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Lean Monitoring Card

An approach for the multi-perspective evaluation of the success of measures to reduce waste within the frame of Lean Development.

Alexander U. Reik, Dr.-Ing. Stefan Weiß, Prof. Dr.-Ing. Udo Lindemann

Introduction

By introducing Lean Development, companies hoped to significantly increase efficiency in development processes resulting in secondary effects such as sales and profit growth. In 2010 a research project has been launched for piloting and later introducing Lean Development in small and medium sized companies. The draft measures mainly concentrate on reducing wasteful activities in product development, suggesting that identified waste fields may be reduced or even eliminated. Capacities that are freed up this way might be used to shorten certain development activities. This reduces the length of a current project or enables to start with work packages of an upcoming development project ahead of time.

Example: An employee of one of the involved companies states during waste analysis that gathering company specific knowledge on material is very time consuming and inefficient. So far, they have to ask around among their colleagues to find the person who has the required knowledge. This does not only delay the development activity of the searching employee himself but additionally takes up working time of the colleagues involved in the search and consequently time of the colleague in question due to the subsequent knowledge transfer.

Currently, a Best Practices Data Base is set up as a first step to list colleagues with specific material knowledge according to topics. In contrast to approaches such as Yellow Pages, the listed persons set up entries in a second step, describing best practices and problem solutions for each topic, providing easy access to repeatedly asked issues at any time.

The idea of “performance measurement” of this and other LD measures through time controlling , as it is often used in project management with regard to shorter project duration, is seriously questioned by all involved project partners. The experience, AGNESIS Unternehmensberatung (business consultants), also involved in the research project, has gained throughout many years in Lean Development is underlining these doubts.

Content

It is assumed that it will take a certain time and complete introduction for the LD measures to serve their purpose and that time-controlling will not be able to detect any advantage. This underlines the question of the benefit of Lean Development. At the same time there is the question whether the consideration of the effects of Lean Development through time-controlling is sufficient and whether the primary effects of the measure - perceivable by the involved employees - may allow a more important statement with regard to the success of a measure.

Against this backdrop, mulit-perspectivity is required as e.g. realized in the Balanced Scorecard tool. Currently a procedure is worked out, based on this approach and therefore integrating several perspectives. The approach allows making a statement on the primary effects gained in waste reduction creates incentives for continuous improvement of development processes beyond operations and records the positive impacts of the gained effects up to relevant key figures. Being able to look at Lean Development measures and their effects from a multi-perspective point of view goes beyond mere application within the lean context and is relevant for several domains (for example the evaluation of alternative innovation projects or staff decisions).

Lean Development

The aim of Lean Development during product development is to enable to concentrate on the value that should be generated and which will be perceived and appreciated by the customer as well as on the elimination of non-value added activities. Lean Development or lean in general does not represent a completed method but a concept i.e. philosophy. Pending activities should be arranged according to the flow principle to avoid any interruption and allow to continuously improving them [1], [2]. Starting with the success of Toyota Production System (TPS) in the 90's, Lean Production has become a successful and worldwide known example of the Lean Philosophy. Womack et al. defined the five Lean Principles of Lean Production [3]

- value,
- value stream,
- flow,
- pull and
- perfection

These principles are regarded as universally valid and are designed for application in all company departments. However, results in production and development are of different nature and therefore applying these principles in product development is a challenge. Instead of being in charge of physical products or system components, development is mainly responsible for gathering relevant information for the later product with regard to the mode of function and production. Corresponding to lean aspects, the product development process leading to this kind of information will be analyzed by examination of the activities in the process with regard to their added value. According to [1], these activities can be divided into three categories, namely:

- directly value adding
(e.g. dimensioning components)
- indirectly value adding
(e.g. adjusting product features)
- non-value adding
(searching for product data)

Non-value adding activities that take up company resources and cause costs while at the same time do not generate any value to the customer, are called waste and have to be reduced or eliminated at best [4]. Derived from production, waste is subdived into several categories. Table 1 shows waste categories of different authors in the context of product development as well as examples in product development.

Waste can be seen from the perspective of perceived symptoms and their causes. Waste results for example in delays and therefore in a higher demand of resources and time in product development, as shown in figure 1. Only by eliminating the source of waste, product development processes can be designed in the long run as "lean", i.e. be streamlined.

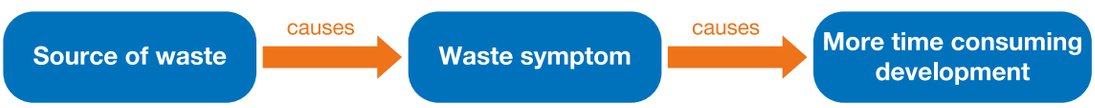


Figure 1: waste chain in product development

Types of wastes	Examples in product development
Overproduction of information	• Two different groups creating the same deliverable • Delivering information too early
Overprocessing of information	• Overengineering of components and systems • Working on different IT systems, converting data back and forth
Miscommunication of information	• Large and long meetings, excessive email distribution lists • Unnecessary hand-offs instead of continuous responsibility
Stockpiling of information	• Saving information due to frequent interruptions • Creating large information repositories due to large batch sizes
Generating defective information	• Making errors in component and architecture design • Delivering obsolete information to following tasks
Waiting of people	• Waiting for long lead time activities to finish • Waiting due to unrealistic schedules
Unnecessary movement of people	• Obtaining information by walking up and down the hallway • Travelling to meetings

Table 1: Examples for the different types of wastes in product development, according to [1], [4], [2], [5]

The Lean Development Project

Lean Development is regarded as having been initiated in some big companies. However, the challenges and particularities that will have to be faced when introducing Lean Development in small and medium-sized companies, are yet unknown. This is why in March 2010 the Department of Product Development of Technische Universität München and KME - Kompetenzzentrum Mittelstand GmbH (center of competence for small and medium-sized businesses) have launched a two-year research project called “Development of a methodology for piloting and successfully embedding Lean Development within SMEs”.

The following companies of the Employers’ Associations for the Bavarian Metalworking and Electrical Industries (bayme vbm) are involved in the research project: E-T-A Elektrotechnische Apparate GmbH, Metz-Werke GmbH & Co KG and Richard Bergner Holding GmbH & Co KG. These companies produce consumer products and capital goods and have between 5 and 100 employees working in their development departments. Products of these companies have a life cycle of 10 to 50 years. Due to competition, the time-span to introduce new product generations gets increasingly shorter. For this reason, partner companies state that their motivation to participate in the research project is driven by the goal to increase efficiency in the processes and activities of their development departments and to reduce the duration of development projects while maintaining their workforce.

AGENSIS Unternehmensberatung, another research partner, has been providing consultancy services for companies of various sizes and in different sectors for many years. Due to the experienced gained in Lean Development the company constitutes an important discussion partner in the research project.

The project concentrates on three key research aspects:

- piloting and implementing Lean Development
- developing possibilities to measure success, and
- guaranteeing long term embedding

Group- and one-to-one interviews served to analyze waste fields in partner companies; depending on the individual company, employees of the development department in operating and leading positions, employees in key functions and members of the management had participated in the survey. In the first instance, the interviews allowed identifying was-

te symptoms primarily perceived by the employees. Further, based on the waste symptoms, sources of waste were identified serving as a basis for setting up Lean Development measures. The individual measures concentrate on different aspects: covering the visualization of various processes in development departments and adjacent areas, certain documents for project specific content and tracking as well as IT-tools for archiving and organizing product data and specific product knowledge. The measures are supposed to make employees more aware of development processes and their individual role within such processes, to enhance faster understanding of decisions and current project status, to shorten the time needed to gather product data and product designs, to shorten product- and material-appropriate product development and to enhance the re-use of developed product concepts.

Problems with Time Controlling

Established controlling tools that are partly used in companies do not entail measurably shorter project duration. The reasons for this phenomenon can be explained by considering the following five aspects:

Lack of comparability of project durations in different project types with different project staff

It is generally conceivable to compare the project duration before and after introduction of LD-measures. However, measuring the success of a project on the basis of the project duration represents a challenge, since the development is usually integrated into a project structure in line with other departments of a company. The impact of other departments on processes in the development department is considered to be very high. This is why the effects of waste-reducing measures would not result in measurably shorter project duration. Even if considering a project that is merely run in the development department, the different project tasks such as

- predevelopment
- new product development
- adjustment development or
- development of variants

result in widely different project framework conditions (6), enhanced by the varying experience and competence of the staff involved in the project. Nippa and Reichwald list further primary factors that have an impact on development times and make it even more difficult to compare projects [7], see fig. 2. Indeed, project staff of the involved companies has repeatedly confirmed that the framework conditions have major impact on the course of the project and significantly impede comparability. Further, unexpected events may also massively affect the planning and the course of projects. For example, new patent specifications or lacking availability of purchased parts leading to complex redesign and impeding comparability.

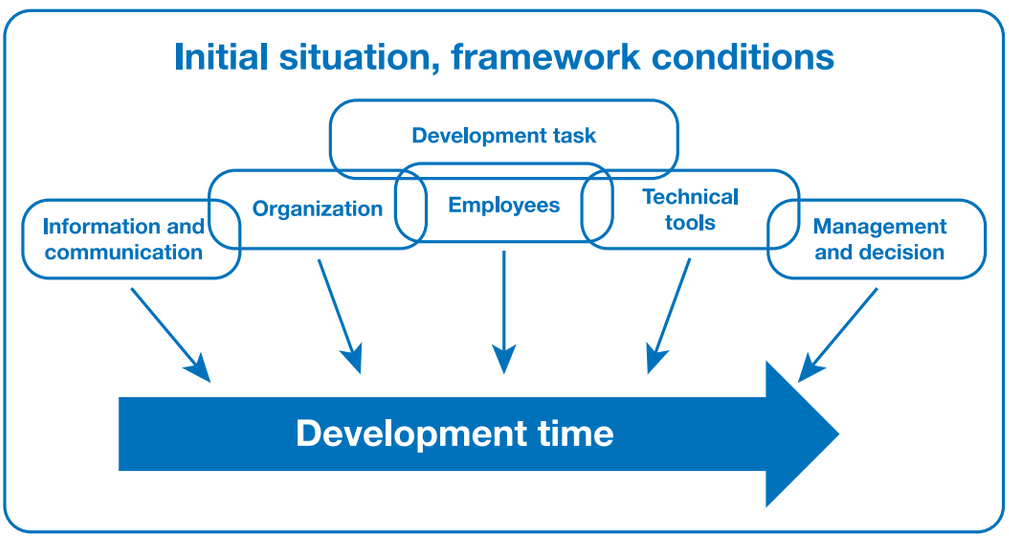


Figure 2: Primary factors influencing development time, according to [7], p. 75

Lack of availability of a data base for comparison of time

If, for a comparison of project durations, the development department could agree on projects with similar framework conditions and thus a higher comparability, still, the required data of previous projects would be missing. Companies observe different parameters within the scope of project controlling. They control either financial parameters, such as the share of sales of a certain project or "project parameters" such as the required time, compare [8], p. 39. However, success-related parameters such as the share of sales have only limited significance for the success of LD measures, since it is difficult to evaluate the contribution of development to a company's success [9]. Most of the time, time-specific parameters such as the project duration are tracked rudimentarily or in projects across departments only. The length of time of individual sub processes in product development and/or included work packages that need to be executed, is unknown. This means that the data basis, required to compare the duration of development projects and included sub processes, is missing, compare [10] p. 178. In a first step, this data would have to be introduced in the individual companies through data collection. If such time-controlling were to be introduced, attention would have to be drawn to the fact that a first set of data needs to be collected as a benchmark of success before introducing LD-measures.

Lack of accuracy of time controlling in development activities

Regardless of the above described difficulties with time comparison of project durations, the actual duration of individual projects can be tracked relatively easy and accurately with the help of milestones or the like and the starting-, finishing-, i.e. completion date. When tracking the duration of development activities or project work packages that need to be executed, the required accuracy represents yet another challenge. Such tracking can be realized for example by using time-sheets as is common practice to control personnel costs in projects.

Companies partly carry out very detailed and project-related time tracking. In contrast, some disapprove of time tracking since they fear that it exerts too much control over their employees. But even project-related time tracking does not lead to the desired results since explicitly the duration of development activities is supposed to be recorded and compared independently of the project to enable making a statement about waste reduction within individual development activities regardless of the current project. It would be advantageous to use a time tracking system that distinguishes between different types of activities, as suggested by Burghardt [8]. It would allow tracking the duration of development activities that are affected by identified waste, for example:

- calculating / dimensioning components
- designing components
- adjusting product properties
- favoring product concepts
- ensuring product properties
- etc.

Employees of the involved companies state that they record their activities respectively the required time at the end of their workday at the earliest or most of the time at the end of a work week. Analyzing the effects of LD-measures, however, requires accuracy which is not sufficiently ensured by such practice, as confirmed by representatives of the companies. This can easily be shown by a closer look on development activities and the waste contained. Some waste categories, for example searching for product data, have repetitive character in development activities, i.e. within a work package. The development activity, however, can be reduced at maximum by what is attributed to waste. The more inaccurate the effort of time in development activities is tracked, the more difficult it is to demonstrate successful waste reduction, see fig. 3.

Lack of objectivity and honesty when naming wasteful activities

In order to address the above described problem of identifying waste, the time tracking approach may be taken up and broadened. The time sheet for recording time effort should provide the possibility to not only write down development activities that are generally regarded as being of value-added character but to record wasteful activities, too. These alterations enable to identify those time efforts that ought to be reduced by means of LD measures. It allows tracking how much time an individual employee, a certain group of employees or the complete development staff is spending on wasteful activities. Once appropriate measures have been introduced, it is theoretically possible by analyzing the time, to see to what extent time effort has been reduced. This would provide a quantitative measure of the success of the LD measures and take away vagueness.

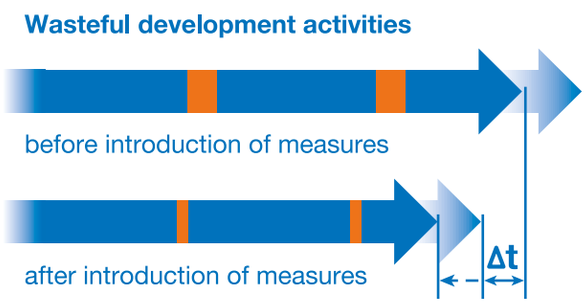


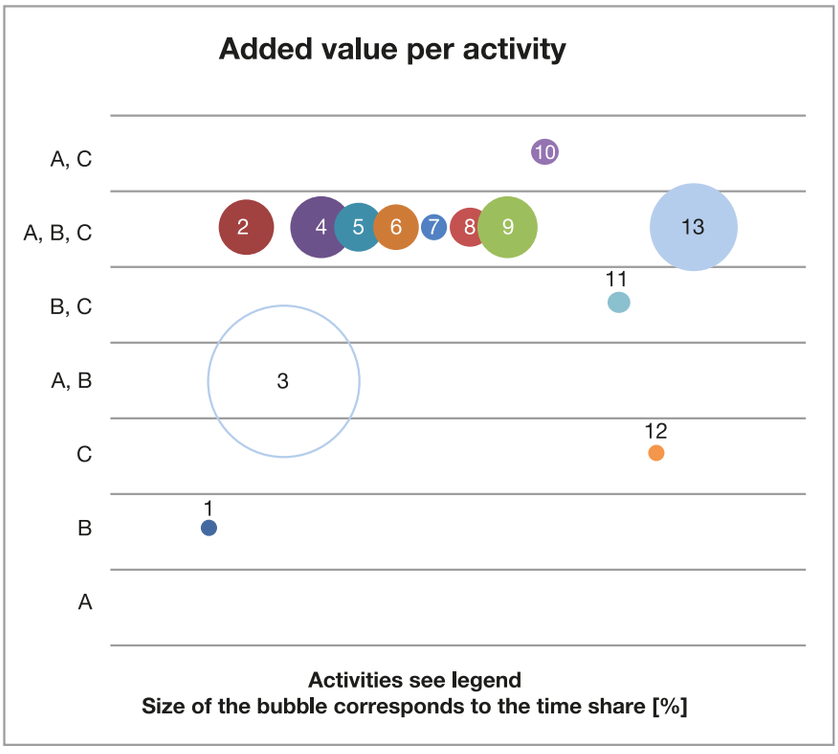
Figure 3: Waste reduction is difficult to prove due to inaccurate expenditure tracking

But considering prospective careers or the respect of colleagues, which employee would be ready to admit having been wasteful? There is therefore a substantial risk that the forms of time tracking will not be filled out truthfully and honesty will not be provided due to understandable reasons. Company representatives think that the above mentioned difficulties of accurate time tracking are even more severe since they don't expect their employees to be very accurate in declaring wasteful activities.

Lack of understanding of the term „waste"

Even if employees in the development department could be convinced that time tracking is a prerequisite to evaluate the success of LD measures and that they need to make truthful statements, the differing understanding of the term waste still represents a problem for a realistic assessment of success. In a first approach of time tracking in one of the involved companies, employees were asked to record the amount of time spent on their activities and to additionally categorize these activities into value added, indirectly value added and non value added. The Lean Thinking Philosophy [11] determines activities that are definitively wasteful, i.e. non value added, for example "the provision of drawings". As shown in fig. 4, employees classified these activities in all three categories ranging from value added to wasteful activities. This leads to the conclusion that even if declarations of wasteful activities are truthfully given and wasteful times are accurately documented it is still not possible to make a clear statement about the extent of waste reduction.

Due to the given factors and considerations, time tracking that is oriented towards reducing the duration of wasteful activities has proven to be difficult and would lead to substantially higher efforts than the mere introduction of LD measures.



Categories of activities:

A Directly value adding
B Indirectly value adding
C Non value adding

Activities:

1. General meeting Development and Design
2. Internal meeting of Development and Design
3. Engineering
4. Emailing
5. Provision of drawings
6. Provision of information
7. Provision of additional specification
8. Answering questions from other departments
9. Maintenance / Introducing into IT systems
10. System availability
11. Test
12. Waiting times
13. Miscellaneous

Figure 4: Result of time tracking of employees in development and engineering design (example)

Discrepancy between perceived and desired effects of Lean Development

The previous section elaborated the reasons why a reduction of the wasteful shares in development activities cannot be proven satisfactorily by means of the time-controlling currently used or about to be introduced in companies. Similar to measures of re-organization, changes that are caused by LD measures are difficult to assess quantitatively or monetarily [12]. However, since – according to project staff and representatives of the companies - it is obvious that there is waste, the effect chain needs to be investigated. First of all, the focus is placed on the effects that are created after having introduced the measures as well as on the differences between these effects. Fig. 5 shows the effects and explains how they are linked with each other.

1. Effect

When analyzing the effects of LD measures, the objects of the measures need to be examined first. Objects of measures are for example how to proceed to check product requirements, control the current project status, provide product information or gather knowledge about material within the company. Within these procedures and their respective characteristics in the companies, elements that are enhancing waste are identified and require changes for the measures to be successful in the end. In this context, the alteration of an object of a measure is considered as first effect and creates the necessary preconditions for a later success of the measure. In IT-supported measures the first effect can be quantitatively shown, for example in the form of an increasing number of digitally saved drawings of construction parts in a drawings database especially set up for this purpose. Further, the number of saved files and the number of files that were accessed in a certain period of time may be displayed. This allows making a first statement about the frequency of use of the database.

Theoretically, it is possible to quantitatively show the first effect in non-IT supported measures such as the frequency of us in an extended process visualization, but it requires substantially stronger efforts by the person responsible for the measure.

2. Effect

If a LD measure turns out to be user friendly, the first effect in the employees' activity results in a second effect in which the symptom, caused by the sources of waste is reduced or ideally completely eliminated. This second effect is an indirect effect and is recognizable by the employees in the development department as a reduction of waste that had been identified in the development activities. In the example of the drawings database, the second effect means that drawings of construction parts can be found faster. In non IT-supported measures this second effect may also occur. All critical product components determined by Quality Function Deployment (QFD) whose development requires more time, may for example, be known at an earlier stage and be more comprehensible for the developer. In addition, this may help to reduce the number of unnecessary iterations in development processes. It still remains difficult to quantify the advantages of the second effect and involves additional tracking efforts. Since LD measures have an impact on the activities of the employees, a positive feedback of the employees is regarded as an indication that is easier to obtain and more significant at the same time.

3. Effect

Employees in the development department can relatively quickly perceive second effects in their develop-

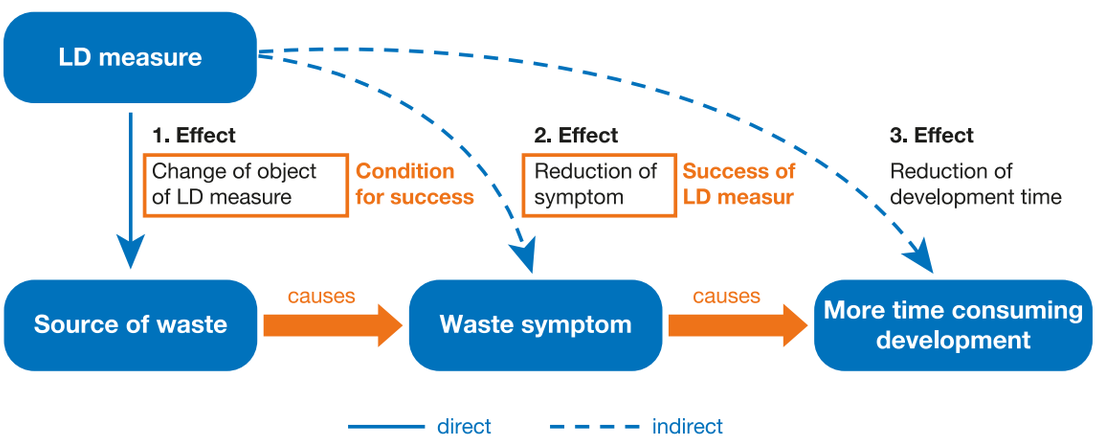


Figure 5: Different types of effects of LD measures in an effect chain model

ment activities or in their cooperation with adjacent departments. Several LD measures jointly lead to a third, equally indirect effect. This third effect is particularly interesting for the development management and higher management levels. The use of the capacities freed by the second effect determines the intensity of the third effect. Fig. 5 shows the third effect with a reduction of development time, corresponding to the main interest of the involved companies. Freed capacities may also be used to start an upcoming development project ahead of time. This increases the number of products that are worked on in parallel which is again in the interest of the companies' management. Consequent competitive advantages such as earlier market launches of the developed products, cost reductions or quality improvements can be anticipated as described by Schmalzer as "economies of speed" in his paper about practical experiences in time reduction [13], p 49. Further, the training of new colleagues in company-specific product development processes, IT- systems or company-specific project documentation can be seen as considerable advantages, particularly with regard to resulting benefits later on.

Discrepancy between the effects

With regard to the evaluation of success of LD measures, the second and third effect should be compared on the basis of a certain waste symptom. When comparing the second effect on the basis of a certain waste symptom, the success of the measures shows in less wasteful activities, a smoother workflow and in an increased time share employees spend on value added activities. Employees can express their observations in semi-quantitative questionnaires in which qualitative statements will be transferred to qualitative evaluation scales, e.g. to an assessment system with grades from one to five. In contrast, the management of companies has expectations on the third effect requiring that success of measures be expressed quantitatively in shorter development times or monetarily in different parameters. However, as elaborated in the previous section, these expectations can only be met to a limited extend. The actual intensity of the third effect and at what point after introduction of the measure it starts developing, depends on how many LD measures have already been implemented and on the scope, frequency and volume of the waste symptoms that are being counteracted by the specific measures. The effect chain model in fig. 5 suggests that there are different perspectives on waste reduction.

Balanced Scorecard according to Kaplan and Norton

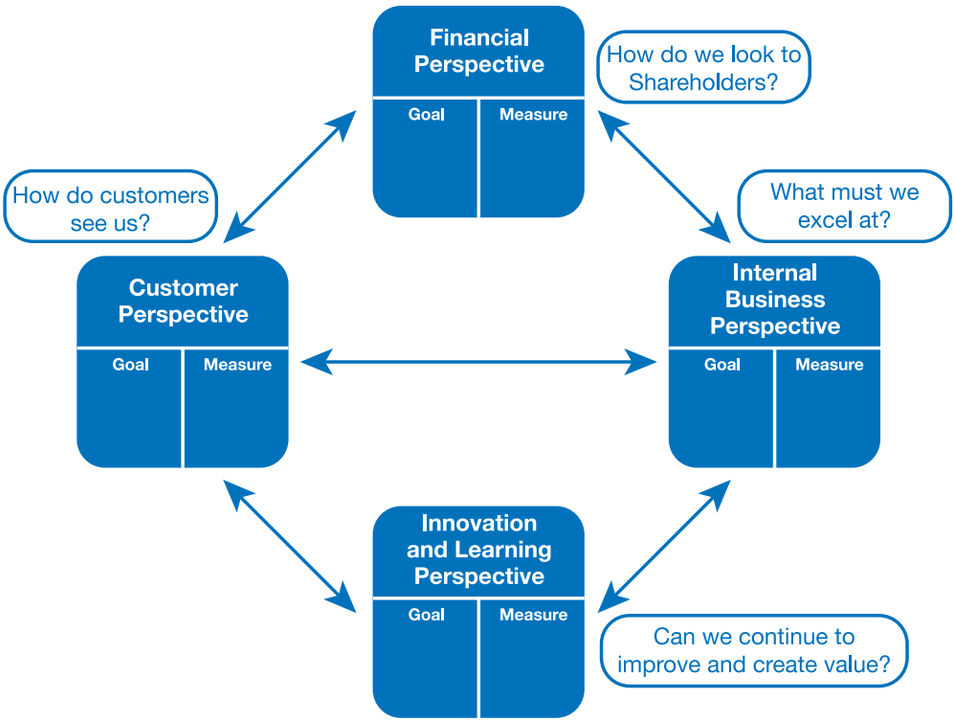


Fig. 6 Balanced Scorecard, according to [16], p. 72

The Balanced Scorecard (BSC) is a management- and controlling concept for performance measurement for multidimensional planning and management of a company as well as for strategy implementation. Its strength is its balanced performance measurement through consideration of different and yet interrelated perspectives [14], [15]. It was established due to the criticism on performance measurement systems that are merely based on financial key figures. Important insights in operational research gained by Kaplan and Norton led to the fact that in the reports on company performance (scorecard) mainly those non-financial drivers are analyzed that result in financial success of the company [16]. The following four perspectives are normally viewed within the frame of BSC (comp. fig 6):

- customer perspective
- internal business perspective
- innovation and learning perspective and
- financial perspective

The balanced character of these perspectives shall guarantee that improvements in one area are not to the detriment of another area. Based on the company strategy, target figures are generally determined for the individual perspectives and compared with the output achieved by the company. According to [14], [16], [17] the perspectives are attributed figures on a value i.e. monetary basis and on a non-value basis as follows:

Customer Perspective

For the customer perspective, parameters that are perceived as company specific by the customers, such as time, quality, performance, service and price are transformed into performance indicators. These variables can be influenced by a company through other variables such as order processing time, fulfillment of customer-related requirements, etc. This perspective is regularly extended by result-related indicators such as customer satisfaction, customer loyalty, customer acquisition or increase of the market share.

Internal Business Perspective

For the internal perspective, companies are requested to identify internal processes that are satisfying their customers' expectations. In order to reach the goals in customer related performance features, parameters such as cycle times or costs per unit need to be determined.

Innovation and Learning Perspective

The ever changing conditions of competition and the market require companies to constantly improve their existing products and processes and to integrate new product functionalities. Parameters like time to market, process efficiency, duration of technology development or efforts to train employees are used in the innovation and learning perspective to assess the capability of a company to enter new markets and increase sales and profit in the long term.

Financial Perspective

The financial perspective determines different parameters of company performance such as cash flow, company value or shareholder value. They should provide information on whether and how the strategy improves profitability or company growth.

Lean Monitoring Card

LD aims at continuously increasing efficiency in product development but it is difficult to satisfactorily evaluate the success of the introduced measures by means of conventional time controlling due to above given reasons. Similar to BSC, the examination of effects caused by LD measures suggests that there are several perspectives. Due to the interconnection between the individual perspectives and - in the case of Lean Development- between the implementation of LD measures and user satisfaction, BSC is taken as approach for the Lean Monitoring Card (LMC). LMC is used to monitor, i.e. to track the introduction of LD from four perspectives with the help of monitoring objects. It enables to monitor the individual implementation of the measure, satisfaction of the users of the measure, the impact of the measure on corporate parameters and the learning effects since the introduction of the LD measures.
The research project has shown that reducing identified sources of waste and symptoms on operating levels triggers shorter development times and contributes to the success of LD. It is important to connect the gained effects with their synergy effect on operating level with parameters that are relevant for the company and enable a statement about the efficiency in the development department.

LMC takes up the feature of BSC to consider corporate success in the long term as well as the required actions from different perspectives. In a first step, the four classical perspectives of BSC are transformed according to an application in LMC:

Customer Perspective → User Perspective

Within the frame of LMC, the users of LD measures are considered as „customers"- that is those developers whose activities are influenced by the measures. The opinions of the developers on the value of measures are important since they are the first to perceive the effects of the measures and best suited to state to what

extent the LD measure(s) were able to reduce individual waste symptoms. The developers are provided with the measures - to check their value. Semi-quantitative questionnaires can be used for each individual measure to collect the developer's evaluation of the measures with regard to customer- i.e. user satisfaction. This ensures comparability of the employees' perceptions and of the individual measures. Further, development managers and sometimes higher management levels up to the management of a company are interviewed in the course of the research project to get their feedback on the benefit of the measures with regard to waste reduction and effectiveness of the measures.

Internal Business Perspective
→ Implementation Perspective

When talking about LD measures it is important to emphasize that there is a difference between the successful introduction of a measures and a successful measure. Only if measures are successfully introduced and show effect, users can perceive the value of the measure and thus its success. For the internal business perspective, BSC asks for the identification of all processes that lead to customer – or in this case to user satisfaction. This means that first of all it has to be ensured that the measures are implemented and that developers will be able to use them. Checklists can be used to verify whether employees have been introduced to the introduction plan and to the motivation the measures are based upon on the one hand, and on the other hand whether the properties of the measures that have been defined in the draft of the measure, have been implemented as prerequisites for use.

The companies involved in the research project use measure-specific information posters after the kick-off events to inform employees in the relevant departments about the measures. In addition, it should be ensured in IT-supported measures that the indicators of statements with regard to the frequency of use of the measures or the like - are implemented in the IT-systems. This corresponds to the request to link the customer-, i.e. the user point of view with internal processes, compare [18]. According to the example of a drawings database, the amount of stored, digitalized information, but most importantly, the number of information requests per time period can serve as indicator . Graphically displaying such indicators is beneficial since it allows observing the development of these indicators over the course of time [13]. An indicator of the frequency of use is considered to be important, since it may point out possible failures in the implementation of the measure. In the given example of a drawings database it can be assumed that a negative result of the use of the measure despite a high frequency of use suggests a lack of user friendliness, e.g. intuitive operation.

Innovation and Learning Perspective
→ Learning Perspective

When using BSC, the changes on the markets and in competition are taken as a reason to repeatedly adapt the products and corporate processes to new situations. LD is not considered as completed once it has been introduced but has to be understood as a permanent improvement process. One the one hand, the learning perspective records the current status for the complete LD introduction; on the other hand it shows learning effects that result from measures already implemented. Employees working in development should acquire the skill to identify problems and waste through careful scrutiny and eliminate them in terms of a continuous improvement process. In addition, those employees should be able to participate in lean-specific training. They should also be able to meet and discuss lean Development issues using the resources available in development.

Employees are asked to communicate any shortcoming or optimization potential in the introduced LD measures and report any waste area they become aware of. They can for example express their criticism of running measures in the comment field of the information posters that had been hung up upon the introduction of the measure. Those responsible for introducing and monitoring the measures are urged to regularly collect this valuable input of their employees and examine it with regard to its potential to further reducing waste. If necessary, digital form sheets may also be set up to express such suggestions which may then be collected in the development department or centrally in the company. It may be recommendable to record experiences gained through the introduction or implementation of the measure so that it can be drawn upon for future LD measures. Drawing on such experience should help to avoid mistakes and to implement new ideas faster.
The time that is needed to implement or optimize LD measures may serve as monitoring objects in the learning perspective. As may serve the number of employees who participated in in-house or external Lean Development training and who acquired a certain expertise through it. In addition, comparing implemented and planned lean measures allows making a statement about the status of introduction. Equally, comparing the number of those employee comments whose potential has been analyzed with the number of generally received comments, may be considered.

Financial Perspective
→ Corporate Perspective

Financial key figures that are determined in corporate controlling according to the top-down approach with the help of individual figures which are generating a complex figure system [18], do not lead to the desired results when analyzing the waste reduction gained through LD measures. This is why, seen from a corporate perspective, the impact of LD measures on corporate figures should be determined. Based on the identified waste, the last phase of the research project should determine and evaluate the interconnection of waste symptoms, development activities that are affected by these symptoms, and further interconnections, e.g. of key figures that are relevant to the company beyond development.
Fig. 7 shows LMC with its four perspectives, exemplary monitoring

objects and their status for individual LD measures as well as the complete introduction of LD. The project experience of AGENSIS Unternehmensberatung indicates that a multi-dimensional monitoring of waste reduction has proven its worth and that therefore elements for management and information systems could be derived from this monitoring approach. Currently it can be assumed that multi-perspectivity and the consideration of the interrelation of effects like in the effect chain are of decisive importance when it comes to a reasonable evaluation and subsequent decisions.

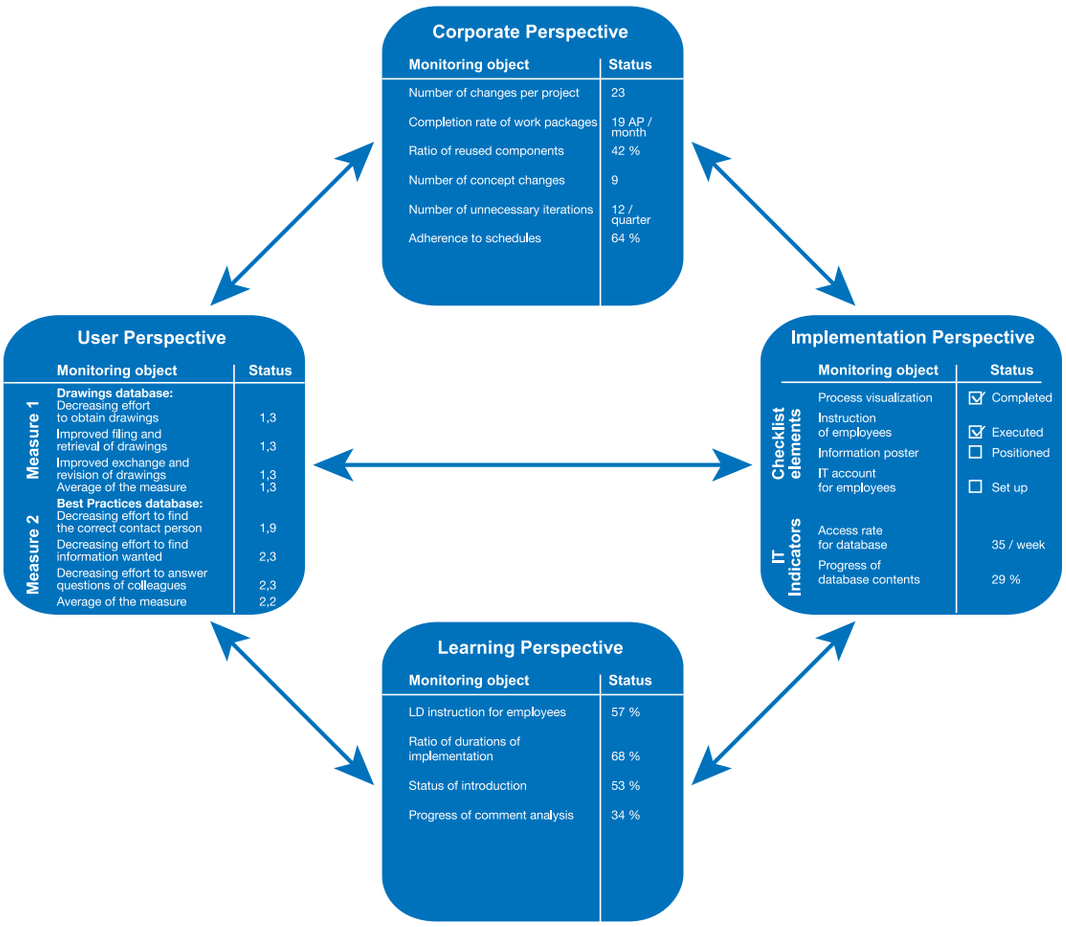


Figure 7: Pattern of the Lean Monitoring Card

Outlook

In the course of the ongoing project, the described approach will be tested in cooperation with the participating companies. In addition to identifying and evaluating the relation between waste and corporate parameters it should be analyzed

- whether companies need all four perspectives to measure performance and effects of waste reducing measures, whether only selected perspectives are relevant or whether they require additional perspectives to be integrated,

- whether and to what extent the perspectives of LMC are suitable to evaluate the performance and the effects of LD measures that are not focused on waste reduction but the generation of customer value

- whether it is possible to derive reference numbers from the interrelation between waste and corporate parameters in order to determine certain quantitative effects

- to what extent the organization of corporate functions and processes (in particular development processes) has an impact on the effect chain model.

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Institute of Product Development
Technische Universität München
Prof. Dr.-Ing. Udo Lindemann
Boltzmannstr. 15
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Tel. 089 289-15131
Fax 089 289-15144
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udo.lindemann@pe.mw.tum.de

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reik@pe.mw.tum.de

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