



## **INTERVENTION FRAMEWORK TO SUPPORT EMPLOYEE-DRIVEN INNOVATION BETWEEN R&D AND MANUFACTURING DEPARTMENT**

C. S. Jensen, A. R. V. Jensen and O. Broberg

*Keywords: employee-driven innovation, intervention framework, participatory design, design workshops*

### **1. Introduction**

This paper is exploring the area of employee-driven innovation (EDI) and describes how we in our research project have developed and tested a framework for initiating employee participation between R&D and manufacturing department. EDI refers to the generation and implementation of significant new ideas, products and processes originating from employees who are not assigned to this task [Kesting and Ulhøi 2010]. EDI is not a well-documented field of research in the general innovation literature [Sørensen and Wandahl 2012], and there is limited descriptions about how EDI is initiated and supported in product innovation. This paper aims at bridging the gap by presenting a novel and state of art intervention framework to initiate employee-driven initiatives and accommodate the need to demonstrate how EDI can be applied in future product development processes. The framework is unique in the sense that it delivers a pragmatic approach to research and business practitioners promoting EDI. The intervention framework is developed as a part of a research project study called “Employee involvement in product innovation” at the Technical University of Denmark, and is currently being tested in an on-going study to further validate the framework.

Innovation capabilities are today a key imperative in order to survive in the ever growing competitive landscape in both public and private organizations [Gressgård et al. 2014]. Being widely adopted in the Scandinavian countries, the notion of employee involvement is considered a way for organizations to achieve the responsiveness needed in a hypercompetitive world [Riordan et al. 2005]. As workplaces become more complex and employees increasingly demand more satisfying jobs, employee involvement becomes a way for companies to attract and retain the best human talents [Kesting and Ulhøi 2010]. It is argued that companies should not restrict themselves to relying exclusively on R&D employees, but also recognize that manufacturing employees possess abilities for innovation [Høyrup 2010]. Several other theories, such as high-involvement innovation share the conviction that innovation is a team-discipline and rely on participation and involvement of people outside R&D [Bessant and Caffyn 1997]. The underlying assumption of EDI is that all employees have hidden innovative potential that can be made visible, recognized and exploited to the benefit of both the company and its employees [Kesting and Ulhøi 2010]. Innovation is originally defined as “novelty creating economic value” by Schumpeter in 1934, but in terms of EDI and workspace learning, other values could mean employability, welfare in working life, learning culture and innovation [Høyrup 2010]. Some of the benefits of turning towards EDI thinking can be described as:

- Higher levels of employee involvement are positively associated with increased financial performance of a company [Riordan et al. 2005].

- Increased employee autonomy has positive impacts on employee satisfaction and retainment of good employees [Kesting and Ulhøi 2010]. Happy and satisfied employees are more productive and have fewer sick days [LO 2008].
- Increased focus on radical innovation. Compared to user-driven innovation, EDI can breed more radical innovative thinking, where user-driven innovation tends to focus on sub-optimization and incremental design changes [Kesting and Ulhøi 2010].
- Involving employees improve collaboration and knowledge sharing to optimise processes and product development. It is considered a key success factor in complex environments where networking, fast renewal and innovation are central competitive factors [Alasoini et al. 2013].
- It can generate a flow of additional information and tacit knowledge from employees to point out opportunities that management cannot [Kesting and Ulhøi 2010].

With a long list of known benefits from EDI, one might wonder why it is not implemented everywhere? The list of EDI obstacles includes [Sørensen and Wandahl 2012]:

- No incentives or motivation to engage in development and innovation activities
- Management focus is on production tasks, hence no management support
- No systematic approach to facilitate idea generation and knowledge-sharing
- Organisational culture
- Development and innovation are based on few individuals

The company culture is one of the main barriers, and supports the management truism; that "culture eats strategy for breakfast". The formality of the R&D organisational structure becomes a limitation when trying to make organisational changes to support the product development process. Well knowing that the innovative capabilities of a company is also determined by a complex set of different aspects such as the culture and mind-set of the employees in all levels of the organization [Sørensen and Wandahl 2012], this project investigates how to initiate an organisational change to support the ideation of employee participation in two case companies. The overall purpose of this paper is to present, develop and test participatory methods for initiating employee-driven innovation across R&D and manufacturing employees.

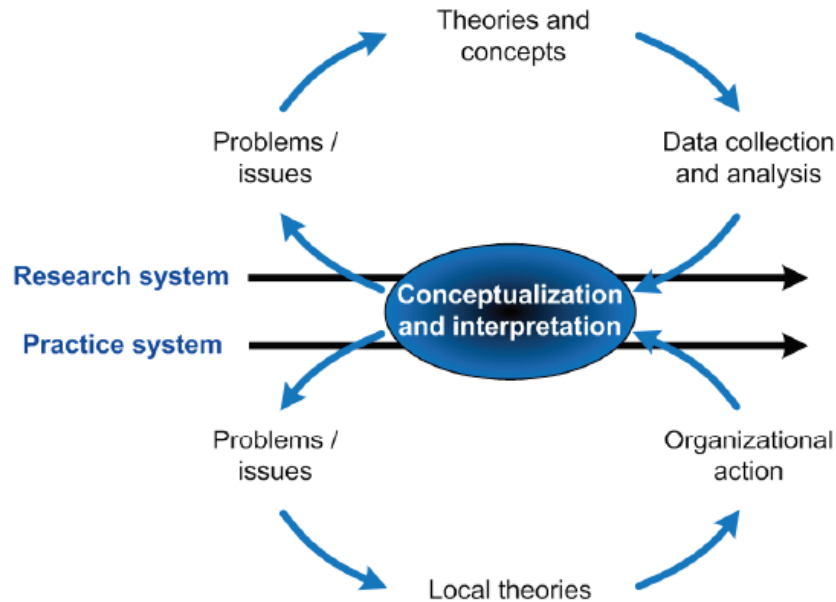
## 2. Methods

### Case company description

The case company is an international industrial manufacturer of pumps and valves with around 600 employees. The company is highly organised and uses a much formalised stage-gate development model. The company was very cooperative and had an interest in improving the communication across departments, as they felt too divided into siloes. They even formed a project group assigned to assist the execution and implementation of the project. A criterion for choosing the company was that both a R&D and manufacturing department was present at the same facility. The selection of the case company was information-oriented [Flyvbjerg 2006] with the aim of maximising the utility of information from single cases.

### Intervention methodology

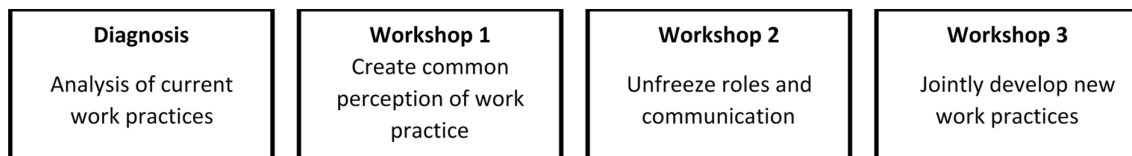
In our study we have chosen to use two manufacturing case companies of which one is informing this paper and the other is ongoing. We employ a qualitative research method with semi-structured interviews to ensure in-depth investigation. The overall research approach has been interactive [Eklund et al. 2008], where research is being conducted in parallel with practical problem solving actions within a collaborative practice system, as seen in Figure 1. In this case the researchers and the case-company being two different systems with different interests are collaborating in alignment; the focus of the practise system was to improve participation and collaboration between two departments, where the focus of the research system has been to develop and test how the intervention framework could be used to initiate employee participation and organisational change. The method allows for investigation and interpretation of issues that both systems find valuable, and can lead to new issues of joint interest.



**Figure 1. The CMTO model of interactive research [Eklund et al. 2008]**

The nature of the interactive research approach was very iterative and explorative with constant new insights and decisions that were made as the project progressed. We as researchers then got the opportunity to experiment with different methods in practise, to see how well they could be used to stage the wanted intervention.

The interaction with the case-company has followed four intervention phases; an initial company diagnosis followed by three participatory workshops, as seen in Figure 2.



**Figure 2. The intervention framework structured with three collaborative workshops [Broberg et al. 2015]**

To stage the intervention, three collaborative workshops were arranged with eight employees from both R&D and manufacturing department, sixteen in all. At the workshops, the participants were divided into two mixed groups and given a specific task or challenge. The workshops were designed to actively involve the employees through participatory design-games and prototyping sessions. The design games have been developed specifically to this project, but are generic, and can be applied to other cases. The aim of the three workshops was to share an understanding of the current work and to facilitate the development of organisational measures necessary in order to make organisational changes and initiate employee participation initiatives.

### Company diagnosis

An initial diagnosis was made to understand the current level of communication and collaboration between the R&D and manufacturing department. In order to collect both qualitative and quantitative data, the diagnosis included a survey with forty-seven respondents and eighteen semi-structured interviews that created the foundation that could later be used as reference to future progress. Ten semi-structured interviews with R&D employees and eight interviews with manufacturing employees provided the initial qualitative data in the project. The interviews followed a specific interview guide,

with topics such as what drivers and barriers exist today, and proposals for ideas to improve employee involvement. Even though an interview guide was used, the interviewers were allowed to stray off topic to allow new findings to emerge. All interviews were voice recorded and documented for further analysis. The data analysis was inductive and allowed for categories to emerge from the interviews, such as what barriers and drivers were mentioned. The purpose of the diagnosis was to collect contextual information about the current work practice and processes as a basis for developing the intervention plan and workshop methods.

### Workshop 1

The primary goal of the first workshop was to test if two design games could facilitate the emergence of a common perception of current relations between R&D and manufacturing department. Design games are useful for staging explorative design dialogue [Brandt et al. 2008], and two design games were developed and used to create a communicative landscape and identify what challenges they experience in their daily practice, as seen in Figure 3. With physical board pieces and rules, the format of the game was designed to not favour any of the participants, but to allow for conversation and discussion. One of the rules included that the participants should not distinguish between "us" and "them", to emphasise that they were one team with a common goal. The workshop was designed to bring people from two different departments together and letting them get to know each other. The first board game used coloured cardboard pieces to indicate how they communicate across the three departments; R&D, manufacturing and engineering department.



**Figure 3. Design games were used to facilitate the emergence of common perceptions. The first game (left) focused on communication between departments and the second game (right) focused on the needs and contributions in the different stages in the development process**

The second game was a game that illustrated the stage gate model of the case company. With this game we wanted the players to understand and discuss the actual development process and how knowledge, competencies and information from the manufacturing department is needed in different stages of the development process. With coloured game pieces the stages of the development process was illustrated and the players used post-it's to identify needs for information, development activities, and involvement of manufacture department in each stage.

### Workshop 2

The goal of the second workshop was to test if prototyping activities could contribute to unfreeze roles and communication between R&D and manufacturing department. To get the participants in the right mind-set, a professional facilitator of rapid prototyping was hired to encourage creativity with specific rules and circumstances. For example the participants were asked to create the worst possible ideas, to emphasise that no matter how bad an idea was, it was still accepted. As seen in Figure 4, many different materials were available during the prototyping sessions, such as cardboard, yarn, tape, foam, glue etc.



**Figure 4. The second workshop was centred on prototyping with different materials**

With different materials, they were tasked to create twenty prototypes in one hour. The prototypes were related to existing products. The reason for choosing prototyping was to allow for creativity in a format that the production workers were familiar with and also to illustrate the difference in how knowledge is understood and communicated. The workshop was held inside a showroom with different tools, to illustrate the importance of creativity and crafting prototypes. The different solutions were presented and evaluated by all the participants. And finally we had a brief evaluation of the workshop and their experience of being creative and innovative together in a collaborating effort.

### **Workshop 3**

The goal of the third workshop was to test if a collaborative task, to create an action plan could initiate and support organisational change. Evaluating and reflecting on the outcome from the previous workshops and using the concrete results from the workshops, the third and final workshop was developed. The participants were divided into two groups who both received an empty action plan table with goals, means and resources. The action plan was for them to determine what future goals they wanted to strive for and by which means and actions they thought it could be possible.

The ideas for collaboration from workshop 1 were condensed into goals and means in two categories of organisational structure and processes. The goals and means were placed on separate boards and on each game piece. The first task in the design game was to formulate an overall goal based on a discussion, evaluation, and selection of the goal boards and pieces. After formulating the overall goal, the participants were supposed to discuss, evaluate, and select the means for which the goal would be obtained. A table divided with goal, means, and actions (Figure 5) was then filled by the selected pieces describing how the involvement of manufacturing employees in product development processes and the collaboration between R&D and manufacturing could be improved and who should be responsible for implementing the new initiatives.



**Figure 5. The third workshop was about creation new work practices by filling out an action plan**

### 3. Results

#### Results from the diagnosis

From the initial survey and semi-structured interview analysis, we identified several organisational barriers that prevented effective communication between R&D and manufacturing. The overall R&D processes were highly formalised, and no procedures for employee participation existed. From the interviews it was found that a third department, called engineering was prominent in the design process, which led us to include them in the first design game. The development departments were divided into siloes, with very specific gates, goals and KPI's, which sometimes complicated work practices across organisational borders. The KPI's were sub-optimising some areas, but was conflicting and not aligned with the overall strategy of the company. Another significant barrier was the different work cultures between the manufacturing workers and engineers from R&D. There was a clear division of employees, which could be noticed by the way they referred to each other. The R&D employees worked in "carpet country", because they have carpet on the floors. In contrast was the manufacturing workers called "blue collar" workers and they were having "pallet meetings". The highly formulated development structure is limiting the ease of participation across borders. Aside from the abovementioned barriers, the participants were very enthusiastic and shared the vision of improving the communication across the different departments.

#### Workshop 1

The first workshop used design games as a participatory approach to create common perception of the current work practices and improve social dynamics in the group. Based on the high engagement level and amount of multi-coloured game-pieces on the table, the games did a good work facilitating conversation and share the current communicative barriers and challenges. The game objects allowed visualisation of communication, and made tacit knowledge explicit for interpretation. The game was designed to allow communication without articulation, as many of the production workers are not

familiar with complex reflection of their communication workflow. In this context, the design game makes new sense to what, how and why [Bogers and Sproedt 2012], which makes it ideal in the first workshop to create common perception of the current work practices.

Based on the identified challenges, the participants generated sixty topics from the two games; twenty-three ideas, thirteen barriers and fourteen general topics. One of the ideas was called "find you colleague" was an exercise chosen to be adopted in the period after the first workshop. The exercise emphasized the short distance between the departments, and that knowledge can, and should be, easily distributed between R&D and manufacturing.

## **Workshop 2**

The goal of the second workshop was to test if prototyping activities could contribute to unfreeze roles and communication between the participants. The participants were clearly more engaged with each other, and had fun while developing ideas. The second workshop had a teambuilding effect, and the participants became better at working together across professions, and even learned from each other. It was found that the prejudice that R&D experts are best at creating ideas was put to shame, since the production workers was better at creating prototypes under strict time pressure. The R&D manager said that "I was struck by my own prejudices when we "engineers" was busy making the models look like something, where others just created models quickly." The R&D employees were too focused on the design, and that the ideas had to look good. In contrast, the production workers did not care about the design, but in the functionality. The prototype activities actually changed the view on roles and how creativity was distributed among R&D and manufacturing.

## **Workshop 3 – Evaluation and implementation**

Workshop three was centred on creating and developing an action plan, based on the findings identified on the previous workshops. The two groups presented their action plans to each other and a final action plan was developed, negotiated and adopted. In the third workshop, the participants were working more independently and had to perform in a team across different disciplines to reach common goals. The predetermined table created the boundaries, and caused the discussion to stay on the natural topics in the table. The post-its allowed for an experimental approach, where things could be adjusted during the workshop, until the final version was accepted.

With the finalisation of the action plan and the workshop programme, the participants had the responsibility of implementing the changes and continue to work towards better exchange of competencies and knowledge across siloes. It was decided to present the results to the company management, to get their acceptance and approval to make the necessary arrangements to proceed and execute the actions in the action plan. Among the solutions to improve future communication between R&D and manufacturing, one proposal was the development of a Service Level Agreement (SLA) that followed each project and described how and when employees from manufacturing should be included actively in the development process. In the aftermath of the workshop intervention, a designated project group have been responsible for implementing the SLA in the future.

The results from the intervention workshops is evidence that people from R&D and manufacturing can get clarification, alignment and build new work practices that support an EDI approach. The R&D manager said the following after the workshops: "I see the outcome of the workshops as a door opener to reach the goals we want to achieve", which points to the intervention framework as a tool to initiating a cultural change and support EDI. He further emphasised that "it is not about methods, but about a cultural change. The sole purpose of these methods is to facilitate and maintain the cultural change in our mind-set. If we already had the mind-set we would not need of all these methods."

The statements are a representation of how the practice-system perceives the methods, which indicates the diversity in the views of the research system and the practice system.

## **4. Discussion**

The intervention framework was designed to support EDI initiatives between R&D and manufacturing departments. Based on the findings from the workshop, the methods used may be appropriate to facilitate the wanted effects; common perception, unfreeze roles and create new practices. The design games

made tacit knowledge explicit with the game pieces accommodating the barrier of complex communication, and allowed the manufacturing workers to participate and contribute to map the current work practices. The rapid prototyping activities facilitated a learning environment, where the roles and competencies was exploited and revealed. It was found that new roles emerged and old prejudices were put to shame when the manufacturing employees were better at creating prototypes than R&D employees. The development of the action plan enabled the group of employees to work jointly towards new work practices with increased involvement between R&D and manufacturing. The action plan did, as expected, not include breakthrough innovative ideas, but instead realistic simple incremental organisational changes that can prove to be the first steps on the road to successful EDI.

### **Future challenges in EDI**

In this project, the case company have shown some characteristics that can have a negative effect towards implementing an EDI climate, such as the high formality product development processes and internal KPI's towards productivity. The company size and global organisational structure makes it more difficult to make sudden cultural changes. Based on the findings and action plans developed at the workshops, the company were to evaluate and implement the wanted changes. Implementation and organizational rooting is by all means the most important and difficult phase, because it requires execution and sustained development. This phase was the least controlled phase, since the outcome was determined by the employees themselves and depended on approval from management. A fundamental dilemma in EDI is the fact that the decision authority lies with a small number of specific functions and managers. The vast majority of the employees in the organisation are not involved [Kesting and Uihøi 2010]. Another dilemma in adopting EDI is managing the employee's incentives to contribute to innovation [Sørensen and Wandahl 2012]. If people are stuck in old ways of working, this exclude being involved and participate in product development, this is why engagement and commitment from management is crucial.

### **Comparing with other EDI methods**

When the intervention framework is compared to other methods and frameworks that support EDI, there are clear similarities. The structure of having three workshops in the intervention model is comparative with the three phases: Ideation, innovating and value creation presented in Liideri's conceptual framework for promoting employee-driven innovation [Alasoini et al. 2013]. The three steps in the framework are viewed as communal processes inside the organisation, and rely on management principles to impact operational performance and improvement [Alasoini et al. 2013]. The layout of the innovation framework is tailored to a professional setting with limited amount of people and time taken off the schedule between operations. The framework was tailored for a small group of participants from different departments, which is why group-dynamics, and team performance is also an important factor when designing the framework. The intervention actually resembles Tuckman's [1977] acclaimed "forming, storming, norming and performing" stages of small-group development, and it is clear that the workshops improve the social dynamics and making them able to perform aligned and in collaboration by the end of workshop 3.

### **Limitations to this study**

There are some clear limitations to this study as a result of only having tested the method in one case-company, making it a stand-alone example. This project is very context dependent, making it less generic for other appliances. The fact that EDI is incredible difficult to measure, and rely mostly on quantitative data, makes it almost impossible to justify the outcomes of an EDI. The decision of turning towards EDI is a long-term process and can be described as a journey, more than a destination as it is the case with high-involvement innovation [Bessant and Caffyn 1997]. The validity of this study also depends on the chosen case-company and the circumstances thereof. The intervention framework is not a definitive EDI tool, and there are numerous of other means to achieve EDI.



## Future work and learnings

We are currently repeating the workshop programme in collaboration with a second manufacturing company, in order to collect comparable data. We have already encountered structural challenges to the workshops, as they need to be adopted and tailored to the specific company. The initial case company diagnosis has proven more important than originally planned, since it is the foundation for structuring the workshops individually. The next activities include further data collection and test of the framework in a second case-company. The second case-company is quite different in size and structure, which introduces new challenges and possibilities for using the intervention framework. For example is the second company less structured and has no formal stage-gate development model. This paper investigates how the innovation framework can initiate a cultural change and support EDI mind-set, but further investigation is necessary to further verify the results of using the intervention framework.

## 5. Conclusion

This paper describes how an intervention framework can be utilised to support EDI initiatives between R&D and manufacturing department. The intervention has included three participatory workshops that a) create an emergence of a common perception of work practices, b) unfreeze roles and competencies among employees and c) facilitate creation of an action plan for future work practices that supports EDI. With the goal of improving the collaboration across departments, the employees have jointly developed an action plan with the means to improve communication and knowledge sharing between R&D and manufacturing department. The four-stage intervention framework has proven really useful in this case, and has the potential to become a research tool to stage EDI initiatives in small groups and neighbouring departments. This study is limited by being a single-case, which is why a second case-company is currently being investigated using same intervention framework structure and methods. This paper describes the development and test of the intervention framework for supporting EDI and concludes that the framework and methods presented in this paper have the potential to stage EDI initiatives between R&D and manufacturing department.

## References

- Alasoini, T., et al., "Rethinking Employee Contribution: a Framework for Promoting Employee-Driven Innovation", 2013, pp. 10-14.
- Bessant, J., Caffyn, S., "High-involvement innovation through continuous improvement", *Int. J. Technology Management*, Vol.14, No.1, 1997, pp. 8-13.
- Bogers, M., Sproedt, H., "Playful Collaboration (or Not): Using a Game to Grasp the Social Dynamics of Open Innovation in Innovation and Business Education", *J. of Teaching in International Business*, 23:2, 2012, p. 78.
- Brandt, E., Messeter, J., Binder, T., "Formatting design dialogues – games and participation", *CoDesign: International Journal of CoCreation in Design and the Arts*, 4:1, 2008, p. 54.
- Broberg, O., et al., "Employee participation in product innovation: Crossing organizational boundaries by alignment of work systems", *Proceedings 19th Triennial Congress of the IEA*, 2015, pp. 1-2.
- Eklund, J., et al., "Interactive research for production and work development", *Division of ergonomics, Royal institute of Technology, Huddinge, Sweden*, 2008, pp. 1-2.
- Flyvbjerg, B., "Five misunderstandings about case-study research", *Qualitative Inquiry*, Vol.12, No.2, 2006, pp. 219-245.
- Gressgård, L. J., et al., "Use of information and communication technology to support employee-driven innovation in organisations: a knowledge management perspective", *Journal of Knowledge Management*, Vol.18, No.4, 2014, p. 633.
- Kesting, P., Ulhøi, J., "Employee-driven innovation: Extending the license to foster innovation", *Management Decision*, Vol.48, No.1, 2010, p. 66.
- LO, "Employee-driven innovation, Improving economic performance and job satisfaction", *Published by the danish confederation of trade unions*, p. 8.
- Riordan, C. M., et al., "Employee Involvement climate and organizational effectiveness", *Human Resource Management, Wiley Periodicals, Inc. Vol.44, No.4*, 2005, p. 471.
- Sørensen, H., Wandahl, S., "Drivers and obstacles for employee driven innovation in large client project organisations", *RICS COBRA conference, Las Vegas, Nevada, USA*, 2012, pp. 338-342.

*Høyrup, S., "Employee-driven innovation and workspace learning: basic concepts, approaches and themes", ETUI Transfer 16(2), 2010, pp. 143-144.*

*Tuckman, B. W., Jensen, M. A. C., "Stages of small-group development revised", Group and Organizational Studies, 2(4), 1997, pp. 419-427.*

Christian Schou Jensen, Research Assistant  
Technical University of Denmark, Engineering Systems Group  
Kurlandsgade 21 2.th, 2300 Copenhagen, Denmark  
Email: chsje@dtu.dk