runs of the simulation. This allows functions to be activated in one instatiation while staying dormant in another.