

Conclusions After One Year: Maintenance Functions of Smart Grid

Field crew level IT-solutions and functions

Smart Grid and Energy Market (SGEM)

General Information

Programme	Smart Grid and Energy Market (SGEM)
Thema	4. Intelligent management and operation of smart grids
Workpackage	4.2. Network management functions of Smart Grids
Task	4.2.5 Field crew level IT-solutions and functions

Roles

Project director	Saku Mäkinen, TUT
Project manager	Henri Suur-Inkeroinen*, TUT

Partners

Empower	Jari Vasell*
Nokia Siemens Networks	Pasi Saarenpaa

*Author of this document.

Overview of the project

In future resource allocation will be even challenging in a complex network system and new competences are needed. The purpose is to theoretically identify alternative variables influencing resource optimization in a networked Smart Grid business environment. Theoretical identification will be further studied and analyzed with empirical analysis of selected field operations and their requirements. Based on these analyses alternative ways to model the resource optimization will be demonstrated in simulated Smart Grid environment. These models are validated with empirical cases to reveal possible performance and efficiency consequences.

Mobile technology and common system interfaces enable to determine new applications for field crew level. This means e.g. integration of data from various office level systems and new user-interface interactions, and development and demonstration of field force resource utilization optimization engine.

Overview of deliverables

- Understand Smart Grid driven new requirements for managing efficiency in the field operations
- Study and evaluate the resource optimization problematic in new networked business environment
- Study and evaluate the roles of existing IT systems and how the integrations to the field force management systems could be done
- Demonstrate the resource optimization concepts
- Validate the business benefits from the demonstrated concepts
- Validate the applicability of common telecom expertise for the smart grid and energy markets domain

Objectives of research

We have three aspects to smart grid maintenance functions: management information systems, organization structures, and management practices. Following questions describe our interests and objectives.

What kind of management information system (MIS) is suitable for the smart grid environment?

- How do employees perceive usefulness and usability of management information system?
- How do individual factors influence to usage level of management information system?
- How to adopt a new management information system?

What kinds of organization structures are suitable for the smart grid environment?

- How to make teams autonomous?
- How to manage the change towards autonomous teams?
- What kind of incentive structures are the most suitable?

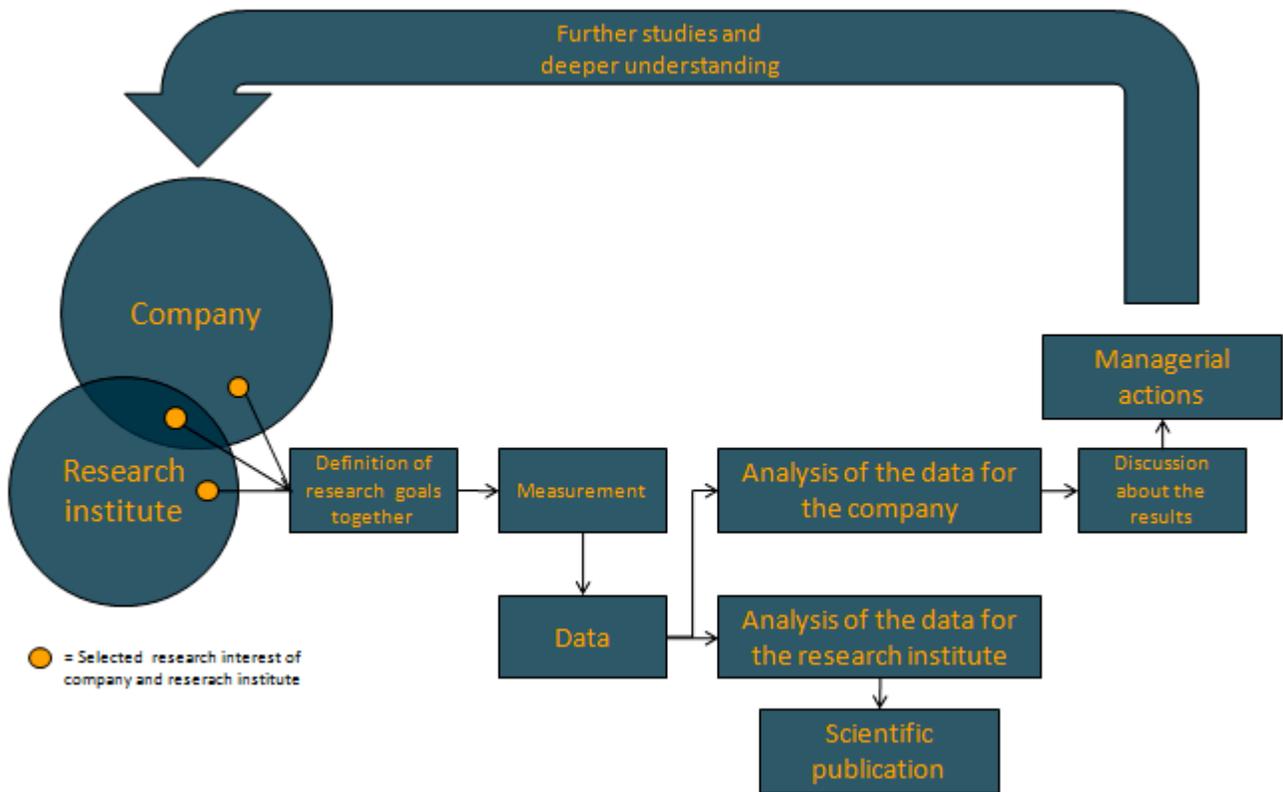
What kinds of management practices are suitable for the smart grid environment?

- What are the effects of value based management?
- What are roles and objectives of supervision of work?
- How to detect a bottleneck in a service process?
- What information does the field force need in daily tasks?

Research model was iterative and focused on getting results for the company and research institute. Results were measured as managerial actions for the company and scientific publications for the research institute.

Research model was considered successful for the use of this program, and it can be applied also when several companies are involved. The used model is pictured below.

SGEM Task 4.2.5: Field crew level IT-solutions and functions, TUT & Empower



In future even more efficient model can be developed. To make the model better we suggest that focus is in detailed planning and definition of measurement and analysis. Schedule of "discussions about the results" will provide basis for fast paced managerial actions and further measurements.

List of Deliverables

Completed

Academic papers

Huttu Essi, Tapaninen Aija & Seppänen Marko. "Incentives in the Transition to a Self-managing Maintenance Organization". ISPIM Symposium. Quebec, Canada. December 12-15, 2010.

This study investigates the effects of incentives in the environment where new mobile technology has streamlined the organizational structure and incurred the need for a supporting incentive system to enhance the productivity of self-organizing autonomous teams. In the near future, energy distribution and its governance procedures will resemble the structure and operating environment of current ICT infrastructure. The findings confirm the importance of intangible incentives, especially perceived recognition from supervisors and peers. In practice, managers can increase the perceived job satisfaction by showing explicitly their interest in employees, well-being and also by establishing an incentive system that comprehensively fulfills both effectiveness and humanity aspects. Further research may be targeted to investigate the balance between these two aspects and what factors may mediate these effects.

Seppänen Marko, Kujansivu Paula. "Identifying the Dissatisfiers in Knowledge Work" IAMOT2011 abstract submitted. April 10-14, 2011. (1/2011)

Development of especially ICT technologies has enabled a change towards leaner and more flexible organizations. In addition to white-collar workers, also blue-collar workers have nowadays a mobile access to most of information in a company's ERP systems, including e.g. work orders and work loadings. Many firms are currently considering or already piloting new possibilities to carry out their operations with self-managing autonomic teams in spite of traditionally supervised teams.

It has been proposed that this type of transition towards more autonomic job description will increase perceived job satisfaction. For example, participation in decision-making influences directly job satisfaction (Scott-Ladd & Marshall, 2005). Improved job satisfaction in turn may affect also firm-level productivity positively (Adam et al., 2005; Kujansivu & Oksanen, 2010; Westlund & Löthgren, 2000).

Concurrently with these internal changes, the business environment is changing. Technological systems are becoming increasingly distributed, as

technology becomes smarter and more independently operating (cf. Chung & Hossain, 2010). Further, the proximity of end customer (e.g. broadband, energy meters) relates to this development towards more distributed technological future (Jacobs, 2010). Therefore, maintenance and support operations are going to be more complex and situate nearer the end-customer that requires ever-higher level of competences from maintenance workers (Bosch-Sijtsema et al., 2009). Thus, many maintenance workers' duties include features of knowledge work (Drucker, 1999; Ramirez & Nembhard, 2004). What are not so well known are how employees perceive these changing working conditions and what kind of relations the working conditions may have with job satisfaction. By identifying the weakest points (hereafter, dissatisfiers) from the point of view of job satisfaction, the development efforts could be targeted more effectively and eventually, productivity improvements could be achieved.

In this paper, we have two objectives: First, we provide new knowledge on the factors of working conditions affecting job satisfaction. Second, we report on our practical experiences in identifying the dissatisfiers of job satisfaction in knowledge work.

Literature reviews

Puha Sanna. "Autonomic Teams and Self-Organisation - A Literature Review". September 2010.

The centralized control over work is a well-established tradition in organizational theory. (Barker. 1993). Traditional way of organizing work involves companywide rules and certain methods common to all employees. However over the past decades the concept of self-control and self-managing teams has increased and several studies has been conducted in order to understand the formation and evolution of the self-managing teams (Barker. 1993), the types of different teams (Langfred. 2000), the relationship between team and individual autonomy (Mierlo et all. 2006) as well as importance of company, the strategy and vision to the self-managing teams (Cordery et al. 1991).

This study conducts a literature review on these aspects of self-managing teams. The aim of the paper is to clarify what are the different types of the self-managing teams are well as how these teams are formed and how do they evolve. Also a brief case example of taxi drivers is discussed.

Goel Dharas. "Value based Technology Management - A Literature Review". September 2010.

This paper presents a multidimensional framework that provides insights in Value based Technology Management after reviewing exploratory as well as empirical research already carried out in this direction. It is an attempt to identify the variety of value sources that are required to be considered for efficiently assessing the value added by technology.

Goel Dharas. "Self Managed Task Assignment in Service Processes – A Literature Review". September 2010.

This paper explores the feasibility of self managed task assignments in the service processes by getting insights from companies which have already went self managed way. The suggestions are provided on how self managed task assignments can be implemented in particular situation under study by taking into account the factors that might affect the subject. The theory has laid foundation for understanding the intricacies of the underlying concepts and then opinions, recommendations, suggestions were made regarding the subject matter of this paper.

Other

Huttu Essi. "The effects of incentives on performance and job satisfaction: Literature review and interviews." Special work in Industrial management. 49 pages. September 2010.

The aim of this study is to research how different incentives affect performance and job satisfaction. In the study, the effects of recognition, participation, feedback, monetary incentives, non-monetary tangible incentives and benefits on performance and job satisfaction are researched. It is posited that different incentives have different effects on performance and job satisfaction.

Incentives effect on performance and job satisfaction are researched trough critical literature review and interview research.

On the basis of the literature review and the interview research, it seems that all the incentives types are important but they have different meanings for employees. Indeed it seems that there are two different aspects in rewarding. These two aspects are effectiveness and humanity. Effectiveness-aspect means that employees feel that they are justified to get monetary incentives because they have put extra effort on work. For the humanity-aspect it is important that employees feel that employer is interested in employees, their work and well-being. The rewarding of the humanity aspect

is more important in generating job satisfaction whereas the rewarding of the effectiveness-aspect affects performance. Different incentives affect different aspects in a different way. Hence different incentives have different effects on performance and job satisfaction, like it was posited. However, it is important to notice that these aspects complement each other. Hence we can talk about comprehensive rewarding.

Kujansivu Paula. "Asennustyökyselyn tulosten esittely." Presentation. November 2010.

Suur-Inkeroinen Henri. "Willingness to Use Information System." Questionnaire. December 2010.

Empower deliverables

Resource optimization concepts were demonstrated on simulated Smart Grid environment. Several different optimization concepts and team sizes were evaluated to emulate the workload on future Smart Grids. Concepts involved services that were delivered to end customers with varying needs and schedules.

In validation of business benefits, it was noticed that Smart Grid environment will create new obstacles for service business in future. These obstacles are not only technological. They arise also from faster pace and increased diversity of work. The involvement of end customers will also bring changes to daily schedules, which must be dealt accordingly.

To make the service work flow smoothly, field engineers must learn new techniques to handle more diverse service orders. In addition to this, flow of information within the teams must be increased to adjust to the changing schedules.

We came to the conclusion that the current way of working must be adjusted to deal with the future needs of the Smart Grid environment. The most important aspects to focus are:

- Share more information about the obstacles in the working environment
- Use position information to tackle the fast paced changes in schedules and service orders
- Mobile devices are necessary for real-time information flow between field engineers, shift managers and customers
- Focus on the usability of the mobile devices to increase work satisfaction and efficiency

Forthcoming

Academic papers, working titles, (due month/year)

Suur-Inkeroinen Henri. "Effect of Emotion and Self-Efficacy to Technology Usage Behavior." PICMET2011 abstract accepted. Aug 4, 2011. (3/2011)

Suur-Inkeroinen Henri, Luoma Arto & Kanninen Juho. "Analysis of Autoregressive Error Models in Diffusion Prediction.", Technological Forecasting and Social Change. (3/2011)

Literature reviews

Pasi Kuparinen, "New service development and service innovations." (3/2011)

Other

Suur-Inkeroinen Henri. "Analysis of Willingness to Use Information System". Presentation.(2/2011)

Suur-Inkeroinen Henri & Vasell Jari. "Conclusions After One Year: Maintenance Functions of Smart Grid". (3/2011)

Contact Information

Henri Suur-Inkeroinen, Researcher, Industrial Management
Faculty of Business and Technology Management, Tampere University of
Technology, Finland
Email: henri.suur-inkeroinen@tut.fi, Phone: +358-40-5610256

Jari Vasell, Development Manager, Empower Oy, Finland
Email: jari.vasell@empower.fi, Phone: +358-400-658923