Managing Software Products in a Global Context

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ABSTRACT

Follow-the-sun has evolved to follow-the-talent. Managing a product thus has a true global perspective. Products increasingly are developed in virtual teams using agile set-up and gig economy practices. The success of a product or service depends on its product management. Recently software product management has moved closer to software development in its understanding that market decisions have technical impact, and vice versa. This research provides results from an empirical field study with twenty companies on software product management in its global context. The empirical study provides concrete practices to fertilize and evolve software product management in global teams and thus the success of products in terms of predictability, quality and efficiency. We show that with institutionalization of a consistent and empowered product management role, global product development benefits in terms of schedule, quality and duration.

CCS CONCEPTS

• **Software Engineering**

KEYWORDS

Software product management, follow-the-talent, virtual teams, best industry practices, agile development, distributed teams, global software engineering

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1 INTRODUCTION

Follow-the-sun has evolved to follow-the-talent. Software today is developed where there is access to the right competences. Innovation happens where there is the right balance of available talent, market stimulus and efficient processes which ensure that products hit the market just in time [1,2,3,4]. Fig. 1 shows these interdependencies which characterize software development in a global context and its drivers.

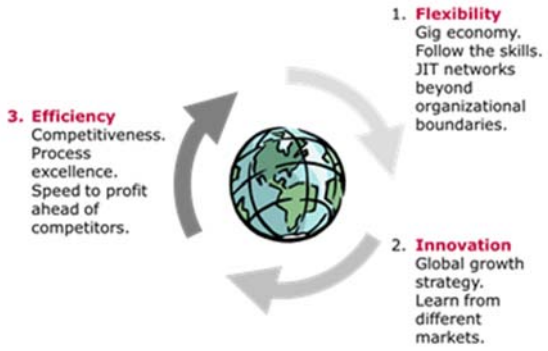

Figure 1: From Follow-the-Sun to Follow-the-Talent.

However, often above mentioned three levers of flexibility, innovation and efficiency are not balanced in their effect. Products are pushed to the extreme to be ever more efficient and done at low cost, but when they hit the market will not sell as expected. Customers demand many changes, thus reducing margins dramatically from initial targets. As engineers, we often tend to overhear the voice of the customer. Technology matters, the schedule needs to be kept, features are lined up like a long shopping list. Poor product management causes insufficient project planning, continuous changes in the requirements and project scope, configuration problems, and defects. The obvious – yet late – symptoms are more delays and overall customer dissatisfaction due to not keeping commitments or not getting the product, they expect. Being late with a product in its market has immediate and tremendous business impacts [1,5,6]. In contract business this often means penalties, and in practically all markets it reduces customer loyalty and the overall returns from sales.

To make a case in point, let us briefly look to some feedback from an industry survey which we have performed in early 2017 [7]. We have been asking 1500 decision-makers in companies in worldwide business-to-business (B2B) context on the top-three challenges that they face. Fig. 2 provides the results of this global industry survey. The horizontal axis provides perceived short-term challenges, and the vertical axis shows more mid-term challenges. Since each reply provided up to three challenges in both dimensions, the sum is more than 100%. The validity is given with a response rate of over 4 percent covering different industries worldwide. It thus represents different B2B business models, but also regions in the world. The result can easily be characterized in its triangular shape of extreme positions. It is what we used to call the "magic triangle" of project management.

Global product development today is challenged on one side with extreme short-term pressure on efficiency and cost [1,5,6,7]. This is indicated by the pole at the far-right side of the diagram where efficiency and cost are by far the biggest short-term challenges. Companies spend huge energy to become faster and stay competitive in product development cost. This evolution towards virtual teams and short-term allocation applies agile set-up and follows evolving gig economy practices. The "gig" aspect as a true game-changer underlines that projects are limited performances with individuals based on available and needed talents. Such pattern of course will change entire product development patterns and processes.

At the same time, innovative products need to be pushed to markets covering the major trends of connectivity on one side representing the more embedded industries such as mobile services, automotive and transport and digital transformation on the other side, representing IT services. Needless to say, that both are converging towards one new software and service industry covering both IT and embedded IoT systems which are connected by cloud solutions.

The real challenge is quality, here emphasized with two major quality drivers, namely safety and security. We have chosen these two because they are pivotal in this converging software industry. cybersecurity is mandatory to ensure reliable and trusted connectivity and related mobile and distributed services. Functional safety represents the growing awareness of product liability where specifically embedded devices must ensure absence of hazards to users and environment. Recent growth of lawsuits in medical, transport and industry shows that functional safety is fast growing in its relevance. Understanding that there is no safety in distributed IT systems without cybersecurity makes this pair of qualities indispensable. Looking at its positioning in our survey shows that it is key soon – but currently there is not enough time.

The downside of any magic triangle is that not all three poles can be perfect at the same time, whether we like it or not. It is important to balance the poles and steer business in the three dimensions of efficiency, innovation and quality. This is where product management meets product development to identify best technical solutions that satisfy market needs.

Product management is the discipline and business process which governs a product from its inception to the market or customer delivery and service to generate biggest possible value to the business [8,9]. Note in this context that while we consistently speak about "product management" this notion and responsibility covers solutions and services equally. A product delivers a tangible value, and that applies to a software service, to a mobile app, and of course to a mobility solution. Product management as a business process overarches and provides leadership to activities such as portfolio management, strategy definition, product marketing and product development. The successful product manager not only masters the life-cycle processes, he is the owner. Note in this context that the "he" format in this text is not pointing to men as genders but men as mankind thus comprising all genders. The product manager must get as early as possible and way before project start a good systems perspective to judge on value proposition and priorities. He balances projects, people and politics. His primary tools are roadmaps, requirements, milestone reviews and the business case.

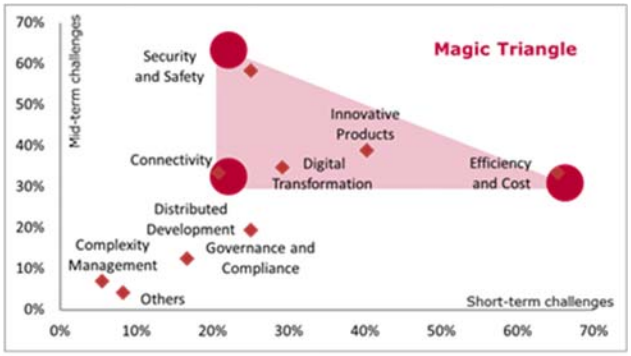

Figure 2: Industry Challenges in Global Product Development.

Obviously, the product manager is not alone but rather orchestrating an often globally distributed core team [3,5,8,10,11]. The product manager asks how to sustain and improve overall business beyond single releases and increments. The project manager oversees delivering one specific delivery or product release in time, budget and quality. He is accountable for business and customer success within a contract project. He manages the project plan and its execution and asks: How do we get all this done? In agile settings, the product owner facilitates a continuous interface from marketing and product management to the development teams. The marketing manager determines how to sell a product or service to create a customer experience. He communicates the value proposition to sales and customers. The marketing manager drives the sales plan and execution and asks: How can we sell more? Fig. 3 shows the interdependencies of above mentioned roles and their mutual impact on value creation.

If the success of a product so much depends on product management, it makes sense investigating best practices from industry context. We wanted to dig deeper and identify the state of the practice in product management and what we can learn from a global software engineering perspective. To this end we conducted an empirical field study with interviews across different Business

to Business (B2B) organizations world-wide on the role of the product manager, its challenges and success factors.

This paper provides results from our survey on global software product management. As a technical solution, we have identified several success factors identified from the research and show how they address the challenges we identified in practice. A concrete case study from the B2B environment which the authors have performed based on these success factors will show how we have introduced and improved software product management, and what was achieved. We found that with increasing institutionalization of a consistent and empowered product management role, the success rate of projects in terms of schedule predictability, quality and project duration improves.

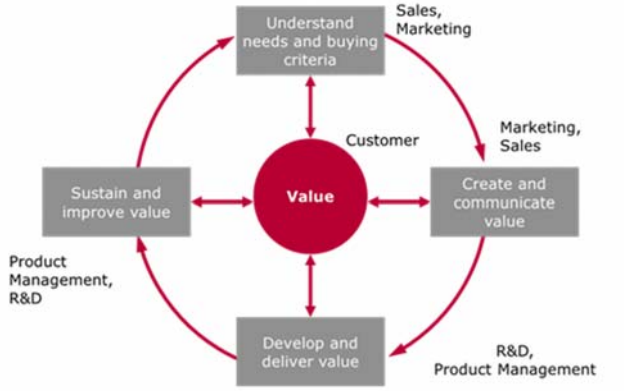

Figure 3: The Value-Creation Chain and Its Players.

2 Product Management Research

Global software development and product management has been the core of our research over many years. We have investigated best practices and the underlying reasons in hundreds of technical products with different origin, development pace and size [2,5,8]. On a periodic basis, we perform surveys of product management best practices with companies around the world [7]. These are companies engaged in software, both IT and embedded to technical solutions, which operate on a global scale. We performed root cause analyses of hundreds of products that underperformed and found similar causes reappearing.

Root causes included business cases that were never re-evaluated, unbalanced portfolios that strangulate new products, insufficient management of new releases and service efforts, and the lack of vision that caused requirements to continuously change [2,3,5]. In working with product managers in many companies around the world we achieved reduction of delays of 20% per year [3]. Explanatory factors for this positive impact of product management include leadership and teamwork, managing risks and uncertainty, mastering stakeholder needs, and accountability towards agreed business objectives and accountability – managed by one empowered person across the product life-cycle. The same holds for efficiency. For instance, we found that with a requirement change rate beyond 20% in a project, productivity falls [5,8].

Let us contrast these observations with related research. A starting point is the ISPMA software product management framework, which serves as a systematic reference point for best practice [8,9], This framework is widely trained and interviews can base upon it for clear terminology. Gorschek et al have looked to several projects and tried to identify some underlying variables to better decide on priorities and implementation [12]. They found that too often some critical stakeholders are overlooked and priorities are given on ad-hoc decision-making. One key reason they identified is that the requirements are described on different abstraction levels so they are not mutually understandable for different stakeholders. The problem is not so much that stakeholders are not known, however that the interdependencies, roles and expectations to requirements are unclear. It is easier to talk to engineers in identifying requirements than to trace needs from various groups to concrete technical requirements. But only this latter approach proves to deliver value from a business perspective. We will show from our field study that insufficient stakeholder collaboration is still a major challenge in product management. Barney et al have been looking to the business side of requirements, how to abstract requirements. They identified the major drivers to prioritize requirements and align with business needs early during elicitation [13].

Gorschek et al have proposed a lightweight greenfield process for product innovation [12] but did not mention in their research that a vast majority of all product management work relates to products in maintenance and service. Aside the individual requirements elicitation and prioritization another field of research in the domain of product management is about roadmapping. Roadmapping is an important phase of the requirements engineering process performed at product level. It is concerned with selection and assignment of requirements in sequences of releases such that important technical and resource constraints are fulfilled. Barney et al have been investigating criteria to select requirements [13]. They used a cluster mechanism to provide priorities and group related requirements according to value. Ruhe provides in his seminal work a good overview on techniques for roadmapping starting with a technology driven roadmap approach and providing techniques and a tool for mapping requirements to the roadmap [11]. Maglyas et al evaluate the usage of lean principles to software product planning [6]. These studies conclude that although many models are available from research, they use similar techniques to address the release planning problem. While several requirement selection factors are covered in the different models, most methods fail to address factors such as stakeholder value or internal value. We found in our empirical study a similar result with respect to specifying value dimensions and getting sustainable stakeholder commitments.

Several industry studies had been performed on software product management and its relationship to global software engineering. Krueger et al had been looking to industry practices and identified several challenges [4]. They took a qualitative approach using interviews at eight software companies. A number of challenging issues were found, including communication gaps between marketing and development, selecting the right level of

process support, basing the release plan on uncertain estimates, and managing the constant flow of requirements. Gorschek et al evaluated requirements engineering practices in light of business models and underlying selection criteria [12]. They looked to product strategies and how they are used to enable early and systematic acceptance or dismissal of requirements, thus minimizing the risk for overloading. Maglyas [6], Weerd [3] and Vlaanderen et al [14] are looking to usage of Scrum and agile or lean techniques to product management and its industry reception. Scrum seems to be the ideal vehicle in small set-ups to relate the frequent iterations in product development to a backlog of requirements which then can be connected to release planning that is the more abstract product management backlog.

Global software engineering causes additional challenges in its distance of culture, as is pointed out by Ebert et al [2,5]. Culture here not only refers to different traditional patterns in region sof the worls, but also companies, as well as role perceptions. Recently with agile development teams, often the role of product owner is confused with that of product manager. Several studies point out the weakness of overloading the product owner with conflicting tasks and expectations in agile set-ups [15,16].

A drawback of several mentioned studies is that most research is done in rather small settings and looking primarily to small and medium-sized software and IT companies. Globally distributed product development is rarely investigated. However, most software product management happens in organizations with very heterogeneous products where software plays a pivotal role (e.g., Apple, Google, Microsoft, Oracle, SAP) or where major software releases are embedded to systems (e.g., GE, GM, Philips, Siemens, Thales, Toyota). We will in our industry survey address this gap and provide insights from these companies with respect to software product management and requirements engineering.

3 Survey on Global Software Product Management

We adopted for this longitudinal empirical industry research a mixed method approach. On an annual basis, we conduct a large-scale survey to industry to capture trends and evolution in the business. This provides us with insights on topics such as short- and mid-term challenges. In this survey, we ask for fixed topics, such as efficiency, digital transformation and globally distributed teams. Participants can also reply with a free answer, which however is only rarely used. On this annual survey with over 1500 recipients globally, we receive typically a reply rate of 5 percent or above. We ask only two major questions, i.e. what are short-term and mid-term trend, making it statistically significant with a 5% reply rate.

Based on this annual survey, we dig deeper in a second phase with a qualitative study using a structured interview approach. This in-depth interview covers companies in direct or telephone interviews. Twenty representative companies had been considered in this benchmark. We selected the companies primarily to represent different industries and have a certain size so that "product management" as an individual role inside the organization would be expected to be known. They all have globally acting business units and diversification across at least two industries in B2B. Their products are software-driven, but often combined with a good share of systems engineering.

The scope of all companies in this second phase survey is software-driven systems, such as in automotive, IT, energy, medical, industry and services. One third of the companies have each over 100,000 employees world-wide, half has 10,000-100,000 employees and the rest are small and medium sized companies with 100-1000 employees. The benchmarking includes companies such as ABB, Bosch, GE, Google, Huawei, Philips, Siemens, etc. Since some of these companies are large and successful in several very different markets with highly distinctive business models, we have split the company in two cases to two data points.

We have been asking a set of defined questions in the form of an interview. The questions were asked in an open way, thus demanding explanations, which could guide us to more questions. All interviews had been done by the same person on our side directly or per telephone. To address a representative audience and avoid fishing for results, we typically asked three types of persons in each company, namely a product manager, a senior executive and a technical manager in development. The latter served as a verification point who could observe the effects and visibility of product management from a rather independent position. In all cases we talked to at least two persons to avoid subjective results when only speaking with one person. If there were differences detected between the first and second interview partner, we addressed those openly. In total, we talked to more than hundreds of persons worldwide. We ensured with this survey method that we received results which we always could validate inside the same company. Questions have been asked similarly in each interview:

1. What is the major market and business model of the company?
2. What size if the company in total?
3. Are there global development teams and practices in most projects?
4. Are agile techniques institutionalized in most projects?
5. Are scalable agile frameworks being deployed?
6. Are development teams working in global set-up spanning at least two continents?
7. What position has product management in the enterprise?
8. What are successful role models?
9. How is the product manager measured?
10. What are the environmental success factors for a product manager?
11. What are the best practices of a product manager?
12. What are the challenges and risks?
13. How product managers selected and what are the typical career paths?
14. How do companies train product managers and grow their skills and competences?
15. Which external standards related to product management are used?
16. Are external certifications used for product management?
17. Would you consider your global product development a success?

Fig. 4 shows how the companies map to different industries. The four segments in this figure had been selected to provide representative mappings. "Systems" comprises companies delivering rather extensive systems with mechanical, electric and of course software and IT components, such as transportation, security or healthcare systems. "IT" includes companies with their primary focus on information technology systems, such as communication and Internet solutions or finance systems. "Services" includes companies with primary focus on IT related services, such as consulting, outsourcing. "Components" finally covers companies with a primary focus on embedded software systems such as electronic components for automotive and IoT.

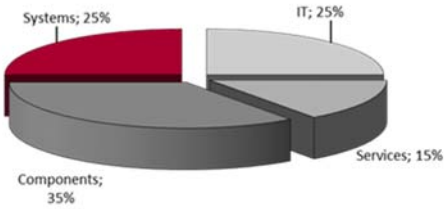

Figure 4: Industry sectors representation in this survey.

In the survey, we did not find any evident influence of company size on the penetration of product management practices and competences. In fact, amongst the best companies were both an industry giant from Asia and a small enterprise in Europe.

Obviously, we investigated the global set-up of teams and product development. 75% of all companies deploy global development teams with a majority having both captive development teams as well as external supplier networks.

Agile development practices are rising fast in usage. 55% of all companies are using agile practices, of which Scrum dominates. Only two companies are deploying scalable agile schemes, such as SAFe and Scrum of Scrums. One has stopped SAFe due to its vast complexity. Several others look towards more light-weight scalable agile techniques which can be used in globally distributed teams.

Fig. 5 provides a mapping of surveyed companies to the usage scheme of product management in a global context. We mapped the introduction and thus "maturity" of an organization's product management according to the typical three steps in the underlying organizational change management, namely foundations (or awareness), pilot (or achieving visibility) and roll-out (or getting to all incumbents). In our industry survey, we found that one third of the companies were already in roll-out, another third was in foundations and initial pilots, and yet another third did not start anything yet. The figures did not change over the past two years since the initial survey had been done, which highlights that a strong and effective product management needs substantial organizational – and individual – change management. This need for professional change management is often underestimated. Many companies still primarily focus on training programs, while not even having a clear responsibility mapping available.

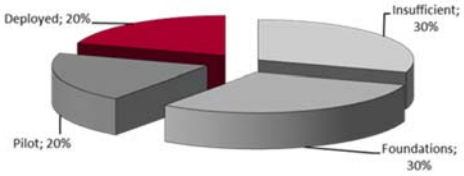

Figure 5: Introduction degree of product management in the companies.

The position of product management varies across companies and often inside a company, from being part of R&D or marketing to being the business manager with profit and loss (P&L) responsibility for a product. The role of "product manager" increasingly evolves towards product and solutions. Other roles such as project manager have much clearer definition and roles. Two thirds see leading global teams as major role model, but also recognize intercultural barriers and thus stay with localized product management teams close to customers. 70% (up from 50% ten years ago) of the interviewed companies have the vision that the product manager is the end-to-end responsible for the success of the product. However, only 30% are actively implementing this vision. This means that about half share the concept of a strong product manager. For the other half, product managers are mostly subordinate to marketing and play an administrative role, such as maintaining technical roadmaps.

Measurements and performance indicators are a key instrument for product managers. All companies measure product managers based on annual targets, such as sales or growth. Mostly objectives are shared within a product team. All who empower the product manager, measure P&L as key performance indicator. However, only one third have actually P&L responsibility delegated to the product managers. The vast majority (over 80%) of a product manager's effort is for managing an existing product, and not for new products and innovations. This means that most effort and skills are used for products in service, which from a software and IT perspective seems natural, but also explains why so much of research topics, which is related to innovation and new products does not arrive in reality, which is related to product service and evolution.

Most product managers in software and IT advance from a technical career and grow into this discipline, lacking any form of formal education. There is no typical career path both into and inside product management. In Europe and Asia product managers mostly evolve from the technical role, such as technical project manager. 30% of the companies practice a systematic competence management and training program. This correlates high with product management success across the interviewed companies.

There seems to be in many companies a vicious circle of insufficient competences and in consequence a weak perception of the role and its incumbents by senior management, which in turn would not strengthen the role. Practice often seems to contradict the

role model of value generation which we introduced above (see Fig. 3). Product management in two thirds of the companies we talked to was not really influenced by product managers for that reason. The difficulties with misunderstanding needs, changing and creeping requirements, missed deadlines and budgetary commitments and failing business opportunities can only be cured with a thorough understanding and implementation of the product manager's role.

The survey identified three major challenges related to global software product management:

1. Insufficient global orchestration with unclear responsibilities and silo work which results in continuously changing focus and schedules.
2. Lack of strategy and unclear strategy and roadmaps with unclear dependencies and vague feature collections, but not mapped to value creation and business cases
3. Lack of software product management discipline, which product managers evolving from technical roles and being thrown into this new responsibility without a clear competence evolution program

Since we found a majority of software product managers with a strong technical background and rather weak finance, marketing and general management skills, they tend to focus on what they know best, namely technical topics, such as requirements specification, roadmapping and architecture design. Looking only to technical aspects might help to master technical projects. However, these product managers are not really pursuing a product management role as we defined it in the introduction. Insufficient handling of globally distributed teams, interfaces to sale sand requirements engineering are typically the first sign of product management failure. Even as they try to specify requirements, they are not developing requirements with other stakeholders. Two reasons are named by the interviewees, namely insufficient exposure and too many technical decisions they must make.

4 Threats to Validity

As in all empirical field studies we need to look to threats to the validity of the results which we have framed in this industry state of the art report. An empirical study is a test that compares what we believe to what we observe. Field studies on the basis of interviews pose the risk that by selecting interviewees or asking specific questions, the interviewer will influence the results heavily. On the other hand, such field studies, when wisely constructed and executed, play a fundamental role in science, because they relate what we see from theoretic articles towards what is actual industry practice. They are a bridge for effective technology transfer. Specifically, they help us understand how product management works in practice, and allow us to use this understanding to further grow the underlying software product management framework. Three aspects of the quality of a field study will be discussed here, namely construct validity, internal and external validity. This section discusses how, and the extent to which, threats to construct validity, internal and external validity are undermining the interview results.

Construct validity observes the quality of choices about the particular forms of the independent and dependent variables. We will look here towards the measurement per se, that is how we obtain results from interviews. The data collection was determined by the standardized questions we have been asking. All questions had been asked by the same person who on one hand has good insight into software and IT organizations and business, and on the other hand had been doing such surveys for over two decades in different settings. The mapping of answers to variables was defined, e.g., the phases in the roll out of the product management competence, or how the "success" of product management in an organization was measured. A key question of course is whether it makes sense looking to product management across different organizations, given that product management neither has a solid underlying theoretical foundation which is taught at universities in a standardized way, nor is it applied equally due to its situational and environmental dependencies, as we pointed out above. All large software projects follow some underlying development process that includes stages such as requirements definition, functional design, unit implementation, integration, and so on. The way in which these stages are conducted, the methods, roles and processes that are used to support them and the rationale for doing so deeply vary. Interviewees were not promised to get immediate access to the results from their peers. In section 5 where we look to a specific case study all data had been gathered electronically from the various underlying operational databases.

Internal validity ensures that there is no manipulation in the data sets and relations between these observations. We will look here specifically to the selection of companies, interviewees and questions. In section 4 we show a set of four success factors in software product management. These could of course been seen as dependent on how companies and interviewees are selected, or how the questions had been asked. We have been selecting companies with respect to their visibility in B2B who can be seen as representative. We had not been in business relationship with the participating organization entities before the interviews. No company which we asked on the first contact refused the interviews, thus eliminating the risk that only good organizations would participate. No organization or person was dropped from the list thus reducing the risk that we select only results which fit to an expected scheme. The interviewees had been selected on two types of contacts, namely people who perform the task and people who observe the task. In some cases we had access to people in the engineering and IT organizations which we know for a while and who we could trust. We used these persons to obtain a confidential judgment how they see product management in their organizations.

As a general observation we found that in organizations that are just starting with systematic product management, there is hardly any positive image of product management. Insufficient focus on systematic product management together with inadequate incumbents shapes a negative picture – which often hinders improvements. Since we did not expect a specific result, such as "product management has improved over the past year", we also avoided the risk of selecting wrong populations. The questions had been asked uniformly exactly following the above-mentioned

scheme. We introduced each interview with a brief description of method and rules, and then made sure that each question was asked once. Order of questions was kept according to the list. Although we attempted an exhaustive search of differences in characteristics across software and IT product management, it is possible that they differ in some way not measured by our analysis. Further study is required to determine to what extent each of these practices actually helps. In section 5 we reduced the risk of inadequate data selection by using a large systems company with global presence and many different products and projects over several years when building the product management competence.

External validity ensures that an observed causal relationship is robust over variations in persons and environment. We will investigate here the impact of interviewees' attitudes and environment on the obtained survey results. Clearly some of the product managers with whom we had spoken could overrate their own role and results, while others could underrate it – both because they expect some effect from it from the interviewer. Also a current business review with a invalid business case could easily trap a senior manager in telling that product management in his organization is immature. These personal effects are difficult to completely avoid. For that reason we introduced the interviews with some rules, one of them being that the person should look towards the past year and carefully avoid distortion by a recent singular event. In one case for instance the business unit was dramatically underperforming and we helped to identify a scenario before the current downturn had started. This means that not all surveys report the current timestamp. Some could reflect indeed the timeframe of the past two years. For that reason, we also repeated some interviews during the past months in order to see what had changed and what remained stable.

5. Growing Your Own Product Management Competence

Often product managers advance from a technical career and grow into this discipline, lacking any form of formal education. There is no typical career path both into and inside product management. In Europe and Asia product managers mostly evolve from the technical role, such as technical project manager. However, these product managers are not really pursuing a product management role as we defined it in the introduction. Rather than formal certification, product management competences must be aligned with what provides value to the business. A product management framework fulfils this demand in providing a framework and individual training modules. It was shaped by working with hundreds of product managers world-wide in different industries [8,9].

Only 30% of the companies practice a systematic competence management and training program. Training correlates highly with product management success across the interviewed companies. External certification is rarely used, as it is, for example, with project managers. The reason is that often the product management role is very much tailored to company-specific needs and constraints. Several senior managers with whom we talked perceive that "there is currently a flood of certification programs which in the end only fill up CVs of people applying for other positions".

As a senior manager with whom we worked pointed out: "We had many so-called product managers which were just promoted from a technical role without a clue about the business needs and the skills they should have." In consequence, they are not content with the role and rather often in our interviews blame "politics" for not achieving their missions. These product managers do not master their role.

Often, we are asked by product managers what they can do themselves to deliver better results. Here is our top-ten list to personally grow as a product manager:

1. Behave like an "embedded CEO"
2. Drive your strategy and portfolio from market and customer value
3. Be enthusiastic about your own product
4. Have a profound understanding of your markets, customers and portfolio
5. Measure your contribution to sales (top-line) and profits (bottom-line)
6. Periodically check assumptions such as business cases
7. Take risks, and manage them
8. Foster teamwork based on lean processes
9. Insist on discipline and keeping commitments
10. Be professional in communication, appearance, behaviors

These ten best practices are applicable for each individual product manager. Having looked at hundreds of industry projects from various domains such as automotive, transport, healthcare and IT systems, we strongly suggest applying these practices to improve personal performance – and thus business results. They depend on each other, so it is not of much value to select only few and disregard the rest. Start using them and you will achieve better results – and more recognition.

5 Product Management Trends

We will finally look to trends in product management (Fig. 6). One part of our interviews always included the specific business constraints and perceived evolution trends of product management in that specific company with its markets. These trends indicate close collaboration between industry needs and research at both universities and enterprises. Product management trends naturally are influenced and determined by external trends that impact our society and therefore buyer behaviors as well as individual needs. Here is the summary which we obtained from the field study. It is sorted according to number of reference points from the twenty companies.

Innovation with market and solution focus rather than technology-driven. Product needs and solutions include service, evolution, integration of business processes and the like. It is about speed to needs. Customers are not interested in features, but in satisfying their needs.

Value creation with customers. Value-oriented engineering will grow rapidly, i.e. improving the evaluation of requirements within a business case from a portfolio management perspective. This implies dynamic segmentation down to the single-buyer segment.

Innovative market rules and business models. For instance, software has such low entry levels that a new competitor is simply a mouse-click away. Friction-free deliveries further add to this competitive trap. Crowdsourcing with networks of stakeholders developing and maintaining components, wikinomics to efficiently get access to and manage big data are two recent examples.

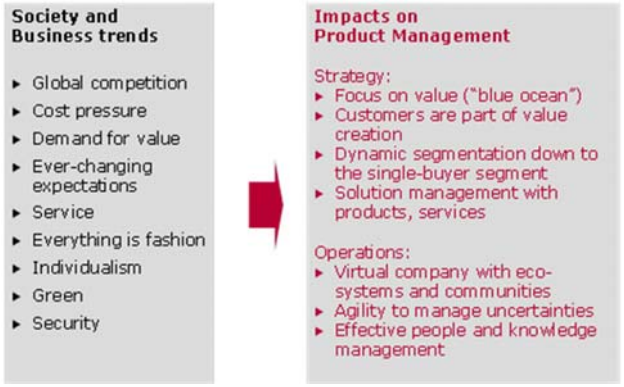

Figure 6: Trends in Global Product Management.

Quality focus. Individual features are long forgotten when excellent product quality is still present. Product management must develop a quality perspective, covering the usage of commercial components, including a variety of partners or suppliers, managing the quality delivered by such external partners, and adapting systems' quality features as business needs change.

Supplier networks and eco-systems. Customers today want to have sustainable networks of suppliers. The traditional concept of supply-chain is disappearing. Suppliers are subject to continuous replacement where necessary. The success of a supplier depends how well he is able to create communities and business models together with customers and other suppliers.

Effective knowledge management. With global development teams and constantly changing markets techniques for capturing the wide-spread knowledge on customers, markets, products and technologies are necessary. Competences and knowledge are our primary assets. Their management must be people-dependent to mature products and product management in an ever-changing environment.

To summarize from our field study on global product management, we conclude two aspects: First and most obvious, product management has evolved from the initial feedback ten years ago when we did the first such study to a key business role in the company. Second and in its consequence equally relevant is that most product managers in global context still do not (!) act as a business owner. We face in many companies a chicken-egg situation where business units would like to empower their product managers and product teams, while at the same time these teams shy away to avoid taking personal ownership. As one of our interview partners at a world leader in automotive and IoT systems had pointed out: "We have the right education program and role descriptions. Our teams increasingly work in agile context. Yet the product managers behave as before and wait until some higher-level business VP acts. There is not enough entrepreneurship visible and this keeps our innovation slow and behaviors somewhat antiquated." Famous philosopher Immanuel Kant once underlined that a person needs to leave the inability of using own power and brain. His rather clear push was "sapere aude!" meaning to use your own capabilities. Such wake-up call is necessary in still many product management teams. Who takes no ownership nor risks will not survive in our competitive business.

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