

Develop products in half the time: lead time reduction in Swedish organizations

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Abstract

This article reports experiences from five Swedish product development organizations, striving to decrease the lead time of the development projects. All companies used different strategies leading to varying results. One of the studied companies managed a 50% lead time reduction, another have similar results within reach. The other approaches has not, or not yet, shown satisfying results. The two winning strategies both required a high degree of top management support, however in different ways. Either the courage to make drastic changes or persistence to continue with an initiative over time seems be necessary.

Keywords: Lead time reduction; product development flow

Introduction/purpose

To remain competitive in a changing market, companies of today need to have a highly adaptable product development organization. Short product development lead times contribute greatly to that kind of adaptability. Finding ways of increasing the process flow is therefore a crucial challenge for most product development organizations of today. In literature, increased process flow in product development is discussed in detail by for instance Reinertsen (2009). His work explains the mechanisms of process flow and defines factors that affect it. State of the art is thus well known, and has been so for several years.

This study investigates state of the practice through case studies in five large Swedish organizations. All of them intend to decrease the development lead times through better flow in product development. How do they approach this challenge, and what prevents them from reaching their targets?

The research question investigated in this study is thus: how do some Swedish organizations approach the challenge of reducing product development lead times?

Research methodology

This work is based on data from four single-case studies and one multiple-case study (Yin, 2003). The multiple-case study consists of 1-2 deep interviews with product developers at 7 Swedish companies. The purpose of the study was to investigate how Swedish organizations work with Lean Product Development and Design for Six Sigma. Results from this study have also been published by Gingnell et al. (2012) and Ericsson et al. (2013). One company from that study has been included in this paper due to the highly interesting approach to lead time reduction. The other four case studies consist of 16-22 deep interviews per company with different roles related to the product development organization. The interviews lasted between one and two hours each. The interview transcriptions were validated by the respondents.

In addition to the interviews, shadowing was used as a means of understanding roles or perspectives (McDonald, 2005). Some internal documentation, mainly covering project models and work routines were also studied.

In all, this paper is based on the experience from 75 interviews and 41 days of shadowing.

Company presentations

The case study companies were chosen as they are Swedish multi-national companies with a traditionally strong development organization. In the following, they will be referred to as companies A-E. The size of the companies is specified in accordance with the definitions of the European Commission (European Commission, 2008).

Company A is a large, multinational company, founded in Sweden. The company develops and produces complex consumer products with a high technology level.

Company B is part of a large global multinational corporate group, founded in Sweden. The studied unit is however autonomous to a high extent, and can be described as a medium-sized company of its own. As a part of the company group, company B can however benefit from some central resources. For instance, part of the early technical development is shared among the sub-units. On a general level, routines and project models of the different sub-units are consistent with each other. Company B develops and produces simple business to business products with a high technological level.

Company C is a large, multinational company, founded in Sweden. The company develops and produces complex consumer products with a high technology level.

Company D is a medium-sized Swedish company. The company is intimately connected to a large, multi-national Swedish company. The development projects of Company D and the large multi-national company are often interconnected with each other. In those cases, company D acts as a supplier of sub-components to the larger company. Company D develops and sources simple business to business products with a low technological level.

Company E is part of a large global multinational corporate group, founded in Sweden. The studied unit is however autonomous to a high extent, and can be described as a medium-sized company of its own. As a part of the company group, company E can however benefit from some central resources. For instance, part of the early technical development is shared among the sub-units. On a general level, routines and project models of the different sub-units are consistent with each other. Company E

develops and produces medium-complex business to business products with a high technological level.

Empirical findings

Company A

The development projects at Company A are executed following a detailed stage-gate process model. The development process is characterized by heavy bureaucracy, which contributes to making the project lead time longer than what is desired. Problems and important decisions are often escalated several hierarchical levels before a solution is agreed upon.

As a consequence of the long lead times, Company A sometimes run the risk of not responding quickly enough to changing demands on the market. This is handled by initiating small high-priority projects focusing on fulfilling one specific market demand. These highly prioritized sub-projects follow a semi-official simplified version of the process model. They are managed by experienced and charismatic project managers with ability to short-circuit decision paths. These projects are often successful, both in terms of fulfilling project goals and staying on schedule. Several persons describe these projects as highly dependent of individuals, mostly the project manager.

A project manager of one of these top priority projects describes this arrangement as well-functioning, arguing that it is a good way of making use of employees with long experience. He believes that years of experience and active participation in many development projects contributes to a highly developed intuition, necessary to tell which parts of the detailed project model that can be skipped through. His many years in different positions at the company have also given him a large social network that enables him to speak directly to the right people. Thereby, he can make sure that everything belonging to his project is treated as top priority throughout the process.

In the standard product development process, top management is reluctant to reduce bureaucracy and delegate decision power downwards in the organizations. The shorter and smoother development process remains an exception.

Company B

The development projects at Company B follow a detailed stage gate project model. The technical developers have more influence on the projects than other roles in the development. Project managers at Company B often have a technical background, or work simultaneously with project management and technical development. Though the company is only medium sized, the hierarchical levels in the development projects are strong.

Company B uses strong product owners to create pull and demand in the development system. They also emphasize performance measurement as a way of keeping project lead times down. They mainly use metrics connected to the lead-time. For instance they measure the lead time of the entire projects, and the time between each process gate. In particular, they measure the time from the initiation of the process to the design freeze.

Several respondents relates that even though they believe that measuring performance can be a powerful tool to affect the behavior of the employees, the ones they currently use, do not seem to contribute much to shorter lead times. Two project managers claim to have hurried through the early phases of projects in order to not get behind schedule, resulting in problems later on in the projects. One of them suggest that

a much better time-focused metric would be to measure the time it takes to solve problems once they have been flagged.

Currently, problems and unplanned decisions are escalated to the steering group of the project. In most cases, this group of people consists to a large extent of members of the company (or sight) board, including the sight manager. Unplanned steering group meetings are thus difficult to schedule and the problem solving process in the development projects therefore takes rather a long time. Project and steering group members alike consider this to be a problem. So far however, no actions have been taken against it. The project manager argue that highlighting this problem aided by measurements might help, and that this would benefit the lead time of the development projects more than measuring the lead time itself.

In connection with this study, it also turned up that the measurements of project lead times had not been carried out in a consistent way. Consequently, no conclusions about changes in lead time can be drawn from comparison with historical data.

Company C

The development projects at Company C follow a detailed stage-gate project model. Only the phase (or phases) closest in time is however planned in detail. The project planning is continuously updated, so that no matter what happens in the projects there is always a present project plan established among the involved functions. Much focus is put on communicating current status.

This and other communication is to a great extent carried through by visual planning. Though the company has many hierarchical levels, information is efficiently shared through the visual planning system. Both top management and employees at operating level confirms that the information sharing works out well.

Decision power is to a large extent delegated downwards in the organization. This responsibility is shouldered mostly by the line organization. For instance, resource allocation is handled entirely by the technical departments themselves, without interference from the project organization.

Several technical departments work actively with leveling out the flow, by decreasing the size of orders and deliveries. A team leader in the line organization describes how they managed to implement this change. She had noticed that the members of her group tended to work extremely hard when a deadline was approaching, while not making the most of the available time when the next deadline was far ahead. This had negative effects on the wellbeing of the group members, as well as on the deliverance accuracy (which is one of the KPI's since a couple of years). She thought that this might be solved, could their deliverances be divided into several but more frequent deadlines.

First, they checked with the function they were delivering to if they could postpone parts of the next delivery. The reaction to this was negative. The team leader understood that delaying parts of the deliveries would always be associated with complaints, as this approach would make the work of their internal customer more difficult. Instead, they started to work more proactively. When asked if parts of planned deliveries could be made earlier than agreed, the answer was yes.

This new way of working started to pay off immediately in terms of higher delivery accuracy and less worn-out group members. Similar initiatives with similar results were noted in other parts of the organization. No lead time reduction on organizational level have however not been traced, as not all line divisions have been included in the initiative yet.

Company D

The development projects at Company D are carried out in close collaboration with their main customer that can be described as their partner or even mother-organization. A representative from company D is involved in the development projects of the customer organization and communicates the need for the type of sub-components that Company D supplies. Company D then develops and delivers these components directly to the development projects of the customer organization. This collaboration is in many ways good. The orders to Company D are however often communicated too late, and they sometimes have troubles to deliver high quality solutions without delaying the development process of their customer organization. Another problem is that the orders most often are met with new product development, resulting in many ongoing projects and an ever-increasing amount of active article numbers.

Company D has lately taken an initiative to reduce their product portfolio to take control over the increasing number of ongoing development projects. According to a technical developer, the project portfolio is so difficult to overview that they often spend time on developing new solutions to a problem that has already been solved. He says that no one at the company has knowledge about all the articles they offer to their main customer. They are way too many, and several serve the same purposes and could have been reused. When solutions are actually reused, this is only due to individual persons in the projects; someone happens to remember about a similar problem in a previous project. Today, almost everything they deliver is developed from scratch.

Another problem is that they often get the development orders from their main customer very late, so that they either have to slow down the development project of their customer or deliver a far from optimal solution. The technical developer describes how this situation forces them to make quick-fixes rather than working out strategic long-term component solutions for their customer. This has been frustrating for everyone involved.

To overcome these difficulties, they are currently investigating how a standard range of products could look like. One of the initiative takers of the project compares the situation with the Pareto principle. He says that 80% of their orders could probably be partly or completely covered by a standard range of products. This will free resources to run improvement projects on the standard range products and assure high-quality special solutions in projects that fall outside of the standard range.

The initiative is not yet completed, but has already started to show good results. The company hopes that this work will shorten the average development lead time with 50% within six years. This is considered a realistic goal throughout the organization.

The main challenge so far has been to explain the purpose of the initiative. Some persons, both internally and representatives from the main customer, have expressed a fear that this will lead to stream-lined product solutions with no or little variety. Employees working with this initiative assure that there is no cause for this fear. The goal is not to take away the possibilities to create something entirely new, but to not run complete development projects that end up in solutions that already exist.

Company E

A few years ago, company E had severe problems of finishing development projects. Top management had become highly concerned about the fact that almost no new products were launched even though the importance of the development work had been highlighted. When they investigated the causes for this they realized that they had more

projects running than they had resources to handle. Phasing what they internally described as a product development crisis they took a drastic decision.

From one day to another, they cancelled or postponed 50% of the ongoing development projects. Recourses from the cancelled projects were transferred to other projects, but in particular, this enabled employees to work in only one or two development projects, as compared to up to five, which had been the case before. Immediate upswings in productivity were reported, and after only a few months, they were able to finish projects that had been ongoing for years. Two years later, they assess that the average project lead times had decreased with 50%. No other major changes that could have caused this improvement were made to the product development process.

Even though positive results were noticeable almost immediately, this transformation was far from easy, and many employees considered the strategy controversial. The product development manager recalls that the most difficult issue was deciding which projects were to keep running, and which were about to be cancelled. Everyone wanted to make sure that his or her project kept going. Finally, top management made an official statement that all projects were important, but that some had to be cancelled none the less, as none of them would otherwise succeed. The project managers were also assured that they could reopening their projects as soon as others had finished. This settled the discussion.

At the time being, the biggest challenge is to have the discipline to keep to the one in one out principle. There are always projects and ideas in line, and it would be very easy to return to the previous situation.

The empirical findings are summarized in Table 1 below.

Table 1 – Summary of case study results

Company	Strategy	Effect	Remaining challenges
A	-Simplified process and project managers with ability to short-circuit decision paths for prioritized projects.	Smooth process flow for prioritized projects. No or negative effect on other projects.	-Highly depending on individuals -Top management reluctant to reduce bureaucracy
B	-Strong product owner to create demand/pull -Emphasis on performance measurement	Unable to detect due to shifting KPI definitions	-Strong focus on functions -Some KPI:s reinforces unwanted behaviors.
C	-Visual communication -Local efforts to even out input and deliveries	Improvements experienced internally, not yet proved.	-Strong focus on functions -More focus on activity status than flow
D	-Reduce number of “quick-fix” projects -Increase number of strategic projects -Reduce total number of projects	Small improvements noticed, large potential if continued.	Establish the purpose and effects of the new way of thinking throughout the organization
E	Radical decrease of number of ongoing projects.	50% lead time reduction proved	Keeping the number of ongoing projects down requires discipline.

Lead time reduction in Lean Product Development literature

According to Reinertsen, the best way of decreasing product development lead time is to focus on achieving a good process flow (Reinertsen, 2009; Blog, 2007), rather than striving to reduce waste in product development (Blog, 2007). Factors that contribute to an increased process flow include good management of queues and pull management (Reinertsen, 2009).

Queues are the biggest single source to waste in product development, as they both slow down the cycle time and jeopardize the quality assurance by slowing down feedback and making handovers more difficult (Reinertsen, 2009). One way decreasing the queues is to make resources more flexible, so that the workload can be balanced over several employees or functions (Reinertsen & Shaeffer, 2005). However, this strategy is not sufficient for situations with large work load variability. There will always be work load variability in product development, but it can be minimized by reducing the batch size; running fewer projects at the same time, and decreasing the size of each project. (Reinertsen, 2009).

Pull management, in other words, to let the needs of the next process step in line rather than detailed planning guide the progress of the development projects, help the organization to focus on what is truly important at the time being (Ward, 2007). Pull management and a high reactivity to sudden changes is facilitated by decentralized control, as it gives the team the possibility to act instantly without going through long discussions and bureaucratic/administrative processes (Mintzberg, 1976; Reinertsen, 2009; Ward, 2007).

Other strategies to keep down development project lead times include working with modularization, and doing more work in parallel. By working with modules on a product platform, the product portfolio complexity can be decreased, without restraining the variability of the final product. More efforts and resources can also be invested in each module, as it will have a longer life time than if it would have been reusable (Cusumano & Nobeoka, 1998).

Process flow and performance measurements

There is no ultimate set of metrics to support a well-functioning product development process. The set of metrics need to be customized based on the contextual factors of the organization the measurement system is applied in (Chiesa et al., 2009; Vanek et al., 2008). Some metrics for flow-based product development have however been proposed. Examples of possible metrics are, among others: queue size, trends in queue size, batch size, number of multipurpose resources and aging of problems (Reinertsen, 2009).

Analysis

The approaches to lead time reduction witnessed at companies C, D and E get support in literature. Getting in contact with the next function in line and discussing when and how they can take deliveries, as some functions at **Company C** do, is a step towards pull management (Ward, 2007). Measuring deliverance accuracy, with the purpose of increasing the trust between functions, is a step in the same direction. The movement towards pull management are further strengthened by the fact that the decision power is being delegated downwards in the organization (Mintzberg, 1976; Reinertsen, 2009; Ward, 2007). The high degree of modularization, though it is not currently under discussion at the company, is also in line with the work of Cusumano & Nobeoka (1998).

Company D wishes to introduce a standard range of reusable sub components. In this, they have started to work with standardization, recommended by for instance Morgan & Liker (2006). The approach is also similar to the platform thinking described by Cusumano & Nobeoka (1998). In doing so, Company D reduces the number of new development projects necessary to fulfil the needs of their main customer. Thereby, they free time and resources to handle the more complicated projects. More resources can also be spent on assuring high quality of the standard range (Cusumano & Nobeoka, 1998).

By reducing the number of ongoing projects, **Company E** managed to decrease the cycle time of each project. As the cancelled projects were promised to get re-opened, the amount of queues in the system remained unchanged. However, only the ongoing projects contributed to active queues that required immediate attention by the organization, the actual number of queues was drastically reduced. The approach of Company E is thus highly aligned with the strategies recommended by Reinertsen (2009).

The approaches to lead time reduction witnessed at companies A and B are not as directly comparable to recommendations in literature. **Company A** lets experienced project managers take short-cuts with highly prioritized sub-projects. Letting projects that would cause great economic (or other) damage skipping parts of the queues can be a necessary way of handling extensive queues (Reinertsen, 2009). However, letting high-priority orders go through a special path have a negative effect on the other projects as it stresses the organization and creates extra work for all involved functions (Rother & Shook, 2003). Another hindering factor for process flow and reduced lead times at Company A is the high degree of bureaucracy and decision escalation. In their reluctance to delegate decision power, the management of Company A actually make the organization less reactive to changes (Mintzberg, 1976; Reinertsen, 2009; Ward, 2007).

Company B's main strategy to increase process flow is to work with performance measurement. Continuous use of metrics could support development flow (Reinertsen, 2007). None of the metrics currently used by Company B is shown to contribute to that purpose in the company. Neither are they mentioned in literature as metrics that would help maintaining a good process flow. To measure the time between flagged problems and agreed upon solutions, as one of the interviewed project managers suggested, is however in line with the recommendations by Reinertsen (2009).

None of the companies have made any efforts to make the resources more flexible, something that improve the flexibility in the entire development organization and help maintaining a good process flow (Reinertsen & Shaeffer, 2005).

Discussion

The five studied organizations all had different strategies to shorten lead times in product development. Out of these, the approach of Company E, to drastically reduce the number of ongoing projects, were the most successful in terms of immediate measurable results. This move would however not have been possible without a committed top management that stayed firm to the decision even when it was internally criticized. This required courage. The reason for the top management commitment in this case was the conviction that something drastic had to be done to change the previously bad finishing rate of the development projects. As for many companies before, whereof Toyota is probably the most renowned example, it was an approaching crisis that made Company E making a great stride forward.

If carried through, the strategy of Company D, to work with a standardized range of sub components, will eventually lead to the consequence as the strategy of Company E: to reduce the number of ongoing new product development projects. This drive is less drastic than the one at Company E, as it can be implemented more gradually. None the less, this requires commitment from people throughout the organization. To succeed, Company D has to show discipline and determination to keep working with this over the next few years.

The strategy of Company C, to increase the pull and flow by levelling out the work loads and communicating about deliveries, shows equal high potential if perused over time. Here, the main remaining challenge is to propagate and align this initiative throughout the organization, which requires a joint effort on organizational level.

Companies A and B have troubles with the balance of centralizing or decentralizing the decision power. In both companies, difficult decisions are escalated high up in the organization. In the case of Company A, detailed information travels through many hierarchical levels, which both takes time and increase the number of handovers. At Company B, though the limited size of the organizations keeps down the number of handovers, the decision process is slowed down as the company board insists to be directly involved in the decision process. If top management would let go of some of the direct control they are currently exercising on the organizations, much could be gain in terms of faster responsiveness to problems and changed condition in the product development.

Company A's solution with special treatment of highly prioritized sub-projects have both positive and negative effects on the organization. Positive, as these projects are often successful. Negative, as these projects obstruct the "normal" development projects. The organization at large has however no incentives to change this arrangement. First, the current system is highly predictable (the special-treated project almost always runs on time or before schedule), which gives the top management a high degree of control. Second, the current system brings about a hero culture, where the people involved in the prioritized projects gets strong positive feedback. None of them would like this to change.

The strategy of Company B have potential, but not in its current form. If they are to pursue the venture of performance measurement, they should review their performance measurement system and critically investigate which metrics helps to drive process flow and reduce lead time, and which metrics that have no or even the opposite effect. There are however many good ideas on how this could be done among the employees throughout the development organization. Company B would probably get their current drive to product development reduce lead times, could they find a way of capturing the good ideas of their employees.

Looking at the five studied organizations, it seems like top management support is crucial, as it is in all improvement work. This support could however take several different forms: the courage to take and stand by drastic decisions, the courage to delegate decision power, persistence over time or ability to align the strategy throughout a large organization.

Summary of paper contribution

This study illustrates the difficulties to approach best practice, even when state of the art is well proven. The case study companies are among the top industries in Sweden; companies that are well established on an international market and have a strong product development tradition. Yet there is a clear gap between state of the art and state

of the practice. If these companies experience difficulties in this aspect, other companies will probably do so as well.

This study constitutes an example base of five different approaches to increased process flow. All of them have good chances of succeeding if pursued over a long time. Each of them however brings about new challenges of their own and requires different actions from the organizations.

The question of which path to choose in approaching best practice is a complex issue. In order to achieve the desired results, either drastic decisions on top management level, or endurance over time is required. Both ways depend on a top management that believes strongly in the initiative. Some sort of top management support –either in the form of courage, persistence or ability to align the organization at large– seem to be necessary for successful lead time reduction.

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