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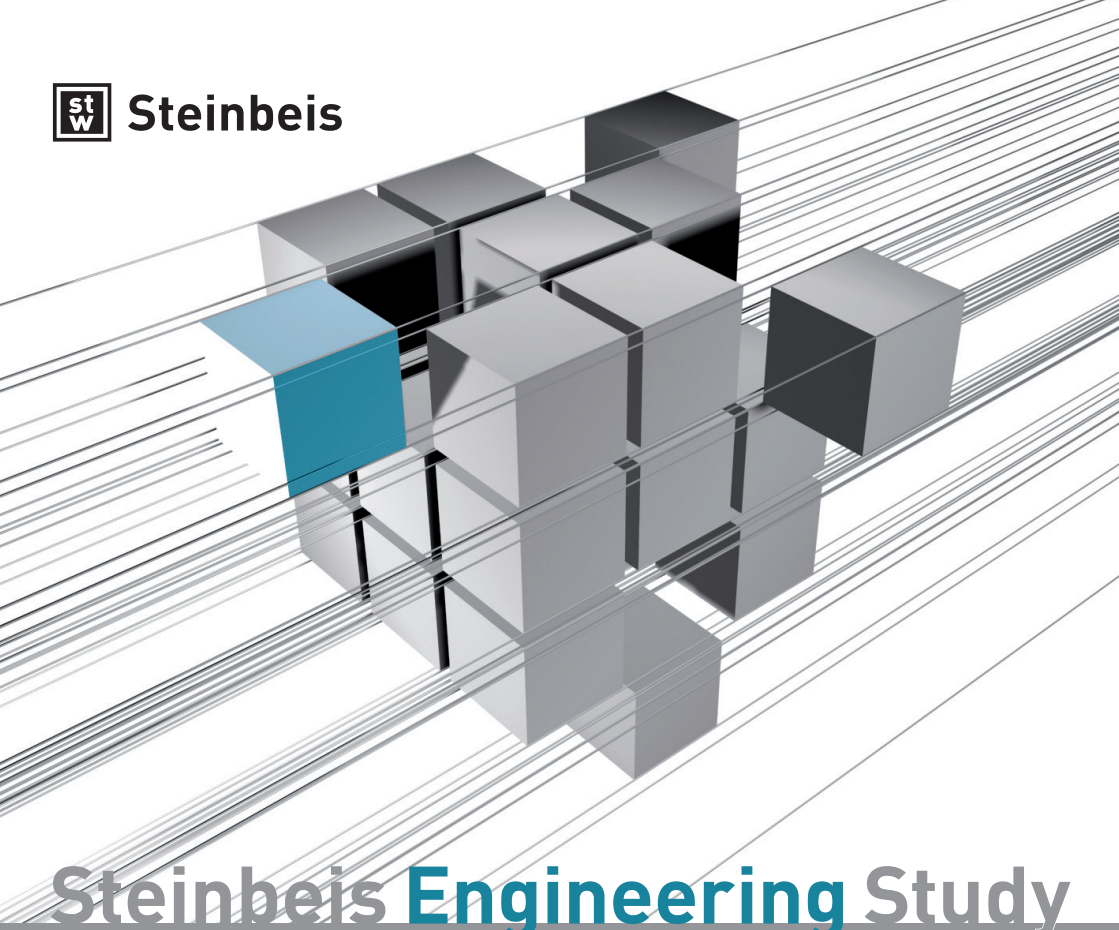

Steinbeis Engineering Study

Part 1: Results of Survey

Successful ProductDevelopmentProcesses

Factors and Conditions

Steinbeis-Stiftung (Publ.)

Steinbeis-Edition

Steinbeis Engineering Study | Part 1: Results of Survey

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1st edition, 2013 | Steinbeis-Edition, Stuttgart
ISBN 978-3-943356-76-2

Layout: Steinbeis-Edition
Cover: © iStockphoto.com / jerry_only

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162876-2013-05 | www.steinbeis-edition.de

Foreword

External influences, such as the short longevity of markets, high customer expectations, the convergence of technology, and aggressive pricing policies are forcing businesses to develop products within the shortest possible timescales. These products should be as innovative as possible, and, at the very least, successful. It is all about being faster, better and less expensive. Is our company ready for the challenges of today and tomorrow? This is a question many managers at small and medium-sized enterprises ask themselves. The product development process (PDP) is a core, if not the core process, which, if successful, is a sine qua non for the success of any company.

But what conditions have to be fulfilled for the PDP to succeed? Do we actually have a PDP, or the right PDP? Do we have the skills, the methods or the resources to face the plethora of new challenges the PDP entails? These questions were a catalyst for the Steinbeis Engineering Group to draw on the expertise of the Steinbeis Network and conduct an online survey on the PDP. The online survey involved 280 companies and was followed up by in-depth telephone interviews. The results of the study are documented in two publications:

- This publication, the "Steinbeis Engineering Study – Successful Product Development Processes: Factors and Conditions", contains a detailed analysis of the results of the survey, complemented by people's thoughts from the telephone interviews. The aim is to reveal unexploited potential open to companies in product development and to help them make full use of this potential.
- The second publication, "Steinbeis Engineering Study | Part 2: Best Practices", examines the key areas of the PDP, analyzing the nature of the process and complementing this evaluation with specific recommendations made by experienced Steinbeis experts. The reader is also shown methods, materials and systems that can be mixed and matched to their own PDPs.

- The aim of both publications is to inspire small and medium-sized enterprises in particular to reflect on their own practices and question their own PDPs. This study should open up new avenues with new solutions that are as efficient as they are effective – and expand people's horizons.

The Steinbeis Engineering Forum
April 2013

Contents

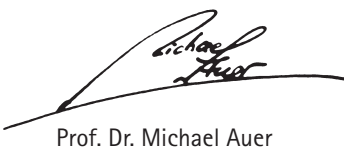
Acknowledgements

This study, and the publications that resulted from this study, would not have been possible without the commitment and energy of the people to whom the "PDP" – and its importance for the success of small and medium-sized enterprises in particular – mean so much. The two members of the Steinbeis Engineering Group who played a key role in shaping this study, Prof. asoc. univ. PhDr. Arno Voegele and Prof. Dr.-Ing. Günther Würtz, deserve particular mention.

We are also particularly indebted to Christian Albrecht, Dr. Meike Reimann, Antje Seyd-Mundhenke and Dr. Jonathan Loeffler of the Steinbeis-Europa-Zentrum for designing and conducting the survey and running the in-depth interviews, as well as analyzing the results and writing this study.

Our thanks also go to the expert group of scientists and businesspeople who invested their time, expertise and experience on behalf of the Steinbeis Engineering Forum and provided their input.

Last but not least, we are indebted to the survey participants, as without their time investment we would have no results to discuss in the first place.



Prof. Dr. Michael Auer

Uwe Haug

Background

Steinbeis is a worldwide provider of entrepreneurial knowledge and technology transfer. The portfolio of services of the highly specialized Steinbeis Enterprises that make up the Steinbeis Network range from consulting to research and development, training and continuing professional development, and evaluations and expert reports – in a variety of fields of management and technology.

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The **Steinbeis Engineering Forum** is a platform for transfer-oriented research and development within the Steinbeis Network. The forum brings together parties involved specifically in the product development process to discuss issues relating to essential factors affecting successful engineering – and thus demonstrate future potential.

www.steinbeis-engineering-forum.de

Since 1987, the **Steinbeis Transfer Center Production & Management** has seen itself as a partner to medium-sized enterprises – wherever production-based industry seeks sustainable, holistic solutions. Its approach is based on pragmatism, efficiency, pertinence and clarity. The center is headed up by Prof. asoc. univ. PhDr. Arno Voegele.

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The **Steinbeis Transfer Institute Development & Management** was founded in 2002 as an entity within the Steinbeis University Berlin (SHB). The Institute's services center around part-time certification courses and master's programs, primarily targeted at future managers working in development and design at medium-sized enterprises. The center also offers evaluations and expert reports on development management, partly in collaboration with companies. The center is headed up by Prof. asoc. univ. PhDr. Arno Voegele.

www.steinbeis.de/su/710

The **Steinbeis Transfer Center Management – Innovation – Technology (MIT)** provides clients with consulting and coaching services focusing on the two core processes of product development and project delivery. Its integrated approach is based on the coordinated reconciliation of product engineering and process engineering, with an emphasis on technical project management, variant management and life cycle management. The center is headed up by Prof. Dr.-Ing. Günther Würtz.

www.steinbeis.de/su/438

The **Steinbeis-Europa-Zentrum Karlsruhe** acts as a stepping stone for companies, research institutions, universities and regional development bodies to access other European countries. Its advisory services revolve around: European research funding, bilateral technology collaboration with foreign partners, regional strategies for the future, regional innovation, involvement in technology exchanges, business tours, congresses, information days and continuing professional development. Dr. Meike Reimann and Christian Albrecht are project managers on international research projects. The center is headed up by Prof. Dr. Norbert Höptner and Dr. Jonathan Loeffler.

www.steinbeis.de/su/1217

Executive Summary

The aim of the Steinbeis Engineering Study 2012 is to demonstrate the conditions that are conducive to the product development process (PDP) at successful manufacturing companies. The study aims to identify issues relating to the PDP, key success factors and possible solutions. Its aim is also to reveal unexploited potential and how to make use of this potential.

Design of the study

The study was carried out in two parts. First, an online questionnaire was completed by 280 people working at German companies involved in manufacturing. The survey was anonymous and centered around the PDP. The results of the survey were subsequently explored in 30 in-depth interviews with people working for a variety of companies in a variety of positions. The topics examined covered issues such as key success factors of the PDP, aspects relating to in-house structures, processes and information flows, market and customer orientation, the use of key indicators and financial controls, the use of IT tools in the PDP and, last but not least, the role played by individuals in the PDP.

Survey participants

Approximately half of the participants in the online survey (49.6 %) work for large companies (with 250 employees or more), nearly one third (32.0 %) work for medium-sized enterprises employing 50 – 249 people, and just under one fifth of respondents (18.4 %) stated that they work for a small company with fewer than 50 employees.

The surveyed participants work in research and development (48.7 %), in senior management (31.7 %), in sales / marketing (21.9 %), and in production (13.8 %).[1] The face-to-face interviewees work in research and development (48.0 %), in senior management (16.0 %), and in product management (12.0 %).

1 Multiple responses possible.

Overview of results

The product development process (PDP) is a challenging task that involves all parts of a company and requires close cooperation between different departments. Hurdles identified in the study are often in some way connected to how a business divides up tasks. As a result, possible solutions have a leaning toward specifically overcoming these hurdles and promoting interdepartmental collaboration in the PDP. There is recognition that steering groups and product managers have a role to play as "promoters", and this has already been achieved with much success at some companies.

There is also potential to introduce structured measures relating to communication, coordination and decision-making processes, and to use IT tools for planning, documentation and financial control reasons.

Key success factors of the product development process (PDP)

The respondents named the following factors most frequently as the five most important factors for the success of the PDP:

- Efficient exchange of information between departments (74.5 %),
- Close / regular customer contact (60.9 %),
- Highly qualified employees (60.3 %),
- Well functioning interfaces between departments (55.4 %),
- Strong sense of responsibility among employees (51.1 %).

Communication, information flows and interfaces

Of the five most important success factors affecting the PDP, the **efficient exchange of information between departments** is most frequently named by the respondents. Furthermore, almost all survey participants who describe interdepartmental communication within their company as good, also state that implementation of the PDP is good or very good (94.3 %). In many areas, the results of the survey do indicate room for improvement, however. Only a little more than 40 % of the respondents state that interdepartmental communication is good or very good. This contrasts with communication within departments, which over 80 % of respondents describe as good or very good. The exchange with external contacts (clients, suppliers etc.) is rated even better (61.5 %) than the exchange between departments.

Despite defined company strategies and business goals, there is a strong **requirement to synchronize** collaboration between departments and sensitize people to the differing needs of each area.

Standardized communication structures and coordination processes between departments prove to be important to the success of the PDP. Nevertheless, only 36.8 % of respondents state that the communication channels in their company are clearly standardized and defined. Standardized communication channels and coordination processes are more likely the larger the company, but they still do not prevent communication problems becoming worse as a company becomes larger.

Meeting internal deadlines in the PDP is described as poor. Fewer than a quarter of respondents (23.8 %) state that internal PDP deadlines are met. The results show that certain shortcomings when it comes to hitting deadlines are not just due to the complexity of product development. Frequently, planning is optimistic and based on best-case scenarios, such that any deviation in timing results in deadline delays.

The product manager's role as a promoter of the PDP

Although fewer than half of the companies (43.4 %) currently have an effective interdepartmental product management system in place, there is a trend toward introducing product management.

All respondents (100 %) believe that **people in product management being good at what they do** is important for the PDP to succeed. Effective product management is frequently (44.0 % of respondents) ranked among the five most important success factors of the PDP.

Respondents who state that the people in product management at their company are good at what they do are much more likely to believe that the PDP in their company is being successfully implemented (92.2 %), especially compared to respondents who believe that the people working in product management are not good at what they do (40.0 %). **This finding indicates that product management plays a crucial role in the PDP and that it is key to success.**

This contrasts to other results of the survey indicating that just under half (47.8 %) of respondents believe that the people working in product management in their company are good at what they do – **in the sample of respondents working at companies with 50 – 250 employees, this is only just over one third of respondents (36.0 %).** The areas of work and training of product managers at medium-sized companies will be a future challenge.

Skills sets considered particularly important to the PDP are: specialist qualifications, which at 84.5 % ranks first among respondent's responses, the ability to work in teams (63.1 %), interpersonal skills (47.6 %) and project management (43.3 %). These are precisely the skills that are needed to work at an interdisciplinary level across departments during product development. They are also precisely the skills that product managers need in their pivotal role in the PDP overall. Thus, in total, this points to a demanding job profile for the lead function performed by product management.

Company organization

The results of the survey show that **company management and culture** are essential to the success of the PDP. Organizations are considered to be better at promoting PDP,

- the more they foster new ideas,
- the more they encourage employees to take initiative,
- the more they foster teamwork,
- the more they encourage employees to assume personal responsibility.

The survey results also suggest that flat hierarchies promote successful PDPs. Nevertheless, the opinions expressed in the interviews indicate that having more clearly defined **hierarchical structures** is beneficial to the PDP.

Market and customer orientation

Employees' experience with markets, trends, customers and competitors are actively put to use by the companies employing the survey respondents. However, according to the survey, companies tend to focus more on the experience and knowledge of employees (59.4 %) than the systematic logging of customer needs or market / user feedback (45.8 %).

In terms of the focus on product development and goal-setting, **a medium- to long-term innovation process** is recommended. This process includes investigating future customer and market needs, and companies engaging in research or technology development with a longer-term strategic focus – and not focusing product development primarily on short- and medium-term goals. As part of the innovation process, a strategy roadmap is created which captures market pull and technology push factors, from which the goals of product development can be derived.

PDP – processes, methods and tools

Using IT tools to underpin the PDP ranks last among key success factors, and the importance of seamless IT support in the PDP shows below-average scores. Is potential being underestimated? Other survey results indicate that IT support is actually key to the success of the PDP. For example, the survey respondents who said there is seamless IT tool support for the PDP are much more likely to report successful implementation of the PDP (88.6 %) in their company. This compares to respondents who said there is no such seamless IT support (56.0 %).

Only around one third of respondents (34.7 %) state that the **specifications laid down for new products** are always complete and clear. Telephone interview discussions indicate that the problem is not only that specifications are incomplete, but that there is also a tendency for specifications to change in the course of the PDP. One recommendation for dealing with changing specifications was, for example, IT-based change management.

Key PDP indicators and financial controls

Only around one third of respondents (37.0 %) state that **benchmarks** are used to compare their company to key competitors.

41.5 % of respondents state that project progress is measured by using key indicators and checked against milestones. Although only around one quarter of respondents (26.6 %) consider the use of key indicators and financial controls to be among the most important success factors for the PDP, the survey results indicate that using key indicators actually is important to successful PDPs. **Key indicators and financial controls used to steer the PDP are only used half as often in small and medium-sized enterprises compared to larger companies. Do these project management instruments hold potential for SMEs – potential that needs to be exploited?**

Conclusion

Overall, the survey results show how challenging product development is as an interdepartmental process. The results point to weaknesses in implementing the PDP at many companies, although simultaneously they underscore the extent to which precisely these areas of weakness are central to success. As a result, one can draw conclusions about the areas that require a closer look. Further, it is clear that **product managers have a significant role to play in the PDP as a "promoter."**

Turning the spotlight on product development

The product development process (PDP) is a sequence of procedures starting with an initial concept and finishing with the production and selling of this concept. Well coordinated, efficient collaboration between different departments and parts of a business (sales, research and development / design, purchasing, production and service) lays an important foundation for the successful implementation of PDPs.

Products have become increasingly complex over time, not only in terms of function but also because of the expectations products have to meet in times of global mass production; even simple products can present a major development challenge. If a product is complex, product development will also be complex. Previously, it was still possible for one person to take responsibility for all areas of knowledge pertinent to a product. Today, this is only possible if tasks are allocated systematically and people specialize in certain areas. The PDP, which places demands on almost all areas of a company, is a particularly demanding challenge. Areas of the business that are separated in purely functional terms have to work together efficiently. The degree to which this succeeds, has a crucial influence on the success of the PDP.[2]

2 cf. Ehrenspiel (2009).

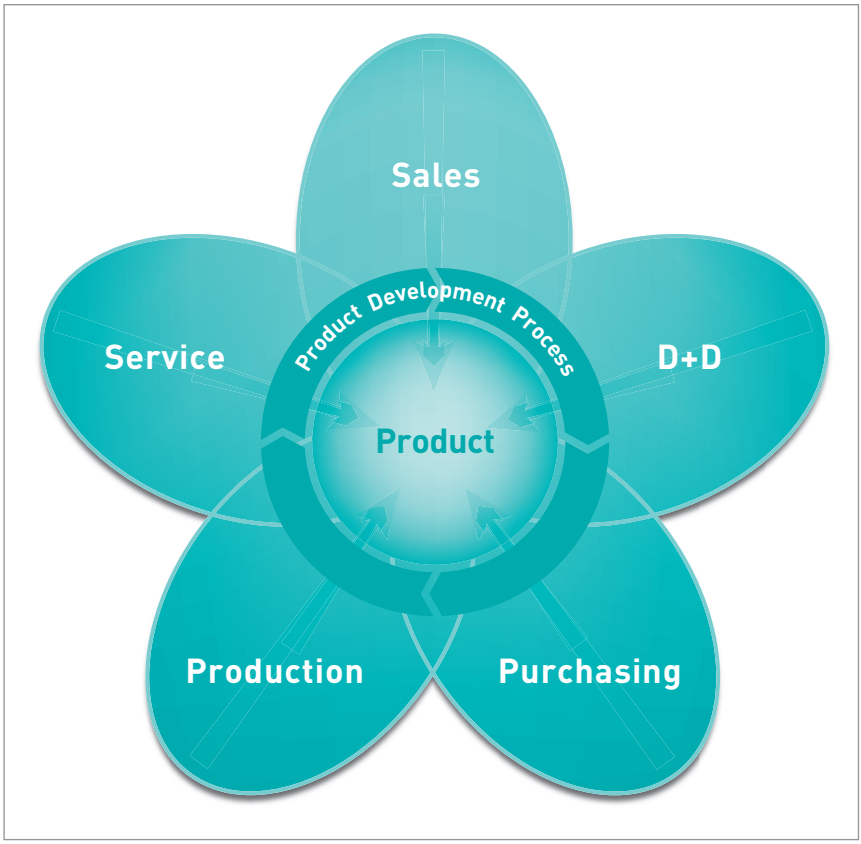


Figure 1: Schematic representation of product development processes and involved departments.[3]

In addition to the challenges of growing product complexity, in many sectors of industry companies also face ever-shortening innovation cycles and product life cycles. Increasingly, competition is not only dictated by product quality, but also by speed.

3 Steinbeis (2012), based on Voegele (2011).

An efficient PDP is considered central to a company's ability to meet these challenges. As a result, it is a key prerequisite of business performance and competitiveness.

It is the PDP that creates the products of tomorrow. As such, it is a kind of coordinated innovation. The PDP defines the extent to which updates are not just left to chance but instead are actively pursued by the company. A successfully implemented PDP decides whether a company is a pioneer or a follower, whether profits can be generated simply through efficiency programs or whether a product's USPs make it possible to attract higher margins.

Sometimes the process used to develop products can be completely different, depending on the size of a company, the sector of industry, and the type of product. The product being developed can be a made-to-measure customer solution or a mass product manufactured in huge batches with plenty of variants. As a result, the PDP is different from one company to the next and from product to product. Yet certain things remain important: the know-how of employees, the information a company has about the market, the experience of users. And these have to be put to good use in product development and shared.

By carefully analyzing the potential of existing PDPs, a company can galvanize its competitiveness and improve product development in the long term.

1 Aims and structure of the study

This Steinbeis Engineering Study 2012 examines the factors and conditions that are conducive to the product development process (PDP) at successful companies. Apart from providing an initial overview of current success factors, issues and the problem-solving approaches of the PDP, the aim of the study is to reveal unexploited potential and reveal how to make use of this potential.

The study was carried out in two parts. As a first step, an online survey was conducted between June and late July 2012 among 280 people working at German companies involved in manufacturing. This survey was anonymous and involved questions surrounding the PDP. The survey provided information on company structures, processes and information flows, but also the role played by individuals in the PDP. In November and December 2012, the results of the survey were explored in 30 in-depth telephone interviews with people working for a variety of companies in a variety of departments.

In the online survey, respondents were asked to describe how they felt about the topics shown below. This study mirrors the structure of the survey: after looking at the breakdown of participants (1) and the results of questions on current PDP practices (2), opinions were gauged on a variety of issues relevant to the PDP (3) and these are subsequently discussed.

(1) Breakdown of respondents and companies – based on responses regarding the following:

- Target sample
- Size of company
- Sector of industry
- Position in the industry value chain
- Area worked in by respondents
- Success of company
- Export orientation
- Nature of R&D function
- Involvement in networks

(2) PDP at the company today – based on assessment of the following:

- Opinion regarding PDP implementation
- Integration / outsourcing of departmental roles
- The need to make changes in the PDP

(3) Opinions regarding the following PDP issues:

- PDP success factors
- Communication and information flows in the PDP
- Interfaces and procedures used in the PDP
- Human factors in the PDP, emphasis placed on qualifications
- Business organization
- Market and customer orientation
- PDP processes, methods and tools
- Key PDP indicators and financial controls

2 Company profile

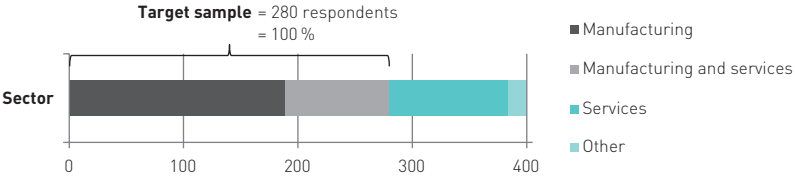
Target group

This study's target group is manufacturing companies in Germany.[4] The online survey involved manufacturing companies from all sectors of industry and employees working in departments or functions involved at all stages of product development. To differentiate between results and statements, and correlate these to the specific nature of companies, detailed questions were also asked about the company.

Sector of industry

405 respondent assessments were collected during the survey period.[5] Of these, **280 assessments** were collected from respondents who indicate that their company works in manufacturing. Only this latter sample is included in the study (n=280, 100 %). This sample is supplemented by responses and statements collected in separate telephone interviews.

? To which sector of industry does the business belong?



! The 280 survey respondents work in manufacturing.

Figure 2: Sector of industry of company (n = 405).

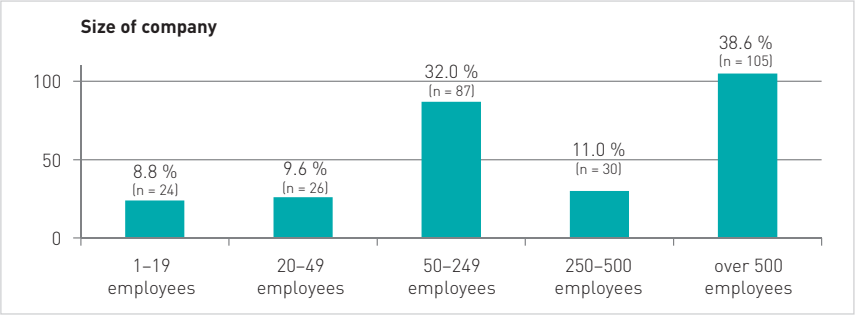
4 The emphasis of the study lay in manufacturing companies in the state of Baden-Wuerttemberg. 77.6 % of respondents work for a company based in Baden-Wuerttemberg.

5 June 14, 2012 – July 27, 2012.

Size of company

Nearly half of the respondents (49.6 %) state that they work for a larger company with 250 or more employees. Around a third (32.0 %) work for medium-sized companies (50 – 249 employees) and just under one fifth of respondents (18.4 %) state that they work for a smaller company with fewer than 50 employees. These classifications are used in other parts of the study.

? How many people are employed by the respondents' companies?



! Approx. half of the respondents (50.4 %) said they work for a small or medium-sized enterprise.

Figure 3: Size of company measured by number of employees (n = 272).

Area of industry

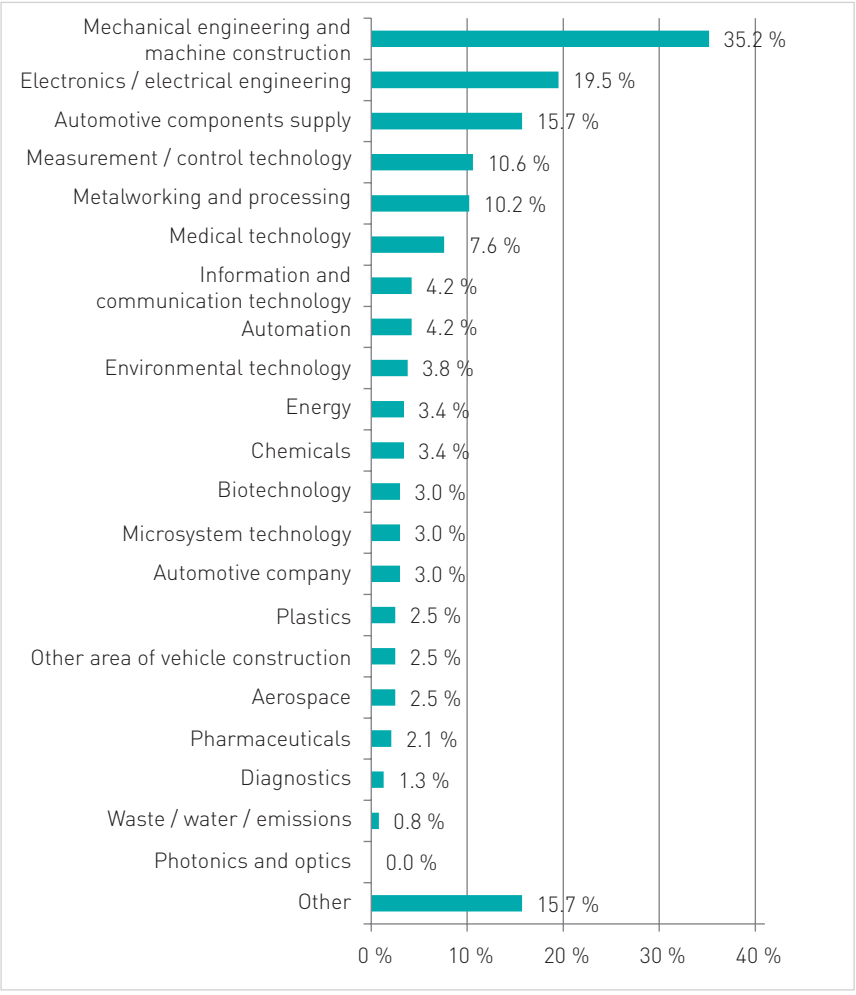
Most of the respondents work in mechanical engineering or machine-making (35.2 %), electronics or electrical engineering (19.5 %), automotive component suppliers (15.7 %), measurement and control engineering (10.6 %), or metalworking and processing (10.2 %).

Position in the industry value chain

Regarding the role of the company in the industry value chain, 44.7 % are component makers, 24.3 % are in machine construction, and 9.7 % supply production materials or make production systems.[6]

6 Around one fifth (21.2 %) of respondents are not able to place their company in one of the three described parts of the industry value chain.

? What area of industry do respondents work in?



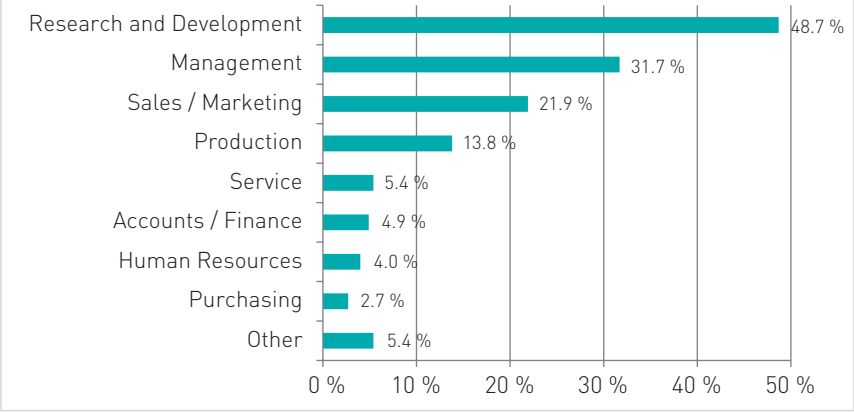
! Approx. one third of respondents (35.2 %) work at a company involved in mechanical engineering or machine construction.

Figure 4: Area of industry of respondents' companies (n = 236, multiple responses possible).

Department worked in by respondents

Overall, there is a tendency for respondents to work in research and development (48.7 %), in a senior management position (31.7 %), in sales / marketing (21.9 %) or in production (13.8 %) (cf. Figure 5).

? In which area of the business do the respondents work?



! Most respondents work in research and development or in a senior management position.

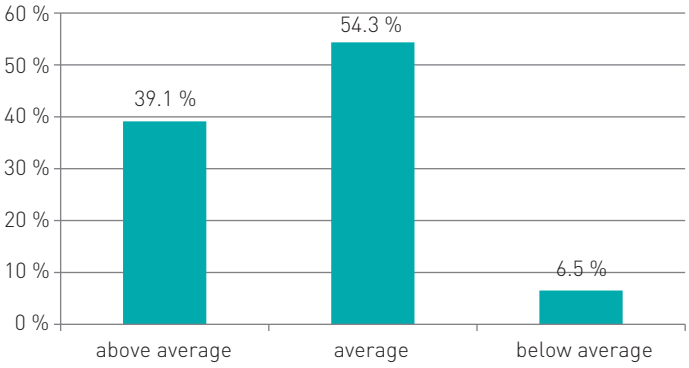
Figure 5: Areas of business respondents work in (n = 224).[7]

Success of business

39.1 % of respondents rate the business performance of their company as above average. Even more respondents rate the technological performance of their company as above average (54.3 %). Only 6.5 % of respondents rate the business performance of their company as below average. And only 3.9 % of respondents rate technological performance of their company as below average.

7 56 (20.0 %) of the 280 respondents working at manufacturing companies do not state which department they worked in.

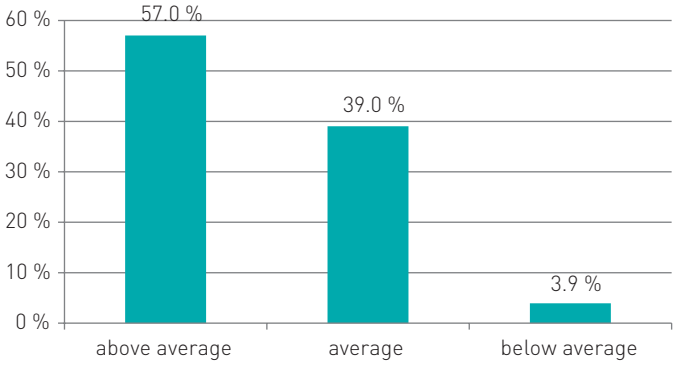
? How do the respondents rate their company's business performance?



! Only 6.5 % of respondents rate the business performance of their company as below average.

Figure 6: Business performance of the company (n = 232).

? How do the respondents rate their company's technological performance?



! More than half (57.0 %) of respondents rate the technological performance of their company as above average.

Figure 7: Technological performance of the company (n = 228).

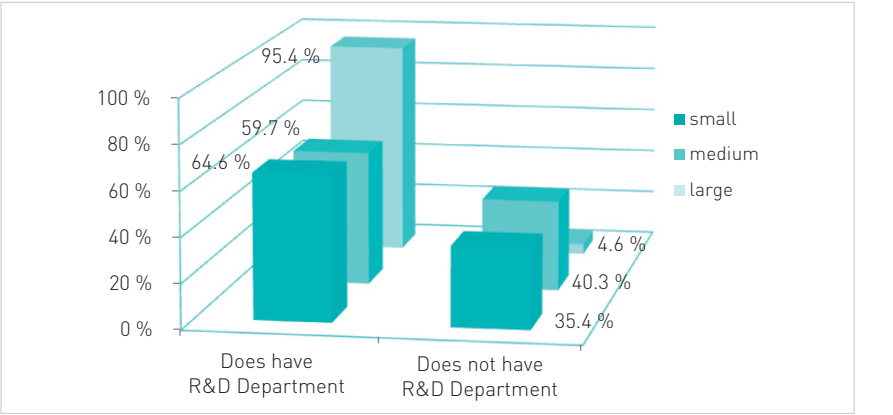
In terms of staff numbers at the companies represented by the respondents, most of the companies experienced either growth or strong growth over the past 5 years (61.0 %). In contrast, at 28.6 % of the companies the number of employees remained relatively stable in that time, and at 10.4 % of companies employee numbers decreased. People working for bigger companies were more likely to state that the company had grown or experienced strong growth (70.5 %), especially compared to people at medium-sized companies (55.2 %) and smaller companies (46.0 %), where employee numbers were more stable. A drop in the number of employees was most frequently reported by respondents at medium-sized companies: 14.9 % versus the average for all companies above at 10.4 %.[8]

Export orientation

The companies represented by the respondents in the survey have a strong focus overall on export markets – only just under one fifth of respondents (18.0 %) state that their company achieves less than 10 % of sales outside Germany. This compares to around half of respondents (50.8 %) who state that over 50 % of sales come from outside Germany. As expected, the degree of export orientation correlates to the size of the company, but despite this, 28.0 % of respondents at smaller companies (with fewer than 50 employees) state that their company generates over half of their sales outside Germany.[9]

8 See Info Sheet 1.
9 See Info Sheet 2.

? Do the companies have an in-house research and development department?



! 95.4 % of respondents at larger companies state that they have a research and development department.

Figure 8: Proportion of companies with an in-house research and development department (n = 229).

Nature of R&D department at companies

Overall, three quarters of respondents state that their company has a research and development department (77.7 %). For larger companies with over 250 employees, this number lies at 95.4 %; at medium-sized companies (50 – 250 employees), it equals 59.7 %; and at smaller companies with fewer than 50 employees, 64.6 % have an R&D department.

69.2 % of respondents' companies manufacture products that are protected by patents, a registered design, a design patent etc. The proportion of companies with their own protected products is much higher among the sample of larger companies (88.0 %) than is the case with smaller companies (53.2 %).

With respect to collaboration on research and development projects, 70.6 % of respondents state that their company regularly cooperates with research bodies such as universities of applied science, other kinds of universities or non-academic research institutions. This approach toward research and development appears to be more likely with larger companies: 91.7 % of survey respondents at larger companies state that their company regularly cooperates with research institutions, compared to 51.1 % of respondents at smaller companies.

Collaboration with other companies (who carry out research and development projects under contract) is confirmed by 63.0 % of respondents. Interestingly, the scores are only 10.7 % apart between large and small companies – different to the situation with the kind of research collaboration described above. Respondents at small companies are less likely to state that their company has R&D projects carried out by third parties under contract (60.9 %), especially compared to respondents at larger companies (71.6 %). Medium-sized companies appear to call for less external R&D support – only around half of the respondents state that their company collaborates with contractual R&D suppliers.

Of the companies that had never turned to third-party support on R&D projects, 86.8 % state that they expect to do this in the near future. This is a strong tendency across all company sizes.

Involvement in networks

According to the respondents, most companies are involved in networks such as industry associations or business clusters (72.6 %). This is particularly true for the sample of larger companies, 87.0 % of which are members of at least one network. Involvement in networks is least likely among the sample of smaller companies: 60.0 % are members of a network. More than three quarters of these networks operate on a national scale (77.0 %) and over half are international (51.7 %).

Breakdown of telephone interview sample

44.0 % of the people questioned in the telephone interviews work at large companies with more than 250 employees, 36.0 % work at medium-sized enterprises with 50 – 249 employees, and 8.0 % work at smaller companies with fewer than 50 employees.

The telephone interview respondents mainly work in research and development (48.0 %), in senior management (16.0 %), or in product management (12.0 %).

The companies represented by interviewees are mainly involved in electronics and electrical engineering (48.0 %), mechanical engineering and machine construction (20.0 %), or in automotive components supply (16.0 %).

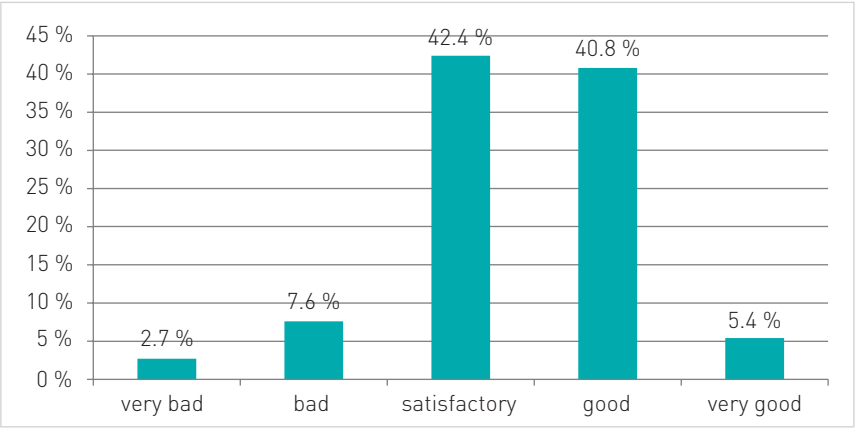
3 Results of the survey and interview findings

3.1 The PDP at companies today

46.2 % of respondents rate implementation of the PDP at their company as *good* or *very good*. This compares to 52.7 % of respondents who feel that PDP at their company is *satisfactory, bad* or *very bad*.[10] This indicates that there is room for improvement in the PDP and underscores the need to take a critical look at existing product development systems and uncover weaknesses.

10 The gap to 100 % (1.1 %) arises from statements that the PDP is not implemented at all.

How successful is the implementation of the PDP at the respondents' companies?

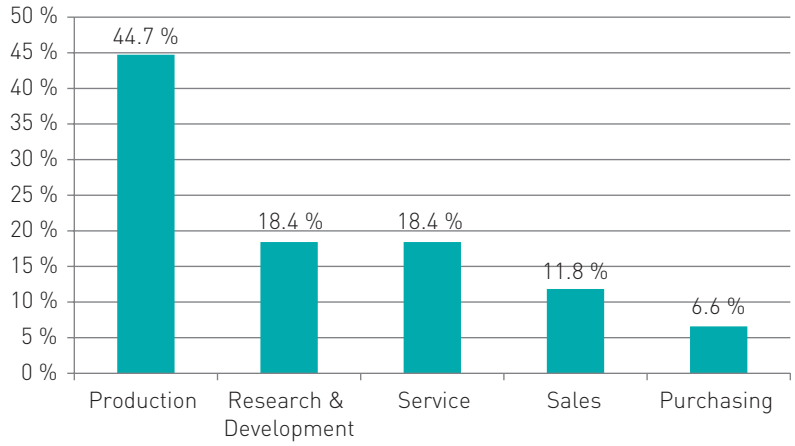


52.7 % of respondents rate PDP implementation at their company as satisfactory, bad or even very bad.

Figure 9: Assessment of PDP implementation at the respondents' companies (n = 184).

The PDP is particularly likely to involve research and development / design, purchasing, production, service and sales. At the companies represented by the respondents, the outsourcing of departmental functions is unlikely. Only approx. 16 % of the respondents' companies outsource a function or the work of a department, and approx. 5 % outsource more than one department. If a company does outsource a function, it is most likely to be production (44.7 %), followed by R&D and service (both 18.4 %). In more rare cases, sales (11.8 %) or purchasing (6.6 %) are outsourced (cf. Figure 10).

? Which departments / functions are companies most likely to outsource?



! If companies outsource a department or function, it is most likely production.

Figure 10: The most frequently outsourced functions (n = 76).

The need to make changes in product development

The respondents feel that changes need to be made in all areas involved in the PDP. The areas most likely to be considered candidates for change are sales (52.3 %), R&D (43.7 %) and production (35.7 %). Change is also considered necessary in service (30.7 %) and purchasing (26.6 %). The table on Data Sheet 6 shows precisely where respondents from different departments feel change is needed.[11] Overall, the respondents are remarkably self-critical in the following areas:

- In sales (n = 80), change is considered especially necessary in R&D, on par, however, with the sales area.

11 See appendix.

- In R&D (n = 226), change is considered especially necessary in sales, on par, however, with the R&D area.
- In purchasing (n = 10), change is considered especially necessary in sales and service.
- In production (n = 58), change is considered especially necessary in R&D and sales.
- In service (n = 20), change is considered especially necessary in R&D as well as sales. Change is also considered necessary in the service department.
- Among senior managers (n=121), change is considered especially necessary in sales and R&D.

A **need to expand departments** is primarily considered necessary in sales and R&D. There is little need to **reduce or outsource functions**. Production is most likely to be named as an area for possible outsourcing.

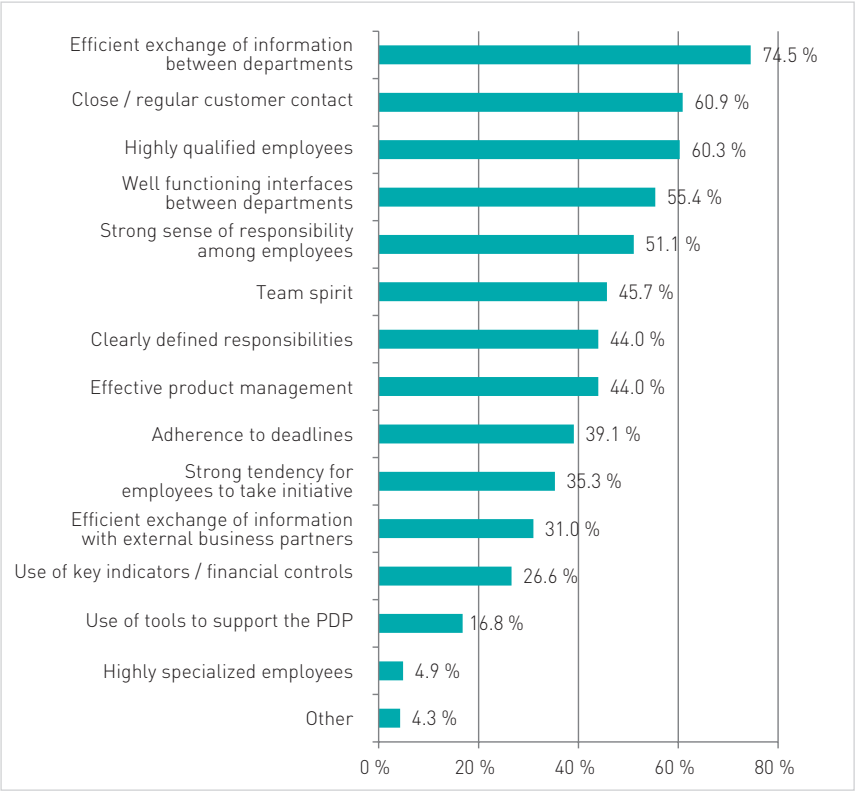
3.2 Key success factors in the product development process (PDP)

The respondents were asked to select the five possible product development success factors from a list, which they consider most important for the PDP to function properly. Figure 11 shows the relative frequency of responses.

The clear number one factor is *efficient exchange of information between departments*. 74.5 % of respondents put this factor on the list of the five most important success factors. Another frequently named success factor, ranking among the top five of the list, is *well functioning interfaces between departments* (named by 55.4 % of respondents). However, the scores for communication, information flows, interfaces and processes indicate that these success factors, in particular, show room for development potential (cf. results shown in Sections 3.3 and 3.4).

Close/regular customer contact is named by 60.9 % of respondents as one of the five most important success factors and thus comes second. As the results of other parts of the survey show, only 45.8 % of respondents described market/user feedback as good (cf. results in Section 3.7, Market and customer orientation).

? What are the most important success factors for the PDP to function properly?



! Almost three quarters of respondents consider the efficient exchange of information between departments to be one of the most important success factors of PDP.

Figure 11: Key PDP success factors (n = 184).

Having *highly qualified employees* ranks third among responses. This contrasts to other parts of the results which show that 70.6 % of respondents consider employees at their company to be *well qualified* (cf. results in Section 3.5 People factors in the PDP). Employees in product management, who play a pivotal role in the PDP, are considered by just under half the respondents (47.8 %) to be good at what they do. This latter finding deserves particular attention, since *effective product management* is seen by almost half of the respondents (44.0 %) to be one of the five most important success factors (cf. Figure 11).

Adherence to deadlines is considered one of the five most important success factors of the PDP by 39.1 % of respondents. However, as the results in Section 3.4 demonstrate (the interfaces and procedures used in the PDP), only 23.8 % of respondents state that internal deadlines are adhered to in the PDP.

The frequently selected success factors include a number of other aspects which indicate that the answers depend on the company culture (cf. Section 3.6 Company organization). Such success factors are:

- *Strong sense of responsibility among employees,*
- *Team spirit* and
- *Strong tendency for employees to take initiative*.

The survey suggests that these success factors are more likely to be named, the flatter the hierarchy of the company. Flat hierarchy could thus, indirectly, be an important success factor for the PDP.

The use of *key indicators/financial* controls and *the use of tools to support the PDP* feature relatively infrequently among the five most important success factors. Other results of this survey do however suggest that tools are actually important to the success of the PDP (cf. Section 3.8 PDP – processes, methods and tools). The respondents who report the presence of seamless IT support in the PDP are also much more likely to state that the PDP is implemented successfully (88.6 %), especially compared to respondents who state that there is no such seamless IT support (56.0 %).

Similarly, the use of key indicators to monitor projects also appears to be relevant to success. Respondents who state that project progress is measured by using key indicators and checked against defined milestones, are much more likely to describe the PDP as successful (91.1 %), especially compared to respondents who do not state that project progress is monitored this way (50.0 %).

Among respondents who rate PDP implementation at their company as *good* or *very good*, the ranking of success factors is broadly similar to Figure 11. However, one factor that is just as important for this sample as the *efficient exchange of information between departments* was the *efficient exchange of information with external business partners*.

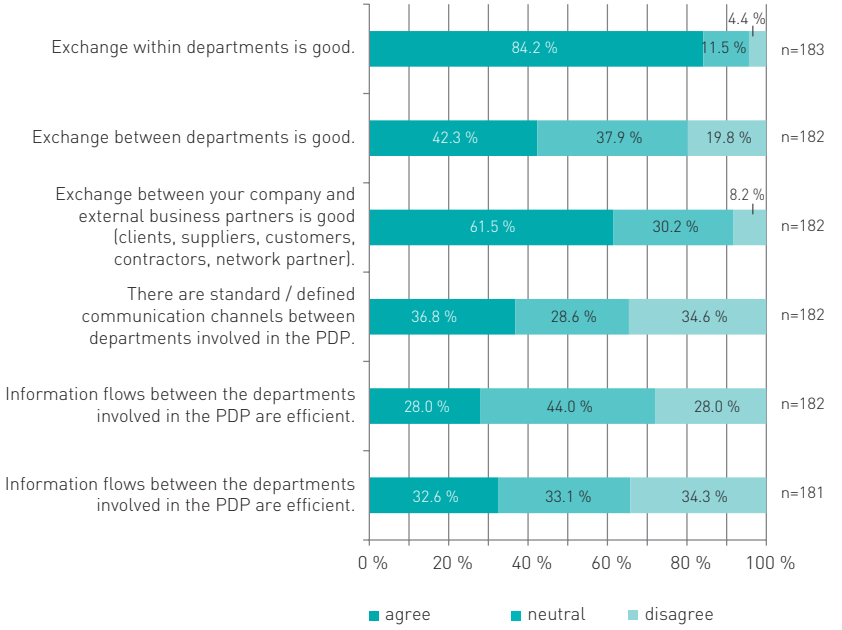
3.3 Communication and information flows in the PDP

The PDP involves all areas of a company. Thus, implementing the PDP successfully hinges on the extent to which companies collaborate successfully between departments, the extent to which the tasks carried out by departments are geared to the common goal of product development, and the extent to which know-how within departments is invested in this goal.

Dividing up operational tasks by setting up departments creates separations within a company which can easily become hurdles in the PDP. So overcoming these hurdles takes targeted measures. It is little wonder, therefore, that three quarters of respondents (74.5 %) consider the efficient sharing of information between departments to be one of the top five success factors in the PDP (cf. Figure 11).

Nevertheless, the survey shows that overcoming departmental barriers in the PDP does not always work. Although most respondents (84.2 %) describe communication within individual departments as good, only around half of this number of respondents (42.3 %) describe exchange between different departments as good. As Figure 12 shows, the respondents state that exchange with external business partners (such as clients, suppliers, customers and network partners) is even better (61.5 %) than exchange between internal departments involved in the PDP (42.3 %).

? What are communication and information flows like in the PDP?



! Only a little more than 40 % of respondents rate the exchange between departments as good or very good. Exchange with external business partners thus achieves a better score (61.5 %) than interdepartmental exchange.

Figure 12: Assessment of issues relating to communication and information flows in the PDP (n = 183).

The importance to success of good interdepartmental communication in the PDP is reflected by the results shown in Figure 13. Respondents who state that interdepartmental exchange is good, are much more likely to describe PDP implementation in the company as *good* or *very good* (94.3 %), especially compared to the respondents who do not rate the interdepartmental exchange as *good* (43.8 %).

Regarding communication channels, information flows and coordination processes, the results expose clear weaknesses in the PDP. Only 36.8 % of respondents describe communication channels in their company as clearly standardized and defined. This is similar to the score for coordination processes between departments, which 32.6 % describe as clearly structured. Only 28 % of respondents describe information flows as efficient.

? What is the connection between a successful PDP and the quality of interdepartmental exchange?

		Question: In your opinion, how successful is the implementation of the product development process at your company? „good" or „very good"	„bad" or „very bad"	
Statement: Exchange between departments is good.	agree	94.3 % (n = 50)	5.7 % (n = 3)	100 % (n = 53)
	disagree	43.8 % (n = 7)	56.3 % (n = 9)	100 % (n = 16)

! Respondents who state that interdepartmental communication is good, very frequently describe PDP implementation as good or very good (94.3 %).

Figure 13: The connection between interdepartmental exchange and the success of PDP implementation.

The importance to success of defined and standardized communication channels in the PDP is shown by the results in Figure 14. Respondents who state that there are defined and standardized communication channels between departments involved in the PDP are more likely to describe PDP implementation in the company as *good* or *very good* (91.8 %), especially compared to the respondents who do not state that such communication channels existed (65.5 %).

? What is the connection between PDP success and standardized communication channels between departments?

		Question: In your opinion, how successful is the implementation of the product development process at your company? „good" or „very good"	„bad" or „very bad"	
Statement: There are standardized / defined communication channels between departments involved in the PDP.	agree	91.8 % (n = 45)	8.2 % (n = 4)	100 % (n = 49)
	disagree	65.5 % (n = 19)	34.5 % (n = 10)	100 % (n = 29)

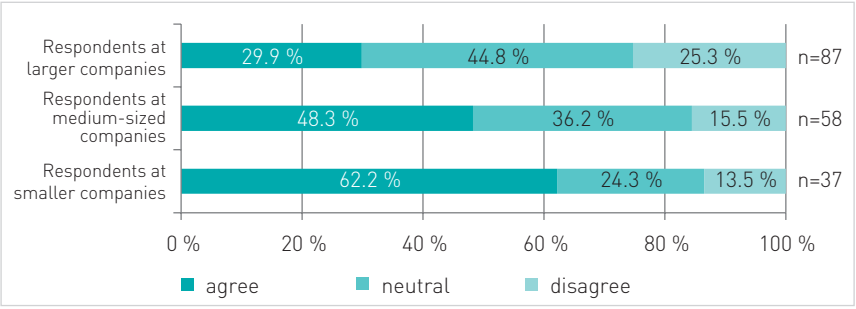
! Respondents who state that there are defined and standardized communication channels between departments involved in the PDP are much more likely to describe PDP implementation as good or very good (91.8 %).

Figure 14: The connection between communication channels and the success of PDP implementation.

Communication and information flows in relation to company size

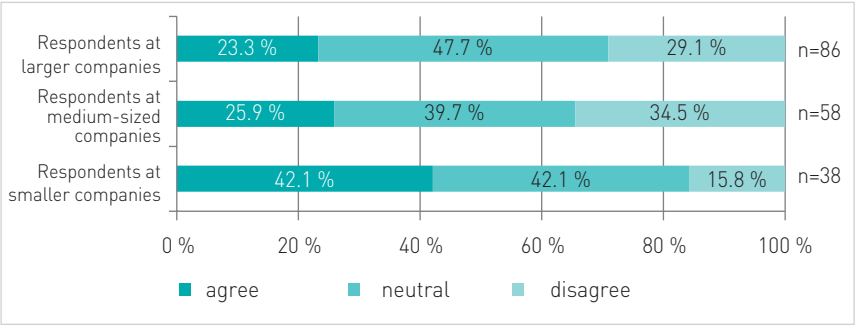
Communication problems between departments involved in the PDP appear to worsen, the bigger the company. Whereas 62.2 % of respondents at smaller companies feel interdepartmental communication is good, only 29.9 % of respondents at larger companies share this opinion. Similarly, 42.1 % of respondents at smaller companies describe information flows between departments involved in the PDP as efficient, whereas only 23.3 % of respondents at larger companies state this (cf. Figure 15).

a) “Exchange between departments is good.”



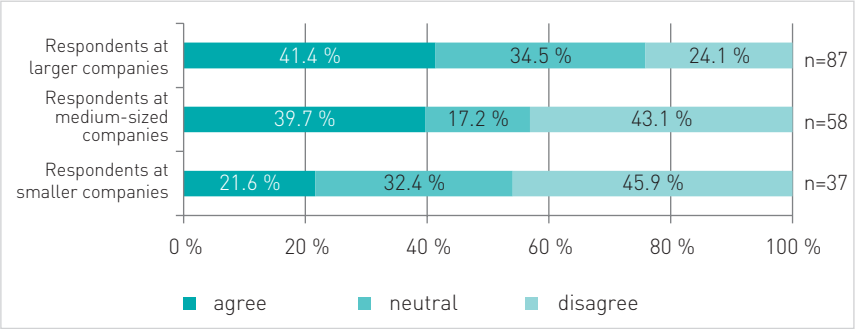
The larger the company, the less likely respondents are to describe exchange between departments as good.

b) “Information flows between departments involved in the PDP are efficient.”



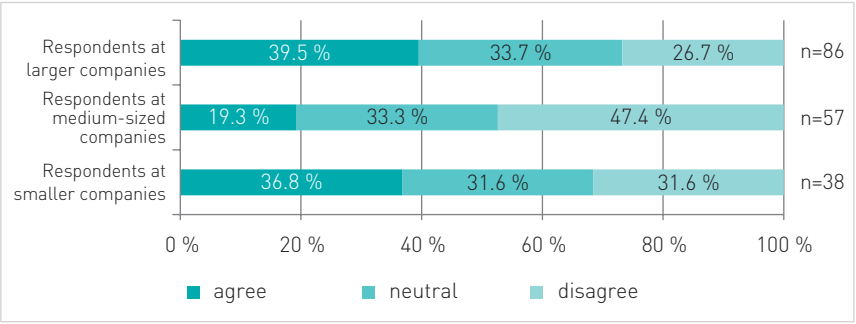
The larger the company, the less likely respondents are to describe information flows between departments as efficient.

c) "There are standardized / defined communication channels between departments involved in the PDP."



The larger the company, the more likely it is to have standardized / defined communication channels.

d) "Coordination processes between departments involved in the PDP are clearly structured."



In medium-sized companies, respondents are least likely to describe coordination processes between departments as structured.

Figure 15: Connection between communication aspects / information flows, and the size of the company[12].

12 Company sizes are categorized as follows here:
"Respondents at smaller companies" = 1–49 employees
"Respondents at medium-sized companies" = 50–249 employees
"Respondents at larger companies" = 250 employees or more

Coordination processes between departments involved in the PDP are described as *clearly structured* by 39.5 % of respondents at larger companies and 36.8 % of respondents at smaller companies. Respondents at medium-sized companies are much less likely to be of this opinion (19.3 % of respondents, cf. Figure 15d). Is there a risk that people at medium-sized companies think they can afford to be a little bit less structured as there may be no serious consequences if they are? Or has it not been possible to adapt coordination processes in the transition from being a small company to a medium-sized company?

Standardized communication channels are more likely to be in place, the larger the company, but they still do not prevent communication problems from becoming worse as a company becomes larger.

The larger the company, the more respondents considered it important to have standardized communication channels and clearly structured coordination processes between the departments involved in the PDP. Larger companies are more likely to have standardized communication channels and structured coordination processes (cf. Figure 15c), but this does not appear to be sufficient to maintain satisfactory levels of exchange and keep information flows in the PDP working (cf. Figure 15a, 15b).

What are the specific communication problems?
Opinions expressed in the in-depth interviews

Some interviewees see the cause of communication breakdowns in the physical separation of departments. This separation creates natural communication barriers and it is more of an effort to communicate. Other interviewees see the cause of poor communication in the growing trend toward e-mail communication. The substitution of face-to-face communication through the exchange of e-mails has a particularly negative effect on PDPs. When trying to describe a new concept, communication does not work along normal lines and it is not enough to resort to standard

vocabulary. Face-to-face discussion is needed to express thoughts, requirements etc. properly during the PDP. But if people replace face-to-face meetings with e-mails, there is a strongly increased likelihood of misunderstandings because the exchange has to be reduced to match the realms of possibility of the written medium.

Communications problems as a result of differing departmental goals

The interviewees point to the fact that communication problems are often the result of departmental goals being unclear to others, or not being coordinated with other goals. This creates different mutual expectations, which were not always explicitly articulated. These kinds of communication problems could be reduced by gearing all departments to common company goals. As many interviewees point out, however, to avoid unclear and / or differing goals, it would not be enough to lay down goals across the whole company. Specific goals should be derived for each department ("What does the company goal mean for us as a department?"). The derived departmental goals would therefore have to be examined carefully to ensure they are mutually compatible. As one interviewee explains, many companies do of course have a defined strategy process so that goals are developed and laid down before being broken down into sub-goals and translated into departmental goals. But time and again, departments draw their own different conclusions from the overarching company goal and then lay down different departmental goals. However, if departmental goals are not coordinated with one another, and the departments do not even know this, there is a risk that false mutual expectations and assumptions may arise, and this may not be evident for a long time in communication. In fact it may only be discovered when it is much too late. The interviewees describe regular workshops that resulted in the successful mutual alignment of departmental goals and clearly defined the course set by different departments to all of the participants.

The interviewees point to the fact that a certain degree of conflict between departmental objectives is quite normal. This is a simple result of the different functions performed by departments and cannot be wholly eradicated through coordination. So even if the goals of two departments are based on the same company goal, due to the very nature of the function of the departments, the implications of the goals could be captured differently. This is quite simply because departments would have different priorities, even if they were pursuing the same goal.

Interviewees also talk about "psychological barriers" between departments resulting from a lack of understanding of the approaches taken by different departments, their working practices and their quantitative targets. These also exacerbate interdepartmental communication. Some interviewees note that it is not so much that departments lack technical expertise, they are simply not attentive to the needs and thinking of other departments. According to the interviewees, at a fundamental level, all departments want the same thing. So it is not as if they do not understand each other. They just do not heed each other's interests and are not **prepared to understand** the needs of other departments. One important starting point lies in continuously making others sensitive to the needs of other departments. Especially applying the tools of efficient product management could help move product development forward along the lines of company goals, independent of departmental thinking.

One possible approach: Strong project teams

36.8 % of the respondents state that their company has standardized communication channels between departments involved in the PDP. Only 32.6 % state that coordination processes are clearly structured. The interview respondents describe positive experiences with **strong, interdisciplinary project teams in the PDP**. These teams are described as interdisciplinary because they consist of employees from different departments, they work across more than one department, and they are independent of departmental demarcations. To a certain extent, they represent a transition from departmental thinking to genuinely process-based thinking in product development. For example, a project team could bring together employees from development, quality management, production engineering, purchasing and sales. "This not only overcomes departmental communication barriers," states one

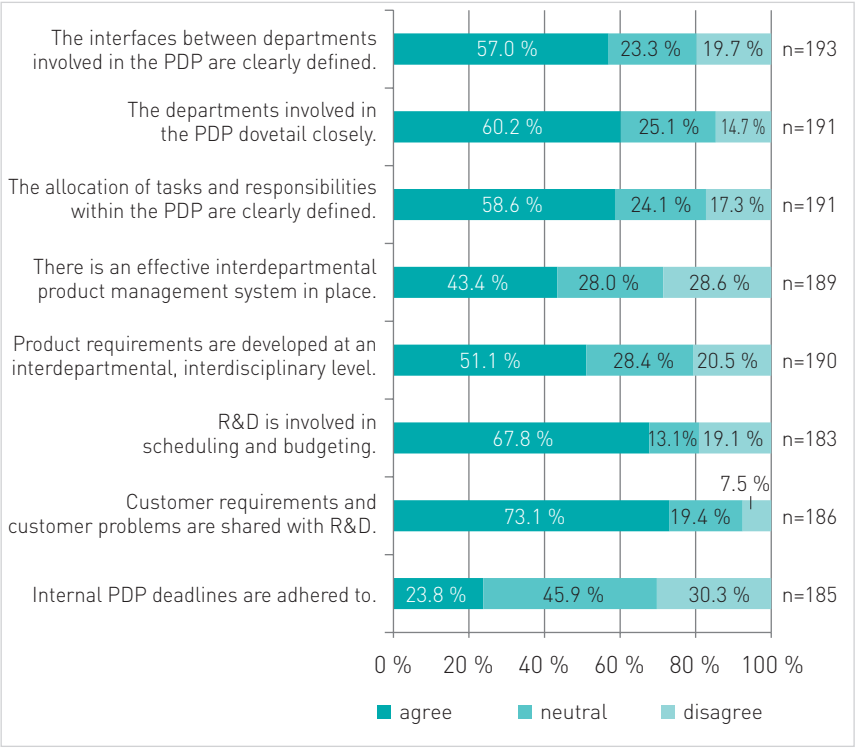
interviewee, “it also turns those affected by product development into a contributor to product development.” The problem caused by an “unwillingness to listen” could thus be avoided from the beginning. Everyone would be pulling in the same direction and people get to know mutual needs and requirements and understand them.

For this concept to work, the interviewees emphasize that one basic requirement is **strong teams**, teams that are in a position to assume responsibility for their actions and could be given plenty of leeway. This would assume that employees working for a team are given enough capacity in terms of time to invest in team tasks. It must therefore be clear to managers that beyond their project team tasks, employees only have extremely limited capacity to take on the everyday workload from their own department. If this were not the case, team members would remain too strongly rooted in their department and departmental hurdles could not be properly overcome by the project team. Interviewees in management also emphasize the fact that senior management should also see it as their task to provide teams with support in these areas.

3.4 The interfaces and procedures used in the PDP

The complexity of product development can be mastered if individual departments take care of manageable parts of the overall process. But the division of labor can only work if the organizational separation of tasks comes hand in hand with well coordinated processes, such that, overall, everything returns to a sensible whole. Figure 16 provides an overview of the survey results on **PDP interfaces and procedures used.**

? What were the interfaces and procedures used in the PDP?



! Less than half of the respondents (43.4 %) state that their company has an effective interdepartmental product management system.

Figure 16: Assessment of issues relating to interfaces and procedures used in the PDP (n = 193).

More than half of the respondents agree with the following statements, and thus the majority feel positive about these aspects: sharing of customer requirements with R&D (73.1 % agreement), involvement of R&D in scheduling and budgeting (67.8 % agreement), close dovetailing of departments (60.2 % agreement), allocation of tasks and responsibilities are clearly defined (58.6 % agreement), clearly defined interfaces (57.0 % agreement), and interdepartmental development of product requirements (51.1 % agreement). Only 43.4 % of respondents agree that there is an effective interdepartmental product management system in place. Yet the existence of an efficient, interdepartmental product management system does not feature among the most important success factors (cf. Section 3.2). This finding is discussed in more detail in Section 3.5 (human factors).

Poor performance in terms of adhering to product development deadlines

An essential part of working together efficiently in the PDP is the ability to meet internal deadlines. As Figure 16 shows, only just short of one quarter of respondents (23.8 %) state that PDP deadlines are adhered to. It was a similar picture across all areas in which the respondents work. Despite this, meeting deadlines appears to be important to the success of the PDP. For example, the results in Figure 17 show that respondents who state that product development deadlines are adhered to, are much more likely to describe PDP implementation at their company as *good* or *very good* (100.0 %), especially compared to the respondents who state that product development deadlines are not adhered to (71.4 %).

Only around one quarter of respondents (23.8 %) state that internal PDP deadlines are adhered to and this is the case independent of the area in which the respondents work.

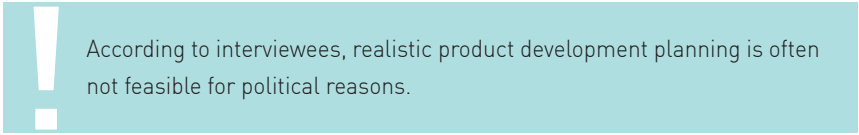
? What was the connection between PDP success and meeting internal deadlines?

		Question: In your opinion, how successful is the implementation of the product development process at your company? „good" or „very good"	„bad" or „very bad"	
Statement: Internal PDP deadlines are adhered to.	agree	100.0 % (n = 34)	0.0 % (n = 0)	100 % (n = 34)
	disagree	71.4 % (n = 10)	28.6 % (n = 4)	100 % (n = 14)

! All respondents who state that PDP deadlines are adhered to, also describe PDP implementation as "good" or "very good".

Figure 17: The connection between meeting PDP deadlines and the success of PDP implementation.

The finding that some companies are bad at meeting PDP deadlines is not wholly unexpected. After all, even the most detailed planning can go wrong with an activity as complex as product development. It can last a long time, involve many different parties and, last but not least, it can largely involve entering new realms, whereby trial and error are a necessary part of the learning process. On top of this, there are totally normal human errors and unforeseen setbacks. This makes it all the more surprising that the majority of interviewees state that such factors are not the cause of poor deadline performance. Instead, it could be observed that product development schedules are regularly prepared that, at the very best, could be described as "optimistic." According to the respondents, once the product idea has been thought of, people quite naturally want to launch it as soon as possible. So there is a tendency to plan product development schedules optimistically and either ignore safety margins or not plan big enough safety margins. For example, according to one interviewee, if a developer asked for a large enough safety margin to be scheduled in, this normally met with opposition from sales, the customers themselves or senior management, and the developer was then basically told to plan timings according to the best-case scenario.



Time-wasting loops in product development

According to the interviewees, almost equally as problematical as optimistic scheduling is the tendency to not work through the PDP sequentially, but to keep getting caught in a loop. Very often, development stages that have already been completed are scrutinized again. People frequently give in to the temptation to revisit improvement potential after the event – and go back to a previously completed stage of development, usually with severe implications in terms of the time and effort needed to make adjustments. This severely delays product development. This need not necessarily originate from someone proposing an entirely new idea, but could simply be the result of a decision made in procurement to source a cheaper component with slightly different features. Given the extra effort, in many cases, it is highly questionable whether making improvements after a stage of development has been completed is actually worth it in financial terms. What is needed in any case is the discipline to go through product development step by step. Getting caught in a loop has, at best, an impact on meeting deadlines, but at worst, it could endanger the profitability of the entire development. So companies would need to be disciplined enough to take ideas and changes into account for future PDP projects rather than integrate these into existing projects. As one interviewee states: "Ultimately, that allows you to fire the starting gun much quicker on the next PDP project."

In this context, many people point to their company's increasing use of Stage-Gate® processes in product development (see box).

Stage-Gate® in the product development process: The Stage-Gate® process divides product development into several stages, each ending with a gate. Each stage is based on logical sections of activity. Before the project team starts working on tasks in the next stage, it checks whether it needs to make adaptations to the current stage before stepping through the gate. If everyone agrees to move through the gate, all previous sections are cast in stone, avoiding time-consuming loops in the PDP between different stages of development, and allowing the team to walk through the development process efficiently.

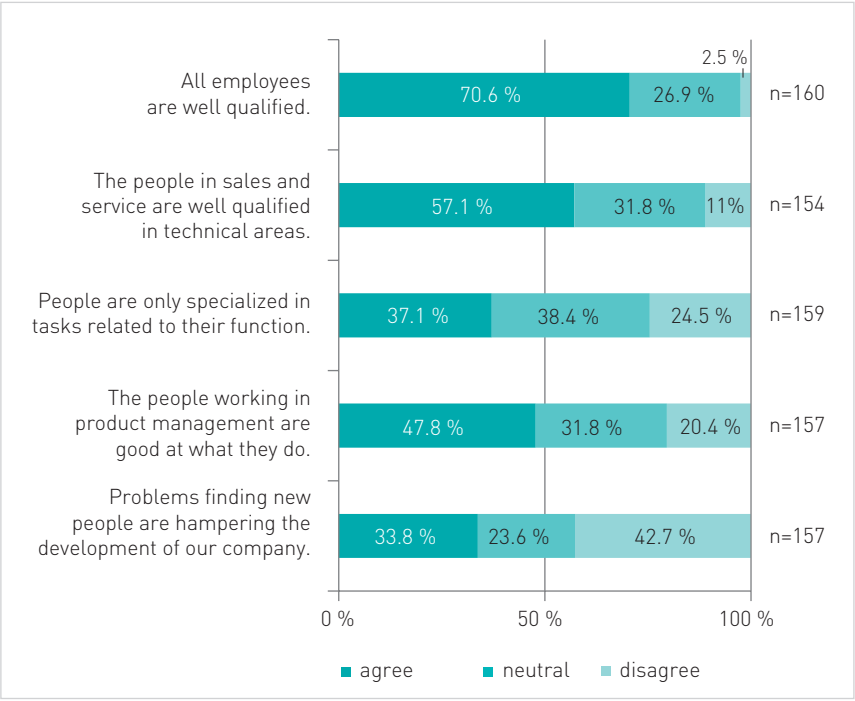
Based on http://www.stage-gate.com and telephone interviews

The interviews indicate that the main reasons companies performed badly in terms of adhering to deadlines is that they are overoptimistic while planning the PDP and are undisciplined when it comes to project implementation. The interviews also suggest, however, that poor deadline performance is also symptomatic of a variety of other problems in the PDP. As already discussed, communication problems between departments involved in PDP can easily result in people holding false expectations and that these remain unknown for far too long. Once these are discovered, it is mostly already too late and the misunderstanding leads directly to delays. Similarly, incomplete or changing specifications can cause delays (cf. Section 3.8).

3.5 Human factors in the PDP and the emphasis placed on personal qualities

The majority of respondents (60.4 %) state that having highly qualified people is one of the top five success factors for the PDP (cf. Section 3.2). 70.6 % of respondents describe the people working at their company as well qualified. Only 2.5 % of respondents do not state this (cf. Figure 18).

? What are human factors like in the PDP?



! Only around half of the respondents (47.8 %) believe that the people working in product management are good at what they do.

Figure 18: Assessment of issues relating to human factors in the PDP (n = 160).

Only just under half of the respondents (47.8 %) believe that the people working in product management are good at what they do. Among the group of respondents at companies with 50 – 250 employees, only around one third (36.0 %) believe this. Nonetheless, all respondents (100 %) believe that having good people in product management is an important aspect of successful product development.[13] Effective product management is frequently (44.0 % of respondents) ranked among the five most important success factors in the PDP.

13 Apart from the evaluation shown in the figure, as part of the survey, respondents were also asked how relevant they believed each statement is.

As Figure 19 shows, respondents who believe that the people working in product management are good at what they do are much more likely to state that the PDP at their company is being implemented successfully (92.2 %), especially compared to respondents who state that the people working in product management are not good at what they do (40.0 %). This finding points to the crucial role played by the people in product management and their importance to the success of the PDP.

? What is the connection between PDP success and people in product management being good at what they do?

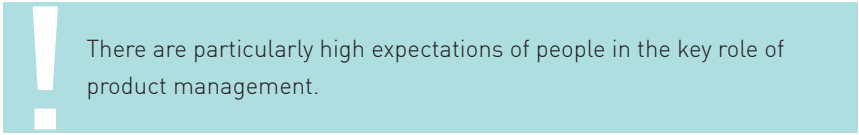
		Question: In your opinion, how successful is the implementation of the product development process at your company?		
		„good" or „very good"	„bad" or „very bad"	
Statement: The people in product management are good at what they do.	agree	92.2 % (n = 47)	7.8 % (n = 4)	100 % (n = 51)
	disagree	40.0 % (n = 8)	60.0 % (n = 12)	100 % (n = 20)

! Respondents who believe that the people in product management at the company are good at what they do, are particularly likely to state that the implementation of the PDP is successful (92.2 %).

Figure 19: The connection between people in product management being good at what they do and the success of PDP implementation.

High demands placed on product management

Although there are many ways to organize product management within companies, ranging from a strong focus on marketing and sales to a close affinity with R&D, product management is often the lynchpin in the PDP between different departments. Interview discussion on the results regarding exchange in the PDP (cf. Section 3.3) suggests why product management is seen as a linking and facilitating element and was so important to the PDP.



One question raised by the survey is why people working in product management are not selected more carefully. A number of interviewees do however state that this finding should not be overrated. Product management occupies a key position within companies leading to high expectations of product managers. Product management is the link between development, production and sales. It needs to keep an overview of production and the product life cycle and should keep a close eye on customers through the sales department or market research. It should define future products and it has to manage profitability. Naturally, meeting these intense challenges is no easy task, making it highly likely that respondents would remember product management actually mismanaging at least one situation.

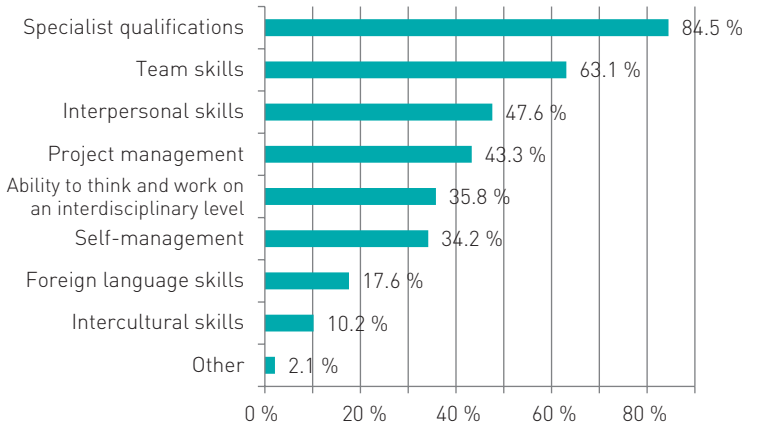
Nonetheless, according to one interviewee, it would be fitting to interpret this survey finding as an indication of the high personal demands placed on product management. This would only be a good thing if people in the company recognized the challenges product managers faced and if this were taken into consideration during recruitment. It is not uncommon to meet quite young product managers who are simply inexperienced in such complex areas of responsibility, which often results in acceptance problems. A product manager would need to know a company extremely well, ideally through personal exposure through previous work in different departments. At larger companies, the work of product management could also be fulfilled by multidisciplinary steering groups consisting of people from different departments. These would be able to input with well-founded expertise and would have the necessary leeway to push the PDP forward and keep the momentum going.

Given the importance of the product management function and the complexity of the product manager's role, the task of product management should really be seen as an issue affecting senior management. As the interviews emphasize, product development is a company task and not the job of an individual department.

Setting company priorities with respect to personal qualities for the optimum PDP

The respondents were asked to choose personal qualities from a list and state which three they believed were the most important for people to possess for the PDP to work as optimally as possible. The results are shown in Figure 20.

? What priorities do companies set with respect to personal qualities for an optimal PDP?



! The respondents consider people's specialist qualifications, team skills and interpersonal skills to be particularly important for optimal PDP.

Figure 20: Priorities set by companies with respect to personal qualities for optimal PDP (n = 187).

Apart from specialist qualifications, which ranks first with an 84.5 % response rate, the most important personal qualities are considered to be team skills (63.1 %), interpersonal skills (47.6 %) and project management skills (43.3 %). These are exactly the kinds of skills that are needed to work at an interdisciplinary level in product management, across different departments.

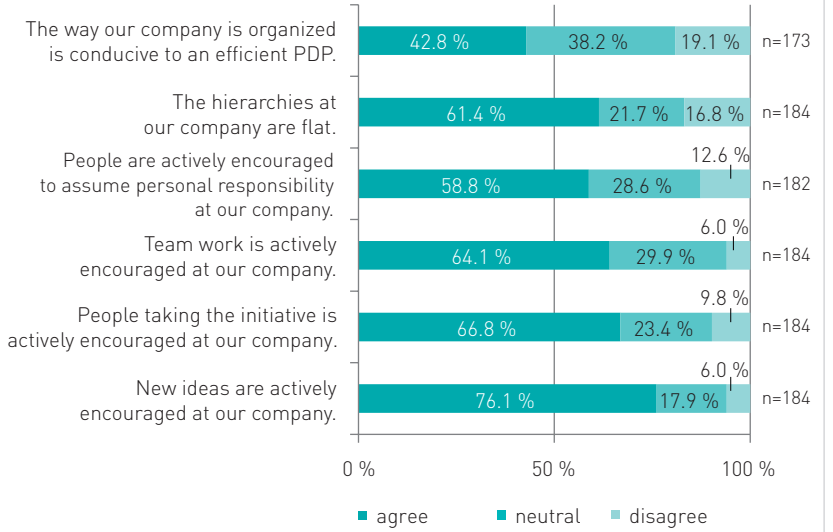
As a result, when recruiting people to be members of the kind of interdepartmental project teams described above, close attention should be paid to these personal qualities, especially given the role people play in these teams as an interface between different areas. These people do have a role to play in the project team, but they can never be totally removed from their departmental role. To a certain extent, they are caught in the middle. To fulfill the expectations people have of them, it is essential for them to possess personal qualities like team skills, interpersonal skills or the ability to manage projects effectively.

It is also precisely these qualities that product managers are expected to possess due to their pivotal role in the overall development process. As a result, their job profile is marked by high expectations. According to one interviewee, product managers are frequently recruited internally from a different area. This means that people then require special training, as the personal qualities they generally needed in their previous role not as broad-sweeping as they are in their new role as a product manager.

3.6 Company organization

With a score of 42.8 %, less than half of the respondents feel that the organization of their companies is conducive to efficient PDP (cf. Figure 21). The question this raises is which qualities of an organization would be considered good for product development.

? How do respondents rate their company in terms of company organization and culture?



! 42.8 % of the respondents state that the way their company is organized is conducive to an efficient product development process.

Figure 21: Assessment of statements relating to company organization (n = 184).

The survey suggests that the nature of the company hierarchy is a determining factor. Respondents who describe the hierarchy of their company as flat are particularly likely, at another point in the survey, to state that the way their company is organized is beneficial to the PDP. Respondents who state that the hierarchy of their company is not flat are much less likely, at another point in the survey, to state that the way their company is organized is beneficial to the PDP. Instead, they are particularly likely to state that the way their company is organized is not beneficial to the PDP (cf. Figure 22).

? What degree of hierarchical structure is particularly beneficial to the PDP?

		Statement: The way our company is organized is conducive to an efficient PDP.			
		agree	neutral	disagree	
Statement: The hierarchies in our company are flat.	flat	56.5 % (n = 61)	33.3 % (n = 36)	10.2 % (n = 11)	100 % (n = 108)
	neutral	25.7 % (n = 9)	51.4 % (n = 18)	22.9 % (n = 8)	100 % (n = 35)
	not flat	14.3 % (n = 4)	25.7 % (n = 10)	50.0 % (n = 14)	100 % (n = 28)

! Respondents who state that the hierarchy of their company is flat are particularly likely to state that their organization is conducive to the PDP (56.5 %).

Figure 22: The relationship between hierarchical structures and conduciveness to the PDP.

From this, one could conclude that flat hierarchies are conducive to the PDP. This would be a plausible assumption for a number of reasons. Especially in product development, which fulfills an interdepartmental role, hierarchical structures are not always optimal. According to the interviewees, flat hierarchies would not only make it possible to improve interdepartmental exchange, they would also be particularly beneficial to the PDP because information would flow more freely and decisions could be made more flexibly. So they would facilitate frequent and quick coordination processes, making it possible for PDPs to function more smoothly. This would apply in particular at the beginning of the PDP. While the need for coordination would ebb to some extent during the PDP, a lot of time could be lost to the concept development and decision-making stage on account of hierarchical structures and protracted decision-making processes.

So are flat hierarchies the best way to organize a company to be innovative and PDP-centric? The tone is particularly cautionary from interviewees in senior management positions. Without a doubt, flat hierarchies do have benefits for the PDP. But the flexibility gained with flat hierarchies comes hand in hand with raised complexity. The flatter the hierarchy, the more not only managers but also all kinds of employees need to be good at organizing so that they do not loose track of things. The ability of hierarchical levels to reduce complexity reverts back to each individual employee. There is thus a strong onus on employees to have the courage to make decisions and possess a broad range of skills.

A number of interviewees who state that they work in very hierarchical companies point to certain benefits of hierarchical structures for the PDP. Hierarchies force people by necessity to plan product development carefully, something often lacking in companies with flat hierarchies. Unlike in flat hierarchies, which allow people to bank on certain levels of flexibility, in more pronounced hierarchies, people have to define in advance who should be involved, when, and to what extent, and how things need to be coordinated. As a result, people are forced to inform and involve others on time. Compared to flat hierarchies, this is thus a more effective way to prevent key points of coordination being missed. In this respect, hierarchical structures could indeed be conducive to the PDP, as they force people to plan properly. One interviewee explains that the typical focus large companies place on processes may frequently be considered a hindrance, but that it could actually be beneficial to product development.

Other interviewees at large companies counter that, at their company, they deliberately avoid having to run PDP projects within conventional company hierarchies. For example, the previously mentioned interdepartmental project teams are used to sidestep the negative impacts company hierarchies have on the PDP.

The attraction of such project teams lies, in essence, in the fact that they operate on islands in an otherwise hierarchical business structure. For the duration of the PDP, hierarchies are kept as flat as possible to achieve the project's ends. Especially at big, hierarchical companies this was a necessary measure to overcome the drawbacks of hierarchical structures for the PDP.

Other interviewees indicate that the issue of hierarchical structures is not actually a primary concern for the PDP. Instead, what is more important is the company culture and style of management, more so than the extent to which a company is strongly hierarchical. As one interviewee points out, if managers were to intervene too much, even the flattest hierarchy would have an inefficient PDP. Conversely, a tall hierarchy could work extremely well if people were given enough leeway. Ultimately, the aim should be to make use of **local insight and front-line optimization**, and not attempt to impose ideas top-down. More than anything, it is about clearly defined, communicated and verifiable processes with unequivocal decision-making processes and goals.

Figure 23 shows the survey results for a variety of aspects of company culture that are conducive to the PDP. As the findings indicate, the respondents tend to feel that organizations are better at promoting PDP:

- the more they foster new ideas,
- the more they encourage employees to take initiative,
- the more they foster teamwork,
- the more they encourage employees to assume personal responsibility,
- the flatter the hierarchy (as discussed).

? What is the connection between factors relating to company culture / the way a company is organized and the efficiency of the PDP?

Statements:		Statement: The way our company is organized is conducive to an efficient PDP.				
		strongly agree	agree	neutral	disagree	strongly disagree
New ideas are actively encouraged at our company.	strongly agree	14	14	9	0	0
	agree	2	39	40	13	1
	neutral	1	2	13	13	1
	disagree	1	1	3	1	4
	strongly disagree	0	0	0	0	0
People taking initiative is actively encouraged at our company.	strongly agree	9	10	3	0	0
	agree	8	37	37	10	1
	neutral	1	9	17	11	2
	disagree	0	0	8	5	1
	strongly disagree	0	0	0	1	2
Team work is actively encouraged at our company.	strongly agree	8	8	7	0	0
	agree	8	38	31	9	0
	neutral	1	10	23	14	4
	disagree	1	0	3	4	1
	strongly disagree	0	0	0	0	1
People are actively encouraged to assume personal responsibility at our company.	strongly agree	9	11	5	1	0
	agree	7	28	32	6	1
	neutral	1	15	22	11	0
	disagree	1	2	4	8	4
	strongly disagree	0	0	1	1	1
The hierarchies at our company are flat.	strongly agree	15	22	7	0	1
	agree	1	23	29	9	1
	neutral	1	8	18	7	1
	disagree	0	3	7	7	1
	strongly disagree	1	0	3	4	2

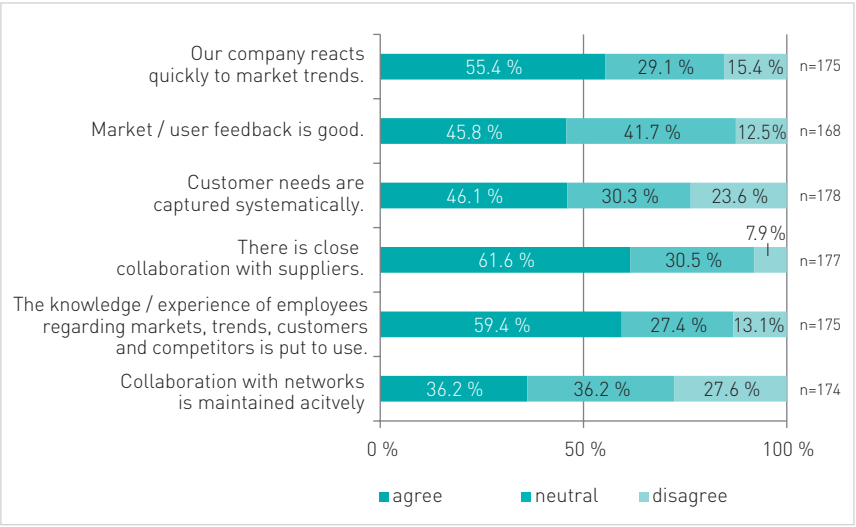
! Respondents consider the way their company is organized to be more conducive to the PDP, the more people are encouraged to come up with new ideas, to take initiative, to engage in team work and to assume personal responsibility.

Figure 23: The correlation between scores for the way a company is organized being conducive to the PDP and factors relating to the way the company is organized.

3.7 Market and customer orientation

New product development ideas or product updates can come from many different quarters. One important source of ideas can be the market, or the customer or user. They represent a treasure trove of experience outside the company and this can provide valuable pointers for future product developments. The extent to which a company is able to capture this information and make use of the experience and needs of users in the PDP dictates the extent to which it is able to satisfy customer needs.

? What are market and customer orientation like at the respondents' companies?



! Companies bank more on the knowledge of their employees than on market / user feedback.

Figure 24: Assessment of factors relating to market and customer orientation (n = 178).

The results in Figure 24 show how respondents feel about different aspects relating to market and customer orientation. 55.4 % of the respondents state that their company reacts quickly to market trends. Although the knowledge and experience of employees is put to use with respect to markets and trends (agreement 59.4 %), it appears that there is a lower tendency to systematically capture customer needs (agreement 46.1 %). So companies appear to bank more on the experience and market knowledge of their employees than on making targeted efforts to gain feedback from the market / users.

92.6 % of the respondents consider it important to acquire good market / user feedback as part of the PDP.[14] Despite this, fewer than half of the respondents (45.8 %) state that market / user feedback is good at their company.

This result raises the question of how much companies actually value market / user feedback. The interviews carried out with people working at manufacturing companies indicate that market / user feedback actually plays a secondary role in product development. According to one interviewee, information from users is relevant to product development but not necessary suitable for setting development objectives. This is primarily because information from market / user feedback is only a representation of current needs. The target outcome of product development should be a product that satisfies future needs. This poses a challenge for companies. They have to find out what product would be best suited to future customer needs and expectations, even though they do not yet know what they are. Product development thus means thinking ahead on behalf of customers.

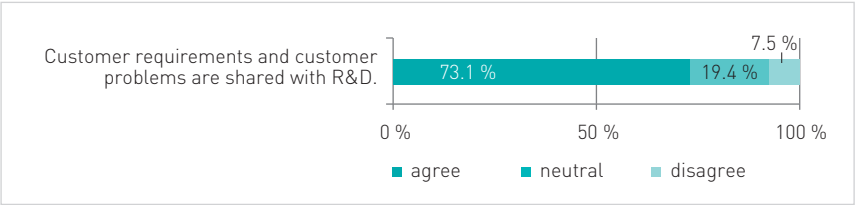
Product development means thinking ahead on behalf of customers.

14 Apart from the evaluation shown in the figure, as part of the survey respondents were also asked how relevant they believed each statement is.

Overall, the fact that market and user information only provides limited insights into the future means that it is of limited use to product development. According to one interviewee, for the same reason, the reverse engineering of competitor products is only of limited use to future product developments. As a result, the PDP must be considered a core part of a long-term company innovation process. As part of this innovation process, companies typically introduce comprehensive tools to lay down a strategic roadmap, in an attempt to capture the medium-term changes in their industry and market, taking into account a variety of information sources. For example, this could be the result of workshops, which were aimed at capturing the opinions of a broad selection of experts to create as reliable a snapshot of the future as possible. Part of the innovation process is also longer-term strategic research or a company's technological developments, which do not primarily revolve around short or medium-term product development objectives. As one interviewee emphasizes, a company's innovation process should by no means culminate in people only developing for future markets. Many of the biggest successes stem from novel products for which there had previously been no demand whatsoever. The innovation process should also benefit from technology pushes derived from R&D activities before the PDP.

It is thus a roadmap, translated into a short-term product development plan (typical timescale: 24 months), that can lay down goals for the PDP, and by no means one-sided information from markets or users, which only relates to the present day. An extensive innovation process is of course especially important if it is not possible to gain user feedback, perhaps because there is no direct contact with users, as is the case with the production of some semi-finished products or for subcontractors.

? Are customer requirements and customer problems shared with R&D?



! Almost three quarters of respondents (73.1 %) state that customer requirements and customer problems are shared with R&D.

Figure 25: Results on information being fed back to R&D (n = 186).

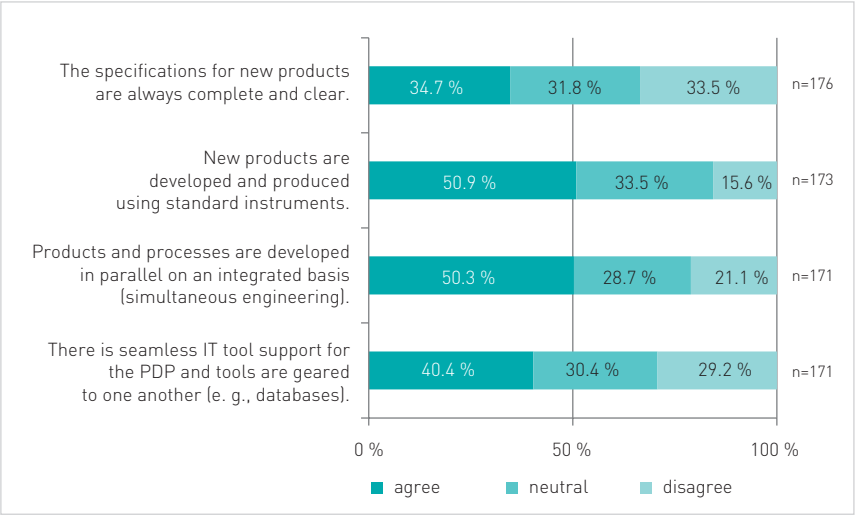
If a company has no established long-term innovation process, including roadmaps, the information from clients or users that is fed back to R&D is of course all the more meaningful. As the survey results show, user experiences, needs or problems actually seem to be shared with R&D (cf. Figure 25) rather frequently (73.1 %). That being said, as the interviewees state, it should be pointed out that feeding information directly back to R&D is not necessarily be desirable. If everyone in sales feeds customer needs and problems back directly to the R&D department, it has the difficult and time-consuming task of working out a clear picture from snippets of information coming from sales. It then has to translate all this information into development goals.

It is not advisable to tie up development resources in such activities. Product management can play an important filtering role in this respect, combining sales information with other sources (strategic goals, roadmaps) and then providing the R&D department with clear development goals.

3.8 PDP – processes, methods and tools

Engineering methods should serve to raise the efficiency of the PDP by tapping into tried-and-tested techniques and providing a useful toolkit for working through the tasks of the PDP. In recent years, a variety of new concepts and methods have been developed, but there are still many classic instruments that have evolved over many decades. What is important for the PDP is that it embraces methods in the right place and for the right reasons.

? What are the PDP processes, methods and tools like at the respondents' companies?



! Only 40.4 % of the respondents state that the PDP is supported by IT tools and that these tools are geared to one another.

Figure 26: Assessment of aspects relating to PDP processes, methods and tools (n = 176).

Around half of the respondents (50.9 %) state that new products are developed and produced using standard instruments. This indicates that companies want, on the one hand, to answer the need for an increasingly shorter time-to-market, and, on the other, they have to deal with stronger and stronger margin pressures. This tallies with another statement: Approx. half of the respondents (50.3 %) state that they develop products and processes in parallel, on an integrated basis (simultaneous engineering). As a rule, companies are thus also pursuing the pressing goal to answer demand for shorter delivery times and, at the same time, completely fulfill complex requirements across the board for the products that are needed.

Incomplete or unclear product specifications

As the survey shows, only around one third of the respondents (34.7 %) state that new product specifications are always complete and clear and 95.1 % consider this a matter of importance.[15] The interviewees do warn that the concept development phase is often not taken seriously enough. At the beginning of product development, there is a lack of discipline, which could prove costly later in the process. One interviewee states that the duration of product development and the ability to hit deadlines could be improved substantially, if the development department were willing to only embark on development work once all key information is available. "Better to have a concept development phase of six months and an implementation phase of six months, than a concept development phase of four weeks and an implementation phase of three years on account of the concept being continually adapted," states one interviewee. It should therefore certainly be avoided that development is embarked upon with incomplete information and then hauled back or continually corrected because new information is only supplied bit by bit. Without clear information, development should not be set underway.

If the product development were intended for a customer-specific product, that is, not a mass-market product, then the sales department would play a particular role in the early stages of the product development. People working in sales have to be aware that they have the task of ensuring that client specifications are complete. This necessitates detailed communication between the customers and sales, whereby sales

15 Apart from the evaluation shown in the figure, as part of the survey, respondents were also asked how relevant they believed each statement is.

has to work step by step through the relevant specifications in a dialectic process with the client. The interviewees emphasize that customers can never be expected to draft specifications by themselves and sales also needs a thorough understanding of the R&D department's needs. A starting point is thus to continually sensitize people working in sales to the need for information in R&D. Ideally, the salesperson visiting the client should be accompanied by somebody from the R&D department to ensure that all relevant information is captured and is thus available for product development.

Changing specifications

Many interviewees highlight the fact that incomplete or unclear specifications are only part of the problem. Changing specifications are just as problematical – given the well-known rule of thumb that changes in product development are more costly or time-consuming, the later they crop up in the development process. Nevertheless, as many interviewees point out, specifications are inherently likely to change. Whatever is being developed will ultimately be new, so this introduces an element of uncertainty to the PDP, and, as a result, not everything can be understood or describable. According to one interviewee, it may be feasible to assume that if a specification turns out to be complete after the fact, then perhaps it is not as innovative a product as initially supposed. On that basis, it should be clear that, to a certain extent, a specification will always evolve. This may be a necessary precondition of innovative product development.

To a certain degree, the changing nature of specifications should be seen as something good, as it is an indication of a learning process, which is an important, if not necessary, part of the PDP. This again underscores the need to plan schedules, not according to the best case scenario, but instead according to a great unknown – improvement – with plenty of safety margins.

The market's role as an external cause of changing specifications

As well as learning opportunities, there are of course also external causes for changing specifications. Specifications are often also a changing entity between the beginning and the end of the PDP because the target market does not stay the same during this time. For example, interviewees describe continual adjustments made to specifications during the PDP as an answer to market changes during this time. This is happening more and more, as innovation cycles are continually becoming shorter in many markets, and change is accelerating as a result. Product development cycles have adapted to this trend to a certain extent, but it has become increasingly difficult to shave off more time. This raises the likelihood of needing to account for market changes during the PDP. According to one interviewee, these days, developers can practically no longer assume that specifications and development goals will stay constant over the entire PDP. If the trend continues toward ever shortening innovation cycles, it can be expected that market-driven specification changes will become more common in the PDP.

According to the interviewees, the best way to deal with changing specifications is to expect them. Complete documentation, capturing plans and changes, are hugely important in this respect, and IT change management tools can help.

IT support in the product development process (PDP)

40.4 % of the respondents state that the PDP at their company is supported by seamlessly integrated IT tools. Given the time and effort needed to implement software throughout a company, this is probably not surprising. It can easily take several years to introduce something like a product life cycle management tool. Nevertheless, as one senior management interviewee emphasizes, the cost-benefit ratio is almost always positive. Mention has already been made of the importance of software as an instrument for dealing with changing specifications in the PDP. When product development needs intensive information flows between different departments, seamless IT support appears to be extremely helpful. Some interviewees even point out that at big companies interdepartmental collaboration would not even be possible without IT support.

? What is the connection between PDP success and seamless IT support?

		Question: In your opinion, how successful is the implementation of the product development process at your company?		
		„good" or „very good"	„bad" or „very bad"	
Statement: There is seamless IT tool support for the PDP and tools are geared to one another (e. g., databases).	agree	88.6 % (n = 39)	11.4 % (n = 5)	100 % (n = 44)
	disagree	56.0 % (n = 14)	44.0 % (n = 11)	100 % (n = 25)

! Respondents who state that there is seamless IT tool support are much more likely to state that PDP implementation is successful (88.6 %).

Figure 27: Correlation between IT support and the success of PDP implementation.

It therefore appears astounding that the survey results indicate that seamless IT support in the PDP is of below-average importance.[16] Is there a lack of awareness of the potential offered by seamless IT support? Other findings of the survey suggest that IT support can indeed be important to success in the PDP: As Figure 27 shows, respondents who state that there is seamless support for the PDP from IT tools are much more likely to state that implementation of the PDP is successful (88.6 %) compared to respondents who state that there is no such seamless IT support (56.0 %).

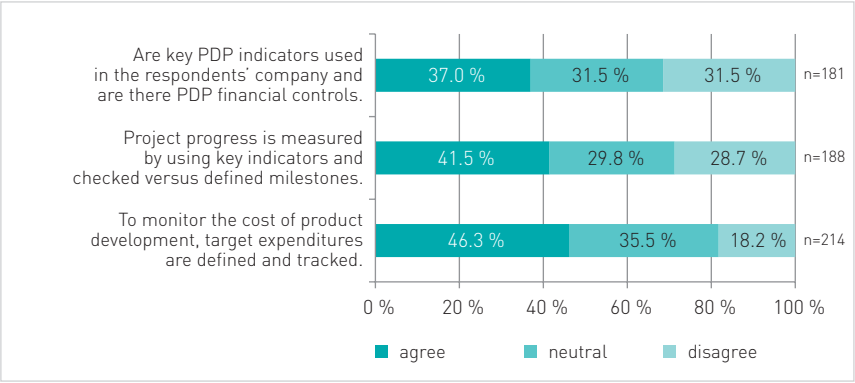
According to one interviewee, it would actually be enough to use non-PDP applications for interdepartmental collaboration during product development. This could be a uniform document management system used in all areas, or jointly used tools based on Office applications. Such relatively general IT tools would allow for the appropriate levels of flexibility needed in product development and they could be upgraded step by step and adapted to special cases. Naturally, as one interviewee points out, such applications would not have the allure of an application-specific, professional software package, but in the same way that hierarchical organizations and procedures could impede product development, inflexible software could hinder the PDP. If the software used did not cover every eventuality, as would probably be the case, one would be forced to revert to other communication channels like e-mail or the telephone. This would then mean that nothing would have been gained from software support, and, at worst, coordination would be hampered. Since many people have probably had such experiences with software, the cautious assessment of the importance of IT support was understandable according to the interviewees.

16 Apart from the evaluation shown in the figure, as part of the survey, respondents were also asked how relevant they believed each statement to be.

3.9 Key PDP indicators and financial controls

An important part of process management is the extent to which the structure of processes and the output of processes are transparent. Key indicators are important tools for ensuring that the output of processes remains transparent. This essentially applies to all company processes, but it is particularly true for the core processes of product development and production – the PDP. Figure 28 provides an overview of the results regarding key PDP indicators and PDP financial controls.

? Are key PDP indicators used in the respondents' company and are there PDP financial controls?



! Only approx. one third of respondents (37.0 %) state that their company benchmarks itself against the most important competitors.

Figure 28: Assessment of statements relating to key PDP indicators and financial controls (n = 214).

Only 37 % of the respondents stated that benchmarks are used to compare their company to the most important competitors. This score is not much higher among respondents working in senior management (45.2 % of respondents). There is a noticeably low proportion of respondents at medium-sized companies (25.5 %) who state this, compared to respondents at larger companies (of more than 250 employees) and smaller companies (fewer than 50 employees), where it is at a similar level with 45.7 %. Interviewees point to the fact that benchmarks are of limited use to product

development and that this is for exactly the same reasons as market / user feedback. Drawing comparisons with the competition is important, but it is only a snapshot of the current situation (cf. Section 3.7).

41.5 % of the respondents state that project progress is measured by using key indicators and checked against milestones. Again, this correlates to the size of the company: The agreement level among respondents at larger companies lies at 63.9 %, whereas this score for respondents at medium-sized companies lies at 28.6 %, and at 25.7 % for respondents at smaller companies. This confirms the results of a 2009 survey of R&D managers which found that approx. one third of respondents had key indicators for the development function / process that they were responsible for, and that these were primarily for personal use.[17] A different study conducted in 2008 showed that approx. 60 % of respondents used control mechanisms for all kinds of different projects they were involved in.[18]

Although only around one quarter of the respondents in this survey (26.6 %) consider the use of key indicators and financial controls to be one of the most important success factors in the PDP (cf. Section 3.2), the survey results suggest that using key indicators actually could be relevant to the success of the PDP. As Figure 29 shows, the respondents that state that project progress was measured by using key indicators and checked against defined milestones are much more likely to state that the PDP is successful (91.1 %), especially compared to the respondents who do not state that project progress is monitored in this way (50.0 %).

17 Voegele (2009).
18 Haufe (2008).

? To what extent does PDP success depend on the use of key indicators to monitor projects?

		Question: In your opinion, how successful is the implementation of the product development process at your company? „good" or „very good"	„bad" or „very bad"	
Statement: Project progress is measured by using key indicators and checked against defined milestones.	agree	91.1 % (n = 52)	1.9 % (n = 1)	100 % (n = 53)
	disagree	50.0 % (n = 14)	50.0 % (n = 14)	100 % (n = 28)

! Respondents who state that project progress is measured by using key indicators are much more likely to state that the PDP is implemented successfully (91.1 %).

Figure 29: The connection between the use of key indicators and the success of PDP implementation.

Only 46.3 % of the respondents state that there are cost controls based on target costs during the PDP and that these are tracked. The proportion of such respondents at large companies is 71.4 %, the number of respondents at medium-sized companies is 41.1 %, and 44.4 % of respondents at smaller companies state this. What this means is that SMEs in particular are less likely to initially establish targets for planned costs during implementation. Costs can only be observed and assessed during the PDP which can thus culminate in higher overall costs. Accordingly, introducing target costs to the PDP can provide more control and help companies save money.

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The German titles of the publications in the bibliography can be translated into English as following:

Ehrenspiel, K.: Integrated Product Development. Carl Hanser Verlag, Munich, 2009.

Voegele, A; Villinger, G.: Missed Opportunities? The Situation Facing Development and Design Managers in Small and Medium-Sized Industrial Enterprises. Steinbeis-Edition, Stuttgart, 2009.

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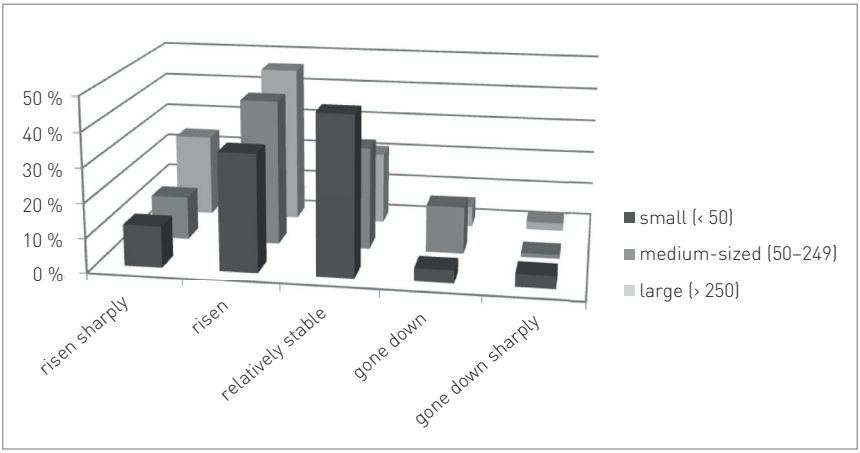
Figures

Appendix

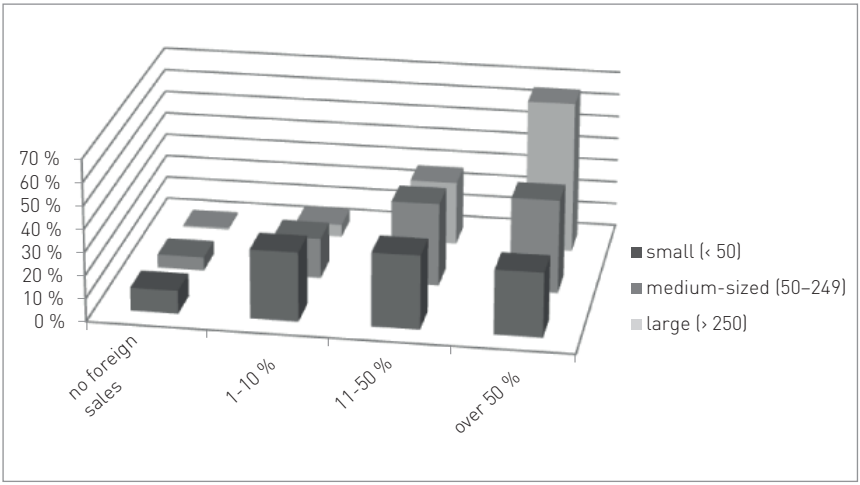
Data sheet 1: Change in number of employees vs. size of company

In your opinion, how have employee numbers changed over the last 5 years?	How many people work for your company?					
	1–19	20–49	50–249	250–500	Over 500	**Total**
risen sharply	4.2 % (1)	19.2 % (5)	12.6 % (11)	6.9 % (2)	29.1 % (30)	18.2 % (49)
risen	33.3 % (8)	34.6 % (9)	42.5 % (37)	55.2 % (16)	43.7 % (45)	42.8 % (115)
relatively stable	54.2 % (13)	38.5 % (10)	29.9 % (26)	27.6 % (8)	19.4 % (20)	28.6 % (77)
gone down	0.0 % (0)	7.7 % (2)	13.8 % (12)	6.9 % (2)	5.8 % (6)	8.2 % (22)
gone down sharply	8.3 % (2)	0.0 % (0)	1.1 % (1)	3.4 % (1)	1.9 % (2)	2.2 % (6)
Total	24	26	87	29	103	269



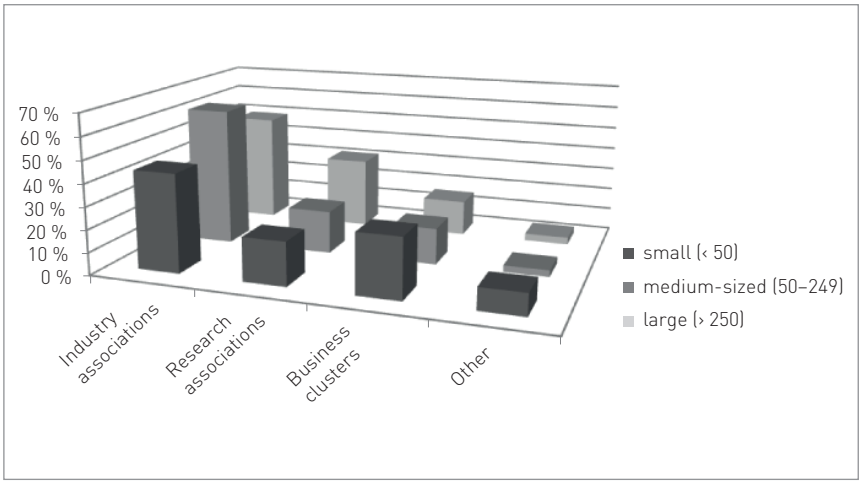
Data sheet 2: Sales outside Germany vs. size of company

In your opinion, what percentage of company sales are achieved outside Germany?	How many people work for your company?					
	1–19	20–49	50–249	250–500	over 500	**Total**
no foreign sales	12.5 % (3)	7.7 % (2)	5.8 % (5)	3.4 % (1)	0.0 % (0)	4.1 % (11)
1 - 10%	45.8 % (11)	15.4 % (4)	17.4 % (15)	10.3 % (3)	4.0 % (4)	13.9 % (37)
11 - 50%	20.8 % (5)	42.3 % (11)	36.0 % (31)	31.0 % (9)	26.7 % (27)	31.2 % (83)
over 50%	20.8 % (5)	34.6 % (9)	40.7 % (35)	55.2 % (16)	69.3 % (70)	50.8 % (135)
Total	24	26	86	29	101	266



Data sheet 3: Involvement in networks vs. size of company

What types of networks is your company involved in?	How many people work for your company?					
	1–19	20–49	50–249	250–500	over 500	**Total**
Industry associations	71.4 % (10)	50.0 % (8)	89.4 % (42)	95.2 % (20)	91.3 % (73)	86.0 % (153)
Research associations	14.3 % (2)	37.5 % (6)	27.7 % (13)	52.4 % (11)	61.3 % (49)	45.5 % (81)
Business clusters	28.6 % (4)	43.8 % (7)	23.4 % (11)	9.5 % (2)	35.0 % (28)	29.2 % (52)
Other	(21.4 %)	(6.3 %)	(4.3 %)	(9.5 %)	(5.0 %)	6.7 % (12)
Total	14	16	47	21	80	178



Data sheet 4: Network scope vs. size of company

In geographical terms, on what scale do the networks that your company is involved in operate?	How many people work for your company?					
	1–19	20–49	50–249	250–500	over 500	**Total**
Regionally	37.5 % (6)	50.0 % (8)	50.0 % (23)	38.1 % (8)	55.7 % (44)	50.0 % (89)
Nationally (Germany)	43.8 % (7)	68.8 % (11)	78.3 % (36)	90.5 % (19)	81.0 % (64)	77.0 % (137)
Internationally	50.0 % (8)	25.0 % (4)	34.8 % (16)	61.9 % (13)	64.6 % (51)	51.7 % (92)
Total	16	16	46	21	79	178

Data sheet 5: Nature of R&D department versus size of company

Type of R&D activities		How many people work for your company?					
		1–19	20–49	50–249	250–500	over 500	**Total**
Does your company have its own research and development department?	**Yes**	66.7 % (16)	62.5 % (15)	59.7 % (43)	92.0 % (23)	96.4 % (81)	
	No	33.3 % (8)	37.5 % (9)	40.3 % (29)	8.0 % (2)	3.6 % (3)	
	Total	24	24	72	25	84	229
Are the products of your company protected by rights?	**Yes**	56.5 % (13)	50.0 % (12)	51.4 % (37)	75.0 % (18)	91.7 % (77)	
	No	43.5 % (10)	50.0 % (12)	48.6 % (35)	25.0 % (6)	8.3 % (7)	
	Total	23	24	72	24	84	227
Does your company regularly collaborate with research bodies (universities of applied science, other kinds of universities, non-academic research institutions, etc.)?	**Yes**	47.8 % (11)	54.2 % (13)	51.4 % (37)	88.0 % (22)	92.9 % (78)	
	No	52.2 % (12)	45.8 % (11)	48.6 % (35)	12.0 % (3)	7.1 % (6)	
	Total	23	24	72	25	84	228
Does your company collaborate with other companies which carry out research and development under contract?	**Yes**	59.1 % (13)	62.5 % (15)	51.4 % (37)	64.0 % (16)	73.8 % (62)	
	No	40.9 % (9)	37.5 % (9)	48.6 % (35)	36.0 % (9)	26.2 % (22)	
	Total	22	24	72	25	84	227

Data sheet 6: Areas of business that respondents work in vs. need to make changes in each area

In which areas of your company do you think changes need to be made?	In which area of your company do you work?						
	Sales/marketing	Research & Development	Purchasing	Production	Service	Senior management	**Total**
Sales	22.5 % (18)	26.5 % (60)	50.0 % (5)	24.1 % (14)	20.0 % (4)	28.9 % (35)	
Research & Development	22.5 % (18)	22.6 % (51)	10.0 % (1)	25.9 % (15)	35.0 % (7)	19.0 % (23)	
Purchasing	16.3 % (13)	14.6 % (33)	10.0 % (1)	12.1 % (7)	10.0 % (2)	9.9 % (12)	
Production	16.3 % (13)	16.8 % (38)	0.0 % (0)	15.5 % (9)	15.0 % (3)	16.5 % (20)	
Service	15.0 % (12)	15.0 % (34)	30.0 % (3)	13.8 % (8)	20.0 % (4)	17.4 % (21)	
No areas	7.5 % (6)	4.4 % (10)	0.0 % (0)	8.6 % (5)	0.0 % (0)	8.3 % (10)	
Total	80	226	10	58	20	121	515

React more and more quickly to customer demands, even though products are becoming increasingly complex, and business structures keep changing. These are the typical challenges companies now face if they want to remain competitive and keep up performance. But to do this, they need an efficient product development process.

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- Are you geared to react quickly and effectively to challenges?

The Steinbeis Engineering Study 2012 sheds light on the factors and conditions contributing to successful product development processes within companies. After providing initial insights into current success factors, problems and possible solutions in the product development process, the aim of the study is to reveal unexploited potential and make full use of this potential.

The Steinbeis Engineering Study 2012 is based on a survey of 280 people working for companies in the manufacturing industry in Germany. The respondents work at companies of all sizes and across all departments involved in the product development process. They provided information on company structures, processes, interfaces and information flows, and last but not least, the role played by individual employees in the product development process. The results of this first-stage survey were then followed up by in-depth telephone interviews with people working for a variety of companies in a variety of departments.

Free publication

ISBN 978-3-943356-76-2

9 783943 356762

www.steinbeis-edition.de

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