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## Work Organisation and Innovation - Case Study: Radiometer, Denmark

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## Work Organisation and Innovation - Case Study: Radiometer, Denmark

### Abstract

[Excerpt] Established in 1935 by two engineers, Radiometer invented the world's first blood gas analyser in 1954 in connection with the struggle against the childhood polio epidemic. This invention resulted in the development of a company that produces medico-technical products and services for hospitals.

The company's headquarters are in Denmark, where the largest group of employees (948) work. Worldwide, Radiometer has a total of 2,300 employees and subsidiary companies in 23 countries.

### Keywords

work organization, innovation, Radiometer

### Comments

#### Suggested Citation

Høytrup, S. & Møller, K. (2013). *Work organisation and innovation - Case study: Radiometer, Denmark*. Dublin: European Foundation for the Improvement of Living and Working Conditions.



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# Work organisation and innovation

## *Case study: Radiometer, Denmark*

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# Background to the organisation

Established in 1935 by two engineers, Radiometer<sup>1</sup> invented the world's first blood gas analyser in 1954 in connection with the struggle against the childhood polio epidemic. This invention resulted in the development of a company that produces medico-technical products and services for hospitals.

The company's headquarters are in Denmark, where the largest group of employees (948) work. Worldwide, Radiometer has a total of 2,300 employees and subsidiary companies in 23 countries.

Radiometer has manufacturing companies and research and development departments in Denmark, the USA, Switzerland, Finland and Poland, and 23 sales companies with responsibilities for its worldwide sales and distribution of products and services. Its products are available in 100 countries. The USA and China are particularly new and promising markets.

In 2004 the owner of the Radiometer group decided to sell the corporation with its subsidiary companies to an American multinational. The owner of Radiometer believed that new capital, new organisational innovations and a new strategy were necessary to ensure the future of the company in a demanding global market. He felt that Danaher Cooperation with its Danaher Business System (DBS) would be the right partner for Radiometer.<sup>2</sup>

Today Radiometer is a subsidiary company within Danaher, a science and technology leader that designs, manufactures and markets innovative products and services to professional, medical, industrial and commercial customers. A total of 48,000 employees and 59,000 associates around the world serve customers in more than 125 countries.

Radiometer is a leading provider of technologically advanced acute care solutions that simplify and automate all phases of acute care testing. The company offers solutions for blood gas analysis, transcutaneous monitoring and immunoassay testing for cardiac, coagulation, infection and pregnancy markers.

Radiometer's involvement in its products for hospital acute care centres and emergency departments does not end with installation. Once installed, Radiometer supports the product with technical and application support services. The products are combined into customised service packages and training for the end users, i.e. clinicians, laboratory technicians, nurses and doctors. Radiometer offers a holistic solution approach that combines process improvement, product and services.

Radiometer has a very long tradition of collaborative co-management between management and employees and their trade union representatives. It has an old tradition of having a highly developed system of collective bargaining, cooperation committees, works councils, health and safety committees, trade union representation of employees within the board of directors, shop stewards, collective agreements and team-based work organisation. Radiometer does not have a European Works Council (EWC).

The overall vision of the company is to grow the business and markets globally; develop new and better products; and develop new services. The company's vision is to build a team and a reputation for Radiometer's products and services that result in extraordinary loyalty from associates, customers and, not least, shareholders. Radiometer wants to be respected and admired for its reliability, the quality of its products and services, and its ethics and overall business

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<sup>1</sup> <http://www.radiometer.com/>

<sup>2</sup> <http://www.danaher.com/danaher-business-system>

system. This vision is seen as an ultimate competitive advantage. The business goals are to achieve a growth rate of 10% every year, and to increase productivity and efficiency by 8% a year, i.e. to produce 8% cheaper every year by finding new and smarter work processes. The quality of the products and services is intended to improve by 50% each year. Quality is measured as the number of ‘unplanned’ service visits per device. The lower the number of unplanned service visits, the better the quality. Unplanned visits per device were 1.5 on average in 2012.

The innovation described in this case study – the introduction of the DBS/Lean strategy – is critical to achieving these business goals.

A senior manager (HR) stated during the interview for this case study that the former management at Radiometer has deliberately chosen to retain two categories of values: the old values of Radiometer, which have not changed since 2001, and the values of Danaher when Danaher took over the company in 2004. The two sets of values overlap but the Danaher values are more closely linked to the American tradition and culture. The two sets of values are summarised in Table 1.

Table 1: *The Radiometer and Danaher values*

| Values of Radiometer   | Values of Danaher   |
|--|---|
| <p>1) <b>Respect for people.</b> Respect for people is fundamental in Radiometer. Respect for people defines the way we organise the company to accommodate each and every employee, both physically and socially. Respect also defines our way of stating goals and demands. Ambitious goals and high expectations are underpinned by the necessary help and support from management. Respect is also integral for the development- and design processes of our products.</p> <p>(2) <b>Customer-oriented.</b> The most important relations in Radiometer are, and will continue to be, the relations with our customers. After all, without them, the organisation has no future. Everything we do in Radiometer is aimed at making us attractive to our customers by offering products and services of superior value. It is important to understand that our colleagues and internal partners are ‘consumers’ and customers of the services we provide. Only through robust collaboration and teamwork can we continue to deliver the quality products that critically ill patients around the world use every day.</p> <p>(3) <b>Quality.</b> Quality is a key parameter in Radiometer’s activities: Quality in the products, Quality in our customer relations, Quality in timely delivery and Quality in our relations with colleagues, our tasks and our work environment.</p> <p>(4) <b>Innovation.</b> The staff of Radiometer must be: adept at developing new and attractive products, innovative in how we organise work and collaboration, flexible and adaptable and adept at acquiring new personal and professional competencies.</p> <p>(5) <b>Constructive diversity.</b> Radiometer appreciates diversity. We realise that new ideas and sustainable solutions originate from the ability to constructively organise different perspectives, and personalities and skill sets. Constructive diversity is demonstrated in our equipment, in which chemistry, mechanics, electronics and IT technology merge into something more than the sum of its parts. Our appreciation of diversity is demonstrated through our ability to work together towards our shared visions and, and in our ability to coordinate and collaborate across organisational units, teams and individuals in the company.</p> | <ul style="list-style-type: none"> <li>• The Best Team Wins</li> <li>• Associates are our most valued assets</li> <li>• We’re passionate about retaining, developing and recruiting the best talent available</li> <li>• Danaher and its associates win because:             <ul style="list-style-type: none"> <li>• We are Team-Oriented, with Involvement by All.</li> <li>• We seek Fact-Based, Root Cause Solutions; not Blame.</li> <li>• We are Accountable for Results, and We Deliver.</li> <li>• We are Non-political and Not Bureaucratic.</li> <li>• We have High Integrity and Respect for Others.</li> <li>• Winning is Fun.</li> </ul> </li> <li>• Quality First, ALWAYS!</li> <li>• Customers Talk, We Listen</li> <li>• We base our strategic plan on the Voice of the Customer</li> <li>• Robust, repeatable processes yield superior Quality, Delivery and Cost that satisfy our customers beyond their expectations</li> <li>• Continuous Improvement (Kaizen) is our Way of Life</li> <li>• The Danaher Business System IS our culture.</li> <li>• We aggressively and continuously eliminate waste in every facet of our business processes</li> <li>• Leading Edge Innovation Defines our future</li> <li>• We continuously apply our creativity to the technologies of products, services, and processes</li> <li>• Out-of-the-Box ideas, both large and small, add value to our enterprise</li> <li>• We accomplish ‘breakthroughs’ through the Policy Deployment process</li> <li>• We Compete for Shareholders</li> <li>• Profits are important because they attract and retain loyal shareholders</li> <li>• Shareholders secure our future by providing capital for investment and growth</li> </ul> |

New employees are introduced to these two sets of values as part of their introduction to Radiometer and their first year's compliance training, and as part of the introduction to DBS tools; the values are also listed on posters everywhere in the company buildings.

# Nature of the innovation

The Danaher Business System (DBS) is based on the principles and tools developed within the Lean system and philosophy. DBS tools are 80% Lean. The underpinning principles of the Lean system are to eliminate waste in all its aspects, including waste materials, time wasted, too much stock or inventory, wasted efforts, etc., and to produce up to an agreed quality and productivity level defined by the management at minimum cost. Minimum cost means maximising the use of limited resources (staff, time, space, materials, and money).

The methods include workflow analysis used as a general model for continuous change and process improvement at all levels and in all departments.

In order to optimise the workflow and productivity, U-cells<sup>3</sup> are used in production lines together with standardisation of processes and the physical layout (everything has a fixed place). Manuals are developed to ensure standardisation and the tools are used to enhance quality, problem solving, processes, etc. The management of DBS, innovations and the productivity of each unit are ensured by Kaizen Events<sup>4</sup> and daily management meetings. In the production unit daily management meetings are held in the morning and usually last about 15 minutes. This type of meeting is held systematically in all units or departments and between one management level and another on a daily or weekly basis. The purpose of the daily management meeting is to create an overview of the production process and flow, to identify and analyse problems in production and to make decisions on how to solve these problems.

Kaizen Events are a major tool in the company's Lean management. Radiometer undertakes about 100 Kaizen Events every year, during which workflow analyses are carried out within a selected area of the company (Isaksen, 2012). Often Kaizen Events last for one week. Employees who attend Kaizen Events are usually representatives from the units directly involved in the defined challenge or the problem – from the production worker, IT technician, and HR manager to the president – but in varying numbers and for varying lengths of time, depending on where the challenges in the company lie at a specific time. Some employees participate in a Kaizen Event only once or twice a year. Others participate in a series of Kaizen Events. This is the case especially when new processes, products or services are under development. After the Kaizen Event the next step is to present the result of the event to the employees affected by the decisions taken. The responsibility lies with the managers and the participants in the event to inform the relevant colleagues and transfer the results into daily work activities.

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<sup>3</sup> U-cells are U-shaped assembly lines, which are thought to be preferable to traditional straight assembly lines, partly because they allow for more effective work operations, a steady one-piece production flow and a minimum of inventory.

<sup>4</sup> 'Kaizen' is a Japanese term for a gradual approach to ever higher standards in quality enhancement and waste reduction, through small but continual improvements involving everyone from the chief executive to the lowest-level workers. A Kaizen Event is a focused, short-term project designed to come up with a solution to a particular problem, usually arising in a business process (see also <http://www.businessdictionary.com/definition/kaizen.html#ixzz2Iuk5XlhR>).



# Process of implementing the innovation

Before 2004, Radiometer had for many years achieved continuous improvement and innovation through a team-based, dynamic and flexible work organisation called ‘co-managing teams’. Radiometer’s culture of collaborative co-management is believed to have been vital for its success so far and is considered to be an important asset for future growth (Lotz, 2009). Besides the structure and culture of collaborative co-management, two different ‘tools’ have been used to foster this culture. The first is the institutionalisation of role-division within teams. The second is a permanent second job (JOB2) arrangement, which invites employees to change jobs with colleagues across units on a temporary basis in order to learn new skills and competencies that increase organisational flexibility and to improve working conditions for the employees.

Radiometer had also worked in close cooperation or partnership with the surrounding public institutions such as universities, research centres, educational institutions and hospitals. These long-lasting partnerships represented a central strategy for the company and had resulted in a flexible, highly skilled, motivated and engaged workforce (Lotz, 2009) that took pride in being employed at Radiometer.

The result of these policies and strategies was a publicly respected company that offered high-quality products and services to hospitals.

Shortly after the acquisition of Radiometer in 2004, the new leadership decided to introduce the Danaher Business System (DBS), an innovative organisational concept, to enhance Radiometer’s position on the global scene.

The first key event in the process of moving to DBS took place four weeks after Radiometer’s acquisition by the Danaher Group. It was the Executive Champion Orientation (or ECO). Forty managers from Radiometer participated in this team-building event. They were split into six groups to do a value-stream mapping. Peter Kürstein, Radiometer’s CEO, recalls that the event had a very powerful effect on the participants: ‘seeing the absolutely obvious improvement opportunities that could arise from simple changes was amazing ... we came up with improvements that reduced in-process time to less than two days by creating a one-piece work flow and eliminating the planning department and IT infrastructure that had previously managed work scheduling’ (Anand et al, 2011).

The next major event was the strategy plan discussions two months after the acquisition. Peter Kürstein describes it as a very positive process where Danaher management challenged Radiometer management on their market knowledge and growth strategy: ‘Danaher was not going to tell us what to do differently, rather they were going to challenge us on whether we are getting enough out of our opportunities ... the “strat” plan discussion got us thinking about how we can further win in the market.’

Kürstein believes that the introduction of Policy Deployment was perhaps the biggest and most important change for him after the acquisition. This was a method of improving the execution of strategy through the application of a systematic process, from formulating five to seven strategic priorities, to identifying the processes that needed change, then identifying goals and monthly targets for each. These targets were then posted on a single piece of paper outside the CEO’s office and other locations. The goals were then translated into goals for each department and finally into individual action plans, each of which had its own sheet attached to the relevant employee’s door. According to Kürstein, ‘Policy Deployment does not happen automatically. It takes a lot of hard work in the beginning to set it up, several iterations and a lot of discipline to establish throughout level one, two and three and most importantly to get the right action plans developed. But today, I am not in doubt: PD is the most powerful execution tool around and you get it for free – except for the initial investment in setting it up and retaining the discipline’ (Anand et al, 2011, pp. 12–13).

After the initial training activities for the managers, the senior management at Radiometer decided that the results were so positive that they would implement the Lean principles within a relatively short time: three years was the initial target.

The innovation was implemented through a top-down strategy accomplished in cooperation with union representatives. The union representatives cooperated with the management and assumed the role of change masters in conformity with the tradition of collaborative co-management. The production manager met with all the teams in order to clarify and discuss the underlying logic and future strategies of the Lean-based reorganisation. Managers and employees were taught Danaher's Lean principles, while production stopped and stores were reduced. Training included planning and participation in Kaizen Events to improve the abilities of managers and employees to reorganise in the interests of enhanced efficiency and performance.

Union representatives developed a manual for the co-management of teams that addressed the future roles and rules for teams and collaborative practices. These rules explained the division of responsibilities, expectations and rights to employees, union representatives and management in a working environment under constant change and stated that changes cannot be imposed, but must be negotiated (Lotz, 2009).

Despite these initiatives, there was still a great deal of uncertainty about the underlying idea of the whole system and a clash between two cultures and the ways of organising the work in different types of teams. In the old team-based organisation, each unit consisted of several co-managing teams organised around the unit's specific product line. The introduction of U-cells and the one-piece flow process was met with scepticism by employees. One manager interviewed for this case study asked: 'Why change the good old way of working in teams? We have achieved good results in the way we are organising the work.'

Those chosen by management to take part in Kaizen Events were often the most dedicated employees and those who were most motivated to participate in the new activities and processes. According to interviews with managers and an employee, it seemed as if primarily the managers and the most ambitious and motivated employees in the higher levels of the organisation or in the most strategically important departments or units were trained in the use of Lean tools. There were areas or sections that were more or less forgotten.

In 2007 an American director arrived, bringing new ideas and experience with the DBS to Radiometer. This director took over responsibility for the systematic implementation of DBS tools. He introduced systematic management meetings – 'blackboard meetings' or 'daily management meetings' – with reports from each U-cell or department coming up from one level to another on a daily or weekly basis all over the company. The training in using different DBS tools was enforced in a more systematic way and extended to all parts of the company. In this process, external resources have been used in terms of external consultants from other parts of the Danaher Group, Japanese Lean experts and experts and teachers from American universities and the Danish public educational system.

This innovation in work organisation has now been in progress for eight years, although the DBS system is still not fully implemented. A special board with representatives from both managers and employees has been established. This board has the responsibility of developing and defining a new team-based structure and team roles. In the HR department the staff are working with the development of new DBS tools that are more in line with the Radiometer reality.

# Reactions and challenges

The decision in 2004 to implement DBS/Lean and ‘Kaizen is our way of life’ at Radiometer was not an issue open to discussion. Cooperation was only established in relation to how to implement DBS/Lean in the company. As described above, the initial phase was characterised by excitement, high expectations, feelings of being listened to, respect and cooperation but also uncertainty and some resistance to the idea of the new system and a clash between the two cultures and their ways of organising the work in different types of teams. The Lean tools were not introduced everywhere and some areas were ‘forgotten’ whereas others were trained thoroughly – especially the managers. The reactions clearly will follow the same patterns – the fewer workers are involved and listened to, the more resistance and feelings of uncertainty they will exhibit. But uncertainty also arises because of the newness and the complexity of the organisational innovation.

It seems that both management and employees have been overwhelmed by the complexity and length of time it has taken to implement the process. After three years of too much uncertainty, initiatives were taken to place responsibility for the implementation of DBS and the use of DBS tools in a single department under a manager with expert competencies in DBS. Today, DBS tools are used in a more focused and systematic way together with systematically run daily management meetings in all units and departments.

Not all employees from the ‘old’ Radiometer found the changes acceptable. Many have left Radiometer and it is indicative that within eight years 50% of employees were replaced. In 2010 and 2011 staff turnover was 3.7% and 3.9% respectively.<sup>5</sup> According to a management interview undertaken for this case study, the company finds this level acceptable.

Most employees at Radiometer today have adopted the Radiometer/Danaher values mentioned earlier and the principles of working with DBS and, especially, with Kaizen Events. According to management, in cases where an idea, suggestion or decision is reached – e.g. at Kaizen Events – participants show enthusiasm, take ownership and commit themselves to implementing the decisions. Employees accept the process of continuous improvement of the company in the DBS way.

In the interviews with employees and managers five major challenges were mentioned:

1. To implement DBS/Lean practice in all areas, levels and corners of the organisation;
2. To perfect DBS tools and practices continuously;
3. To develop the necessary competences amongst both managers and employees;
4. To redefine the co-management teams;
5. To produce new products and conquer new markets.

## Implementation of DBS/Lean practice

The prevailing technique for involving selected areas of the organisation in DBS/Lean management is the application of Kaizen Events. According to an interview with a manager, Kaizen Events did not take place regularly after a general action plan, but occurred ‘when the need is there’ and often with the most motivated employees as participants.

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<sup>5</sup> Company Annual Reports 2010 and 2011.

Kaizen Events are management tools and platforms for co-creating improvements and innovations in work practices, products and services. Kaizen is a tool to develop ownership, understanding and responsibility for the agreed work processes. It is a very important and powerful instrument in Lean and could be used in an even more focused and systematic way. Improvements decided upon in Kaizen have to be implemented within a short period of time. This is a challenge especially for managers. Managers need to get employees involved in the improvement process and handle the daily management meetings skillfully in order to overcome resistance to change in daily work and thus ensure successful implementation of the changes. Management has to run the meetings in a constructive way and develop their relationships with employees to be trustful and supportive.

### Continuous perfection of DBS tools and practices

One technique applied here is to develop and refine new DBS tools on a continuous basis. For example, two new tools have been developed by the company's DBS expert:

- *Problem Solving Process (PSP)*. PSP teaches employees a new way to solve problems specific to Danaher/Radiometer
- *Quality System Basic (QSB)*. QSB helps establish a platform for ensuring quality.

The improvement processes are strongly supported by education and training in Radiometer. The learning processes of employees take the form of both formal learning, e.g. in Kaizen Events, and informal learning in their daily working activities. In this way, the competencies of employees are constantly developed to meet the needs of the company.

Competence development and knowledge resources are important at Radiometer. The company has a huge need for knowledge resources because current developments in terms of new, unique products and solutions imply large demands of knowledge in the fields of markets, customers, types of patients and technological options.

These challenges are primarily met by comprehensive training efforts. Radiometer is working actively to ensure that the knowledge and competences of employees including managers are continuously updated and developed to meet the demands of the daily work, especially the competences to use different DBS tools and DBS management.

The development of co-management teams into DBS/Lean teams is seen as an important challenge in the development of Radiometer. The two kinds of teams are related to two different kinds of production systems. The roles needed in the two teams are different, and structure of work, job descriptions and control and authority are different. A group has been set up to analyse and support the transformation process.

### New products and markets

Radiometer works continuously to improve the speed at which the advanced equipment delivers accurate measurement results when used by professionals at hospitals, and the range of factors/parameters in the blood to be measured, depending on each hospital's needs. In a Danish business journal (Jyllandsposten, 2012) Radiometer's CEO announced that the next important market was China, but the USA is also a huge market of interest for Radiometer. The entrance to both of these markets is likely to be very demanding and costly due to the complicated and time-consuming governmental demands and regulations. To meet these demands it has been necessary to hire more people with the necessary competencies and knowledge of the cultures within the new markets.

# Impact on employees

The impact on employees is conceptualised in terms of **job satisfaction**, **working conditions** and **social relations**.

Job satisfaction among employees varies from unit to unit in the organisation, depending on the concrete working conditions and influenced by staff involvement, style of management, pressure from the defined ambitious goals, the resources at hand, competences, technical problems etc.

Both management and employees interviewed for this case study stated that job satisfaction is high when employees :

- Believe that their voice is heard by management
- Believe that the unit can benefit from their ideas and proposals
- Receive an explanation of why proposed ideas cannot be used
- Are involved in problem analyses and solutions, i.e. they believe that their knowledge matters.
- Understand how to carry out their job, and why.

Job demands that put pressure on employees are:

- When deadlines for delivery require speedy work processes
- When the work performance requires employees to remember many items, e.g. a long and fixed sequence of small operations necessary to produce the component
- When the employee has to produce a new component and this means that continuing routine actions are not possible. Unlearning has to take place and old habits have to be left behind
- When employees feel unable to meet job demands and expectations from managers
- When employees feel vulnerable in open discussions about production problems and improvements.

Management explains that introverted employees are often vulnerable, tending to keep worries to themselves. They prefer to discuss their experiences at work on a continuous basis with colleagues, their shop steward or their managers. Extrovert employees seem more at ease in the new working environment.

According to both management and employee representatives, many employees enjoy participating in Kaizen Events – especially in situations where new products are developed. This creates a stimulating environment where employees are asked to contribute new ideas, creativity and suggestions for improvements of the working process. Such conditions contribute to high job satisfaction.

Every year, HR examines job satisfaction among staff through a so-called ‘Radiometer Associative Survey’. The questionnaire addresses 18 themes related to job satisfaction such as employee involvement, engagement, and security. Data are quantitative. Respondents are informed that only honest feedback (answers) will help the company improve. Between 2004 and 2011 the weighted total score for employee satisfaction was between 3.5 and 4, where 4 signifies that employees have good job satisfaction. But from 2004 to 2005 – the transition year for DBS implementation – the satisfaction level dropped quite steeply before rising again, ending up in 2011 very close to 4.0.

With regard to working conditions, interviews with management and employees indicate that it can be hard and demanding to work in the U-cells. Some indications of stress reactions are observed such as a certain amount of absence due to sickness. However, management does not find this alarming as the overall picture of types and amount of sickness has not changed since the introduction of DBS.

One manager states that the DBS way of organising work in the production lines holds a definite advantage: The job of the individual employee is not to produce the ultimately simple part of the product, but to produce components that are more complex. Thus, the DBS organisation takes a first step towards preventing repetitive strain work and strained work that may imply stress and body pain. Yet the production of components may include such an amount of simple and repeated movements that the work pressure still exists.

Further arrangements are developed to reduce work pressure. Employees are invited to engage in a kind of job rotation in the U-cell. Job rotation may help to reduce strain, yet employees may experience that the jobs in the cell are quite similar. An important arrangement is the so-called JOB2. This possibility to move to a different kind of job within the company for a shorter period is highly valued by employees.

As regards repetitive strain work and workload, management and employees do not agree. Management expect that repetitive strain work will be reduced over time, and workload will not increase. Employees interviewed expect that both will increase.

With regard to work-related stress, it is important to note that changes in stress levels cannot be related solely to the DBS organisation of work. Stress may be caused by a combination of factors related to DBS, but also the demands of increasing effectiveness and productivity pursued by the company (8% every year) can also be a forceful stressor.

The company's business goal to increase effectiveness by 8% each year can put heavy pressure on its employees. However, management underline that this does not mean employees have to work harder. In interviews for the purposes of this case study, managers quoted the motto: 'work smarter not harder'. They insisted that the increased effectiveness (8% every year) will be achieved by working smarter; in other words, by continuous improvement in the production processes through Lean tools and employee involvement. However, many employees interviewed believe that their workload is becoming heavier.

When new products are developed, there is ample room for improving the product and the production process. This gives employees many opportunities to show creativity and to contribute to the innovation and improvements in the production. On the other hand, when the company is producing long-established equipment the potential for improving the working processes seems to be more limited. In this case, employees may experience a dramatic increase in work strain.

The DBS/Lean practice implies certain changes in terms of social relations. It involves reorganising work structure into U-cells and providing training at all workstations so that employees are able to rotate between and support each other in the different cells, and develop professional and social bonds and interdependence. Teams take collective pride in mastering their specific work activities, products, competencies and performance results. However, not all employees are comfortable with the exposure in daily management meetings and in Kaizen Events.

Both management and employees support social relations deemed essential to make people feel comfortable and productive on the job. However, according to employees, the feedback they receive about their work at daily management meetings is often too dominated by figures but with no clear explanation about what lies behind the figures and why they did not achieve their goals. Some employees state that colleagues keep as quiet as possible at these

meetings. They feel shy or even afraid of exposing their shortcomings in front of other employees. They are afraid of being blamed or being misunderstood by the manager in front of colleagues. The same mechanisms can be observed in relation to the presentation of results in Kaizen Events. Some managers might profit from further training in order to develop their leadership style and be able to question and evaluate employee views and feedback in a supportive and empathetic way.

Most employees at Radiometer have adopted the Radiometer values and the principles of working with DBS and, especially, with Kaizen Events. Management states that in cases where an idea, suggestion or decision is reached – e.g. at Kaizen Events – employees show enthusiasm, take ownership and commit themselves to implementing the decisions. Employees accept the process of continuous improvement of the company in the DBS way.

Creative behaviour is supported at Kaizen Events, and especially in situations in which a new product is introduced. This leaves room for ideas and solutions for improvement. In contrast, employees working in U-cells find that their daily work leaves no room for creativity. Rather, they have to wait for the next Kaizen Event in order to show their creativity and new ideas. This may cause some frustration. Employees may also find that a radical idea for improving the production process is not accepted, because it does not fit into the basic concept of the Lean organisation of work. Employees place a value and take pride in working in a precise and accurate way. Even so, in times of extreme pressure it may be hard to maintain the expected level of performance and to behave in accordance with the agreed values.

# Impact on the organisation

The impact of the innovation on the organisation is not simple and direct. Rather, it emerges as a result of the interplay between different macroeconomic factors such as the economic and financial situation, demands from the market, new regulations, state policies, etc., and the strategies of the company.

## Changes in number of staff employed

The number of employees has grown consistently over the past decade. In 2004, when Danaher took over, Radiometer had 1,559 employees globally and 816 in Denmark. In 2011, the figure globally was 2,300 and 942 in Denmark. There has been a movement from blue-collar to white-collar positions, so that the number of white-collar employees in Denmark is increasing whereas the number of blue-collar workers in Denmark has been declining by 5% a year over the past three years. A few blue-collar jobs in Denmark have been lost due to relocation to a production site in Poland, but the main driver for the flat development in blue-collar positions in Denmark has been increased productivity. The number of blue-collar workers in Denmark is expected to decline by 5% a year in the years to come, but the majority of the production will still remain in Denmark. According to the Senior manager, HR, the number of employees in sales companies has grown steadily as a consequence of the strategy of becoming more closely connected with the customers, and this trend is expected to continue.

In the period 2004–2012, in which the Lean implementation process took place, 50% of the existing staff at the company were replaced – a rather high staff turnover.

There is no clear evidence of the reasons for this high level of staff turnover. The reasons are likely to be a mixture of possibilities, individual preferences, new management style, new processes, roles and new demands that cannot be met. Staff unable to comply with DBS/Lean business system left the company. For some it was also the possibilities for new opportunities. Often major changes provoke some people to take important decisions they may have postponed, such as retirement, starting further education or changing profession. First of all the new ways of managing, the new ways of producing in a one-piece flow and the high demand for productivity were difficult and not very attractive for some of the old Radiometer employees. Secondly, the old team structure with its high degree of autonomy was threatened, and this had been a highly appreciated part of the job at Radiometer. Thirdly, there was a high demand in the labour market for the sort of skills that Radiometer employees have, so they found it very easy to find another job. Fourthly, the seniority in the company was very high and there were attractive possibilities for early retirement for people at 60 years.<sup>6</sup> The voluntary early retirement programme pays generous benefits between 60 and 65 to workers who have been members of the unemployment insurance system for more than 30 years. Finally, management was supportive to employees who wanted to undergo further training not only to take new positions within the company and its subsidiaries but also to qualify for their dream career or a new profession. This HR strategy will also ease the desired changes in the company without the need to dismiss employees.

## Changed company profile

The changes in products and services from 1984 to date have changed the overall profile of the company and the composition of its employees from a mainly manufacturing company with many skilled and semi-skilled workers and engineers, to one with a much more diverse staff profile and employees with different types of professional and academic training, such as IT engineers, humanists, clinicians, technicians, IT specialists, laboratory technicians, marketing and sales people.

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<sup>6</sup> <http://www.oecd.org/dataoecd/0/15/42565773.pdf>.



While the number of jobs for unskilled, semi-skilled and skilled workers are declining, the number of jobs requiring engineering and other academic degrees is growing. One employee interviewed noted that:

*‘The competences of the electronic technicians are on their way out – they can be bought cheaper elsewhere – every two technicians will be replaced by one engineer. The same is true for the metalworkers and the general workers. In the future general workers will have to develop their competences to be able to take over skilled workers’ jobs and skilled workers will have to develop their competences further to be able to hold jobs in manufacturing or elsewhere. The integration of several competences is important if we are to survive.’*

The qualification profile of the workforce in 2012 is shown in Table 2.<sup>7</sup>

Table 2: *Qualification profile of employees*

|     | Categories of staff  | ISCED category | Formal educational level (in years) |
|-----|--|----------------|-------------------------------------|
| 150 | Academics (engineers as the largest group and academics with a degree in arts, economics etc.) | 5–6            | 14–17                               |
| 90  | Laboratory technicians   | 4              | 13                                  |
| 50  | Clerical employees   | 3–4            | 10–13                               |
| 70  | Technicians (electronic, chemical, mechanical, software)                                       | 4              | 13                                  |
| 70  | Metal workers  | 3              | 10–13                               |
| 350 | General workers  | 2–3            | 9–12                                |
| 80  | Managers   | 3–6            | 10–20                               |

These changes have created an urgent need for a more systematic and continued education/training of employees and competence development, especially amongst the semi-skilled and skilled workers as well as technicians in the hope that they will be able to take over new jobs in the company or to find jobs elsewhere.

### Organisational performance: Turnover and market share<sup>8</sup>

There is a growing demand for Radiometer’s products and services worldwide in line with the increased need to improve efficiency and the quality of care in hospitals. The global demand for efficient hospitals delivering quality makes the hospital owners, administrators, clinicians and doctors very important users of Radiometer’s products and services.

In 2002, the company’s global market share of analysers amounted to 40%, and its market share in Denmark was 97% (figures for 2011 are not available).

Turnover rose from US\$150 million in 1999/2000 (DKK892 million) to US\$260 million in 2006/2007 (DKK 1,409 million) and nearly US\$496 million in 2010. This turnover is expected to grow by 10% a year in the coming years.

<sup>7</sup> For information about ISCED category in relation to the Danish education system, see <http://eng.uvm.dk/Education/Overview-of-the-Danish-Education-System>.

<sup>8</sup> Information based on Lotz, 2009, Radiometer’s Company Annual Reports 2004 to 2011 and the Radiometer website.

Ninety-six per cent of Radiometer's turnover comes from exports; 21% of the company's turnover comes from analysers, 63% from accessories, 9% from services and 7% from non-company produced products. Forty-one per cent of its products are sold on the European market, 25% in the US and 19% on the Japanese market (2002 figures, Lotz, 2009) (later figures are not available).

The company used 13% of its turnover in 2010 and 2011 for the development of measuring instruments and parameters in blood to be tested.

### New competences

In order to practise the DBS/Lean concept, new competences are required at all levels in the company:

**Personal competencies** are required. People with a 'competitive gene' are minded for continuous improvement in their work. Further 'readiness for change' and positive 'attitudes toward lifelong learning' and 'ongoing improvements' are important competencies.

**Language skills**, notably English, and literacy in Danish due to increased demands to Danish and English literacy, not least because employees must write, read and sign special journals. The need for competencies in understanding and speaking English for all employees comes from participation in Kaizen Events, where foreign Lean experts often visit the company to provide information on Lean problems and new expertise within Lean. Also the growing global orientation of the company and the recruitment of experts and managers from other countries calls for a higher skill level in English.

**Basic skills in maths** are needed to understand figures, columns, curves, etc., presented at the daily management meetings.

Besides these requirements, there is a growing need to possess academic and cultural competencies, for example in the fields of engineering, marketing or sales, due to the ever more complex and advanced technical equipment produced by the company and the services offered to hospitals in many different cultures.

Last but not least there is a huge demand for competences in using the different DBS tools and to take new roles in running the Kaizen Events.

In light of the challenges facing Radiometer, the management sees the ongoing training and education as a central part of its strategy and has launched an extensive training programme in its Company Annual Reports from 2009, 2010 and 2011. It is expected that this programme will help secure continued growth in future.

A considerable proportion of overall learning and competence development takes place in connection with the job, and it has long been an established practice for provision to be made for the employees' competence development and educational planning in the enterprises in the collective agreements between the social partners.

Radiometer's competence development model is based on Princeton University's concept of Adult Learning. This concept aims at developing employee competencies through on-the-job training (job enlargement and job mobility) (70%), coaching and feedback, visual management, daily management meetings (20%) and courses/training (10%).

All employees are ensured an individual plan for competence development related to the company's requirements for the year.

Training in Danish, English, Mathematics, Problem solving, etc., takes place at Radiometer and is much appreciated by the employees, especially those who have negative experiences from their own school days. According to both managers and employees, it saves time when training can take place at work, and it is also better if the training occurs in a well-known setting together with colleagues one knows.

The training through Kaizen Events (approximately 100 a year) and the training in using the DBS tool is a totally integrated part of the daily work processes and a part of the overall strategy to focus on ongoing improvements. On-the-job-training can take place through job enlargement and job change. Coaching and feedback on achievements are assured through visual management, daily management meetings, mentor programme and other meetings.

### Impact on HR practices

Increased focus on international cooperation and globalisation imply new roles for the HR staff and new practices. The employees in the HR department have traditionally had the role of specialist, but the management would like to change this role to one of a generalist. Every staff person has to be competent within a broader field of HR responsibilities. This is to prevent vulnerability in the HR department; if one person is absent for a period, colleagues can take over.

The HR partners – as employees in the HR department are called – are in the process of changing their roles from taking care of all HR-related activities and responsibilities including personal matters at all levels, to be more internationally focused and to primarily take care of more strategic and political HR issues, training, recruitment and to be advisors and 'coaches' for the managers. It is the managers who hold responsibility for the well-being, training, productivity, etc., of the individual employees in their department or unit.

### Innovation in products and services

Innovations are created through a dual structure. Firstly there is a **top-down structure** where R&D-based innovations are created in the high-tech field. R&D-based innovations cost 13% of the yearly turnover and it is planned to continue spending on this level on innovations expanding the range of parameters in the blood to be measured/tested. Immunoassay testing for cardiac, coagulation, infection and pregnancy markers is in particular focus. Further speed and accuracy in the testing are continuously an option. A new generation of blood gas analyser was introduced in 2010 – the ABL90. It is expected to have a huge potential. Within 35 seconds after a single drop of blood is dropped into the device doctors can get the answers needed for the diagnosis and treatment of an acute patient.

Finally the company continues to develop the equipment to be as user-friendly as possible.

The second structure is a **bottom-up structure** where employees participating in Kaizen Events and daily management meetings are involved in finding new solutions to problems in the production process and creating new ideas for improvement in the production process. The Lean model, in this way, offers possibilities for employee-driven innovation (Høyrup et al, 2012) in cooperation with management and within the given Lean structure. The two structures co-exist and contribute to the total system of innovation in the company: R&D-driven innovation and employee-driven innovation.

New innovative initiatives are taken by the company in relation to customers and services to meet their needs to optimise the patient flow. The high-tech products from Radiometer to be adapted and used in a hospital context need both training and technical services. But to use the Radiometer equipment correctly and efficiently, the hospital ward, the emergency departments, operating rooms and intensive care units have to be efficiently organised. This has led to a new area of innovation for Radiometer: consultation and collaboration with hospital staff to develop the hospital department or unit's way of organising the work processes so that the hospital can gain the maximum benefit from the Radiometer equipment.

By working in close collaboration with hospital staff, Radiometer not only identify and address immediate technical problems and challenges, but may also identify issues and opportunities for further development of Radiometer's products as well as services to meet the needs for analysing and training of the hospital staff to optimise the patient flow.

### Unanticipated consequences

According to management, the essence of DBS/Lean is the very highly structured work it requires. Management has considerable faith in DBS and Kaizen. The results in productivity are also convincing. According to CEO Peter Kürstein, 'we have eliminated waiting times, product waste, transport and utilised unused creativity' (*Jyllandsposten*, 2012).

In the field of innovation, empirical research and theories of innovation emphasise the work place as being a very productive place for releasing creativity, supporting application of problem solving skills and application of special practical knowledge of the employees. Such a place is often found in informal networks and relations. Furthermore, we find it in forms of work organisation which offer a lot of autonomy to employees in terms of how they perform their job, with whom they have to cooperate, when they have to do so, etc. Job descriptions are broad and open to personal interpretation, and variations in job performance are seen as incentives for innovative processes at work.

The Lean concept certainly appears to be quite opposite to this thinking of creating discretion at work. The very high structure of work inherent in the Lean thinking and its emphasis on making things exactly in the same and prescribed way, and the subsequent relative high degree of control of work, seems to exclude discretion at work. Consequently the company cannot exploit innovative resources embedded in the informal networks and informal relationships in human side of the enterprise.

The part of the Lean system that comes closest to this 'discretion at work' is Kaizen Events and daily management meetings taking place shortly after a new product is introduced. In this situation, there exists a space for creative ideas in terms of improvement of the production process. When the production process has been in operation and improved for several years, the space for creativity of employees seems to be strongly reduced.

# Lessons learnt and future plans

According to both management and employee representatives, DBS/Lean has proved an effective means of increasing productivity. Turnover is increasing steadily as organisational performance improves.

Management and employees emphasised in interviews that in the process of implementation, it is important that managers are very visible and strongly engaged in the processes. Management has to be convinced by and deeply committed to the concept.

The changes in work organisation include a broad range of interrelated aspects of the total organisation. The transformation of the entire organisation takes a very long time, and in fact, it is a journey that never really stops. The transformation process (innovation process) requires new roles, new work practices and new competencies for both employees and managers.

To support the change process, it is important that management is committed to the role as change master and feels responsibility to train DBS/Lean at all levels and in every corner of the organisation.

The process of change needs thoroughly support by education/training for both employees and managers. Managers certainly have to learn not only to manage but how to take up new leadership roles and adopt new leadership styles to support the continuing improvement process of the organisation, support and listen to employees with empathy and contribute to the improvement of their working conditions and processes including training.

The social dialogue and the involvement of employees and their representatives at all levels are a prerequisite to obtain the necessary understanding, trust and support to ensure successful implementation of organisational innovations.

Future plans include efforts to improve competence development of unskilled/semi-skilled employees and to improve the cooperation with the public educational institutions, especially those offering vocational training.

New advanced technological innovations are planned. The goal is to expand the number of parameters in the blood measured by the equipment.

Future plans also include the expansion of activities on the global scene, to open up new markets, to benefit from an increased cooperation between the company's international partners, and to forge closer and more extensive customer relationships. This implies both an increased sensitivity to customer needs and experience in using the equipment. Further consultancy will be offered to help hospitals develop their work organisation in order to optimise the benefits of using Radiometer equipment.

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