IMPLEMENTATION OF R&D MANAGEMENT MODELS IN GLOBAL ORGANISATIONS

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Abstract

This paper addresses implementation of R&D management models in global product development organisations. The study rests upon empirical material originating from five industrial companies that was collected via workshops and interviews. A number of enablers for and barriers to implementation of R&D management models have been identified. The study adds to the current theory on how companies with global organisations can ensure that the R&D management model is implemented throughout the entire organisation. In addition, the practical value refers to that the identified enablers and barriers support companies in their strive towards better adherence to the R&D management models in product development projects.

Keywords: Design management, Design process, New product development, Project management

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1 INTRODUCTION

The development of new products is a crucial activity for industrial companies (van Oorschot et al, 2012). If they fail to provide a continuous stream of newly developed products to the market, their competitiveness will be endangered. Factors contributing to product development efficiency and effectiveness have therefore attracted much attention among academics and practitioners. Literature offers a number of best-practice frameworks for product development. These frameworks include various factors that are assumed to support product development success. For example, based on a review of prior product development research Brown and Eisenhardt (1995) list factors that affect the potential to drive a product development project towards success: team composition, team organisation of work, team group process, project leadership, senior management, customer and supplier involvement. Cooper et al. (2004, a,b,c) also list a number of factors that are expected to ensure product development success. These factors refer to strategy, portfolio management, resource allocation, culture, teams, senior management, disciplined processes, etc. Kahn et al. (2006) outline a framework for best-practice product development that includes the following factors: development strategy, portfolio management, disciplined processes, market research, people/organisation, metrics and performance evaluation. This framework has been further developed and presented in a slightly modified version where the following factors are addressed (Kahn et al, 2012): development strategy, disciplined processes, culture, project climate, research, metrics, and commercialisation. For each of these factors some best and poor practices are identified.

A common denominator among the frameworks is that the use of a systematic and disciplined development process is supposed to lead to product development success. Cooper and Edgett (2012, p.43) maintain: *"a recurring best-practice theme is the use of some form of gating process"*. In literature as well as in practice, this type of product development process is often displayed in R&D management models which describe a stage-gate process that shows a principle workflow consisting of activities carried out in a few stages. The stages are separated by gates where decisions are taken regarding whether or not the next stage should be entered and the project continued. Although there is an extensive amount of literature that argues for the application of disciplined product development processes, many scholars are quite vague regarding whether the R&D management models are descriptions of an actual product development process, or prescription of how to run a product development project, or if the models serve both these purposes. Furthermore, literature is imprecise regarding whether R&D management models are process models or project models, or both. For reasons of simplicity and as literature displays inconsistency regarding the terminology, this paper uses the term 'R&D management models' as an all-encompassing term referring to both descriptive and normative process and project models.

As many companies nowadays are becoming global organisations, product development is often carried out in different geographic regions and in distributed settings. *"These global engineering operations have led to new challenges, e.g. physical and cultural, and organisational, mainly due to the distance between teams and engineering operations"* (Hansen and Ahmed-Kristensen, 2012 p. 2005). Implementation of disciplined development processes, as described in the R&D management models, might serve as an instrument to streamline product development. However, due to differences in language and culture, for example, it might be challenging to ensure that the entire product development organisation adhere to a common model. Moreover, despite literature provides convincing evidence that the use of disciplined processes often lead to favourable product development results, scarce guidance is provided regarding implementation of the R&D management models in practice. This is especially true for organisations that carry out product development in different countries. Global organisations that face differences in language, culture, time zones, etc. may find the implementation of R&D management models particularly challenging. The research question raised in this paper is therefore: *Which are the enablers for and barriers to implementation of the R&D management model throughout the global R&D organisation?*

The remainder of the paper is structured as follows. Next, the research method is presented. The following section presents the literature exposition. Then the empirical findings are presented regarding implementation of R&D management models. Finally, the paper ends with a discussion and

concluding remarks, including theoretical and managerial implications from the study as well as ideas for further research.

2 RESEARCH METHOD

This paper is a result of the research project 'Use of project models for efficient and effective product innovation in global industrial companies (ProGlo)', financed by VINNOVA - the Swedish Governmental Agency for Innovation Systems. The project involved five manufacturing companies purposely selected to represent different types of industry segments (see table 1 for an overview).

Table 1. Overview of studied companies

Company A	**Company B**	**Company C**	**Company D**	**Company E**
Producer of a wide variety of products for outdoor use	Producer of components and systems for cars and heavy vehicles	Producer of products for offices as well as building and construction	Producer of products, services and solutions for military defence and civil security	Producer of technology, solutions and services for the Intelligent Transportation Systems (ITS) market

All companies have global product development organisations and carry out product development in different geographic regions. The study specifically focused on the companies' experiences of implementing their R&D management models globally. The research involved three complementary methods. The primary method was interactive workshops. Two full-day workshop sessions were carried out where representatives from the companies participated to discuss potentials and problems to implement the companies' R&D management models in their global organisations. The representatives have different positions in their companies, such as global R&D product development process manager, R&D manager, project leader, quality manager, etc. All representatives had an interest in or were affected by the company's R&D management model. In total, 22 persons participated in the workshops. The workshops were guided by some predefined questions where the company representatives, organized in three mixed groups, discussed and presented their experiences and views on aspects related to implementation of R&D management models in global organisations.

Each group was observed by a researcher who constantly took notes from the discussions. The groups also summarized the outcome from the discussions in a number of post-it notes and presented their findings to the other groups. The researchers took notes during the presentations and collected the post-it notes for further analysis. As a complement to the workshops, in-depth interviews were carried out with five individuals from three of the companies. These individuals were chosen as they had considerable experiences of the R&D model and how it was used globally. An interview guide was used during the open-ended, semi-structured interviews. The guide covered the following areas: background of the interviewee, the R&D model and its value, acceptance and adherence to the model in the global organisation, teaching and implementation of the model. All interview were audio recorded.

A literature review was performed in parallel to the workshops and interviews. The review addressed publications in major Technology Innovation Management journals, as specified by Linton (2007). The list of journals from which articles were derived *included Journal of Product Innovation Management, R&D Management, Research-Technology Management, Technovation*, among others. Data analysis followed the three-phase procedure suggested by Miles and Huberman (1994): data reduction, data display, and drawing conclusions and verification. In the first phase, information on the post-it notes from the workshops were organised into a matrix. Notes taken during the workshops were condensed and added into the matrix. The audio recorded interviews were transcribed. In the second phase, the information in the matrix and the transcribed interviews were penetrated and key enablers and barriers were derived for implementation of R&D management models. In the third phase, the empirically identified key enablers and barriers were compared and contrasted with literature.

3 LITERATURE EXPOSITION

R&D management models displaying stage-gate product development processes have had a big impact on industry and are widely implemented (Ettlie and Elsenbach, 2007). According to Cooper (2008, p. 214), *"a Stage-Gate process is a conceptual and operational map for moving new product projects from idea to launch and beyond - a blueprint for managing the new product development (NPD) process to improve effectiveness and efficiency"*. Scholars seem to agree that adherence to a shared model of the process contribute to product development success (Cooper 1994; Unger and Eppinger, 2009), even though the value of R&D management models that display a stage-gate process is sometimes questioned (e.g. Eisenhardt and Tabrizi, 1995). Arguments raised against the stage-gate process refer to their inflexibility and poor support for narrow iterations where feedback from following stages are needed (Unger and Eppinger, 2009). However, later versions of the stage-gate processes are more flexible and adaptable (Cooper, 2008; 2014).

An advantage of using R&D management models mentioned by Hansen and Ahmed-Kristenesen (2011) is that the product development process becomes explicit and visible to those involved in product development. Ettlie and Elsenbach (2007) findings from a study of the automotive industry showed that nearly 50% of the companies used a stage-gate process and that 60% of the new products were commercially successful. Adding to this study Cooper and Edgett (2012, p 48) identified support for the benefits of using a stage-gate R&D management model and concluded that *"simply having a formal process is itself a best practice"*.

Merely having a R&D model does not, however, guarantee success. Rather, the crucial aspect is how the process, its activities, and recommended practices are implemented (Cooper et al, 2004c). The way models are implemented in everyday practice must be connected to the organizational context. Despite the crucial implementation issue, limited research has addressed the key enablers for implementation as well as use of R&D management models. One exception is the study by Christiansen and Varnes (2009) who investigated how structured approaches were translated into daily practices. The study focused on sense-making from rules to practice. Formal R&D management models can be considered to be a set of rules that should be followed by the product development projects. It was found that feedback from senior managers during project steering group meetings influenced the everyday practice. On a more general level, senior management attention and use of performance criteria can be expected to affect the rules and their application within a company. Furthermore, training was suggested to affect how methods and rules were applied in practice. In a study of companies that have implemented product development according to a Concurrent Engineering (CE) approach, Bhuiyan et al. (2006) identified a couple of enablers. Clear appointment responsibility for the process was considered important, because without such ownership there is a risk that it contributes to lack of project discipline. Another enabler addressed was the use of team reward mechanisms. Such mechanisms can serve as motivators for the teams to adhere to the R&D management model.

Some factors that impede the implementation of R&D management models have also been presented in literature. Ottosson (1996) maintains that some models are too complex and detailed. As a consequence, development teams might find the model to be a burden rather than a help for the product development effort. A model that is employed rigidly for its own sake, can result in increased development time (Shaw et al, 2000). According to Christiansen and Varnes (2009), different opinions and practices inside companies might affect the implementation of rules as represented by R&D management models. They found that the application of any set of rules depend on the interpretations made by employees. Senior managers that do not engage in product development decisions properly might also hamper the process (Cooper et al, 2002). If they are too busy or do not prioritize meetings as specified in the R&D management model, this signals to the product development team that it is not necessary to comply with the model. According to Christiansen and Varnes (2009), differences in national and regional cultures affect interpretation and sense-making among managers, project leaders, and employees. As an example, they state that the Scandinavian management style might be more oriented towards multiple interpretation and thus allow for softer and more flexible application of rules compared to the U.S. style. Consequently, their reasoning implies that culture can influence the implementation of R&D management models. Similarly, Evanschitzky, et al. (2012) maintain that

national culture needs to be considered when a company attempts to achieve improvements of product development success rates.

4 EMPIRICAL FINDINGS: KEY ENABLERS FOR AND BARRIERS TO IMPLEMENTATION OF R&D MANAGEMENT MODELS

Ideally, the R&D management model should fit the activities that different actors that are involved in the product development project has to perform. Thus, it is central that the model specifies clearly what the representatives from different organisational units should do. The findings show the need of tailoring the model to the activities of the organizational units as well as senior management commitment in order to ensure that the model is firmly implanted into the company's business activities. Especially, senior managers need to engage in steering committees and emphasise the need for the project to adhere to the R&D management model activities. Process gates should be strictly followed and senior managers must be tough and ask for the information they need for their decisions. As one respondent stated: *"The steering committee is of utmost importance"*.

One enabler mentioned was the application of mentorship. Experienced project leaders that support newer ones might help the latter to better understand and apply the model in their projects. This is also strongly related to another enabler, i.e. unambiguous project leadership, where the importance for the project team to adhere to the R&D management model is emphasised by the project leader. One interviewee mentioned the use of project leadership seminars where project leaders meet and exchange experiences as a means to ensure focus on the R&D model. However, even if senior managers and project leaders underscore the importance of adherence to the R&D management model it will hardly be followed if all project team members do not receive proper teaching and training about the model. Therefore one of the most important enablers refers to teaching and training. Information regarding why, how and when the model and its specified activities should be applied was considered to be very important. The study also emphasised that variation in the use of teaching methods is important from a pedagogic perspective. Combinations of presentations, teaching material accessible on intranet, web-based teaching, practical example, etc. were claimed to be a preferable teaching strategy.

Implementation of the R&D management model call for patience and consistency. The company representatives agreed that continuous use and improvement are key enablers. Continuous use ensures that the R&D management model becomes known throughout the entire organization. Modifications and adjustments based on previous experiences contribute to better fit between the model and the reality of the product development projects. Hence, this can be expected to enhance the usefulness of the model and therefore add to its popularity in the organization. A related enabler is the need of constant communication about the R&D management model. Such communication serves as a basis for dissemination of the model, but also to collect improvement ideas. Or as one interviewee stated: *"If you understand the requirements you will get adherence. So communication and discussion is important…"*. Another respondent said: *"I think it is really important to spread the message and vision [about the model]"*. Furthermore it was also mentioned that continuous follow-up of how projects applied the R&D management model is central to ensure that it is adopted in the organisation. Auditing of projects was considered to be a driver for the projects to apply the model and its specified activities, methods, tools, etc.

The study also revealed a number of barriers to implementation of R&D management models. One barrier mentioned was the rigidity and details of the models. If the models are to detailed the project teams might experience that the models are heavy to follow. One respondent stated: *"[the model] has a tendency to become more and more burdensome […]. I am afraid that it will be even more heavy and that we have to do much administration"*. This might result in a feeling among the team members that the model is too bureaucratic and hampering, rather than a support for the product development project. Furthermore, implementation of the R&D management model might be restricted if different interpretations of the model exist. Various opinions of what the model really represent and how it should be applied affect the implementation. As one interviewee stated: *"it is always complicated to disseminate a process or a model, or anything. You think it has been communicated…people does not*

always listen to what you say". These differences might exist because the team members represent different positions and competencies, among other things.

The workshops as well as the interviews also revealed that habits and local cultures can be tricky to overcome. If the R&D management model is supposed to be implemented in different countries, culture is a dimension that definitely must be considered. The reason is that culture affects peoples interpretation and understanding of the models. Poor alignment between the company's overall strategy and the different sites' strategies is another factor that can inhibit the implementation and use of the R&D management model. Such strategy misfit might result in that the company's various sites do not see the relevance of the model for their activities. Therefore senior managers must ensure that the strategies are aligned to support the overall business goals and activities. This also relates to the next hindering factor identified in the study. Lack of management attention, or perhaps lack of insights and understanding of the R&D management model, might hamper both the implementation and use of the model. One respondent stated: *"The steering committees have been rather weak; they have not been aware of their responsibilities."* Senior managers must therefore be skilled in the model and also show the entire organization that it is central for driving product development projects to completion.

People turnover was also mentioned in the study as a factor that can hamper R&D management model implementation. When people leave the company, the training and experience that those people have get lost. Therefore, it is essential that companies try to keep the personnel for longer times. Various reward systems and career planning might be means that can be used. A factor related to people turnover is lack of resources. If projects have to fight for resources, it can be expected that there is lack of time for employees to receive the necessary teaching and training in the R&D management model. Lack of resources can also lead to that the product development project take shortcuts in order to ensure project progress. Then adherence to the R&D management model might not be a top priority if the project is pressed for time, especially if the model is very detailed. In table 2 the identified enablers and barriers are outlined.

Table 2. Empirical findings

	Empirical findings
Key enablers for implementation	Tailoring of the model to activities of different organizational units Continuous use and improvements of the model Auditing of projects Teaching and training Clear allocation of responsibilities Steering group commitment Mentorship Constant communication Unambiguous project management
Key barriers to implementation	Too rigid and detailed model Different interpretation of the model Lack of management attention Habits and local cultures Poor alignment between the company's overall strategy and the various sites' strategies People turnover Lack of resources

5 DISCUSSION AND CONCLUDING REMARKS

As can be seen from the table 2, this study revealed nine key enablers and seven barriers to implementation of the R&D management model in global organisations. Evidently, the enablers and barriers relate to the product development process *per se* as well as to organisational issues. The findings show that the R&D management model should not be to "generic" or rigid (cf. Shaw et al, 2000), but has to fit the various organisational units needs and allow for flexibility in application. Follow-up audits where projects are checked regarding their adherence to the model signals to the

organisation that the model should be used as guidance in product development. Such audits is also a means for improvements when the R&D management model is newly implemented to parts of the organisation. Furthermore, teaching and training play a central role to ensure implementation of the R&D management model. The study also revealed that organisational issues are central for ensuring proper implementation of the R&D management model throughout the organisation. Senior management's role is critical to show the entire organisation that the R&D management models should be adhered to. This has been mentioned in literature and is supported in this study (c.f. Cooper et al, 2002). Lack of management's attention signals the opposite and can be devastating for the efforts to spread the use of the R&D management models within an organization The interpretation and sense-making of the R&D management model seems to be particularly critical when implementing the model. The challenge related to this is further amplified when R&D management models are to be implemented in global organizations, where local habits and culture must be considered.

This study focused on implementation of R&D management models in global product development organisations. It has both theoretical and managerial implications. First, the theoretical implication is that the study adds insights into factors that enables and inhibits implementation of R&D management models. Previous research has been criticised for the lack of interest paid to implementation issues (Bhuiyan et al, 2007). The managerial implication refers to that list of identified enablers and hinder can be used by companies as a checklist of essential factors to consider when they aim at implementing their R&D management model in the global organisation. However, the list of factors is definitely not exhaustive, but can serve as a starting-point for adding more experiences gained in the companies. Hence, the findings that originate from this study ought to be valuable for industry.

Despite this study has revealed a number of enablers and barriers, further research is needed regarding the implementation of R&D management models in global product development organisations. As the list of enablers and barriers is not exhaustive, an obvious route of research would be to search for additional enablers and barriers as well as to check the validity of the ones identify in this study. Additionally, a deeper analysis is needed regarding how the different barriers can be handled based on extant knowledge represented by change management literature. It should also be acknowledged that a number of the identified enablers and barriers might be universally relevant in product development organisations, i.e. not specifically for global organisations. However, an analysis of what is specific for global organisations compared to more regional or local ones goes beyond the scope of this paper. The study shows that senior managers play an essential role to facilitate implementation of the R&D management models. This finding is not new, but still has interesting implications from a research perspective. It was found that steering committees are crucial to ensure adherence to the R&D management models. These committees are often populated with senior managers who take key decisions at gate passages. However, according to Barczak (2012, p. 355) *"little best practice with regard to gate reviews exists"*. Further research on gate reviews and the role played by steering committees and its effects on implementation of R&D management models is needed .

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REFERENCES

Barczak (2012) The Future of NPD/Innovation Research. Journal of Product Innovation Management, Vol. 29, pp. 355-357

Bhuiyan, N., Thomson, V., Gerwin, D. (2007) Implementing concurrent engineering. Research-Technology Management, Vol. 49, pp. 38-43

Brown, S., Eisenhardt, K. (1995) Product development: Past research, present findings, and future directions. Academy of Management Review, Vol. 20, pp. 343-378

Christiansen, J., Varnes, C. (2009) Formal rules in product development: Sensemaking of structured approaches. Journal of Product Innovation Management, Vol. 26, pp. 502-519

Cooper, R. (1994) Perspective: Third-Generation New Product Processes, Journal of Product Innovation Management, Vol. 1, pp. 3-14

Cooper, R. (2014) What's Next? After Stage-Gate. Research-Technology Management, January—February, pp. 20-31
Cooper, R. (2008) Perspective: The Stage-Gates Idea-to-Launch Process—Update, What's New, and NexGen Systems, J Prod Innov Manage, Vol. 25, pp. 213-232
Cooper, R., Edgett, S., (2012) Best practices in the idea-to-launch process and its governance. Research Technology Management, March-April, pp. 43-54
Cooper, R., Edgett, S., Kleinschmidt, E. (2004b) Benchmarking best NPD practices – II. Research Technology Management, Vol. 47, No. 3, pp. 50-59
Cooper, R., Edgett, S., Kleinschmidt, E. (2004c) Benchmarking best NPD practices – III. Research Technology Management, Vol. 47, No. 6, pp. 43-55
Cooper, R., Edgett, S., Kleinschmidt, E. (2004c) Benchmarking best NPD practices – I. Research Technology Management, Vol. 47, No. 1, pp. 31-43
Eisenhardt, K.M., Tabrizi, B.N. (1995) Accelerating adaptive processes: product innovation in the global computer industry, Administrative Science Quarterly, Vol. 40, pp. 84-110
Engwall, M., Kling, R., Werr, A. (2005) Models in action: how management models are interpreted in new product development, R&D Management, Vol 35, pp. 427-439
Ettlie, J., Esenbach, J. (2007) Modified stage-gate regimes in new product development. Journal of Product Innovation Management, Vol. 24, pp. 20-33
Evanschitzky, H., Eisend, M., Calantone, R., Jiang, Y. (2012) Success factors of product innovation: An updated meta-analysis, Journal of Product Innovation Management, Vol. 29, pp. 21-37
Kahn, K., Barczak, G., Moss, R. (2006) PERSPECTIVE: Establishing an NPD Best Practices Framework. Journal of Product Innovation Management, Vol. 23, pp. 106-116
Kahn, K., Barczak, G., Nicholas, J., Ledwith, A., Perks, H. (2012) An Examination of New Product Development Best Practice. Journal of Product Innovation Management, Vol. 29, pp. 180-192
Lee Hansen, Z., Ahmed-Kristensen S. (2011) Global product development: the impact on the product development process and how companies deal with it. International Journal of Product Development, Vol. 15, pp. 205-226
Linton, J. (2007) MOT TIM journal rankings 2006. Technovation, Vol 27, p. 91-94
Miles, B. and Huberman, M. (1994), Qualitative Data Analysis: An Expended Sourcebook (2nd ed.). Thousand Oaks, CA: Sage.
Ottosson, S. (1996). Dynamic Product Development: Findings from Participating Action Research in a Fast New Product Development Process. Journal of Engineering Design Vol. 7, pp. 151–70.
Ottosson, S. (2004) Dynamic product development – DPD. Technovation, Vol. 24, pp. 207-217
Shaw, N.E., Burgess, T.F., Hwarng, H.B., and de Mattos, C. (2000). Revitalizing New Process Development in the UK Fine Chemical Industry. International Journal of Operations and Production Management Vol. 21, pp. 1133–51.
Ulrich, K., Eppinger, S. (2012) Product Design and Development, McGraw-Hill
Unger, D., Eppinger, S. (2009) Comparing product development processes and managing risk. International Journal of Product Development, Vol. 8, No. 4, pp. 382-402
van Oorschot, K., Sengupta, K., Akkermans,H., van Wassenhove, L (2010) Get Fat Fast: Surviving Stage-Gates in NPD, Journal of Product Innovation Management, Vol. 27, pp. 828–839