MEASURING AND MINIMIZING WASTE IN PROJECTS - THE 'PROJECT MANAGEMENT WASTE INDEX' -

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Abstract
This paper provides answers to four questions:
1. What does the term waste in projects imply?
2. How can waste in projects be measured?
3. What amount and types of waste can be surveyed in projects?
4. How can waste in projects be minimized?

The first question will be answered conceptually by a novel re-interpretation of the "lean" view in a project context.
The second question includes a methodological operationalization of the concept of waste in a survey, measuring the *Project Management Waste Index*.
With respect to the third question, the results of a survey are presented which displays a mean *Project Management Waste Index* of 25,1% and waiting, misallocation and underprocessing as the most frequent and severe types of waste in projects.
In regard of the fourth question, a case study in an engineering company revealed multivariant root causes of wastes in projects which have to be identified, mapped and assessed.

Hence the outcomes of this paper will be a key indicator and measurement method for measuring waste in projects, its application in an overall survey as well as a method for identifying and assessing root causes in order to minimize waste in projects.

Keywords: Case Study, Lean Project, Survey, Waste Index

1 Introduction: Waste in projects

Over the last sixty years, an overwhelming number of methods and models for planning, monitoring and controlling projects and programs has been developed: From the network planning technique of the early 1950s to more recent frameworks for scaling agile approaches and coordinating several agile teams such as SAFe (Scaled Agile Framework) or the more lightweight framework LeSS (Large-Scale Scrum) that ultimately abandon the project term as such.

Despite the abundance of Project Management norms, standards and methods, the impression remains that there is still "room for improvement" in the management of projects. More precisely: there is still a considerable amount of waste hidden in project systems. According to recent PMI surveys, the amount of wasted investments due to poor project management is estimated at approximately 10% overall (PMI, 2018/2020). Said impression can be also corroborated by further domain-specific research outcomes.

For software projects, as a first example, the 2020 edition of the Standish Group's well-known longitudinal CHAOS studies indicates that only 31% of the software and IT projects surveyed have been completed on time, on budget and with the promised functions and features (Standish Group, 2021). While these surveys have been criticized with respect to methodological issues (Eveleens & Verhoef, 2010), also other studies substantiate a high number of IT project failures (Iriatre & Bayona, 2020; Varajão et al., 2021).

For large infrastructure projects, as a second example, Flyvbjerg (2014) reports that 9 out of 10 large infrastructure projects exhibit cost overruns of 50% or higher. Extreme examples like the construction of

the Sydney Opera House reached 1.400% cost overrun. Similar figures have been reported for large infrastructure projects in Germany (Kostka & Anzinger, 2016), indicating an average cost overrun of approximately 60% in public-private partnerships like the Berlin Airport BER and over 100% mean cost overrun in ICT projects like the eHealth card or the Toll Collect System.

Finally, estimated success rates for organizational change projects differ between 30% (Thomas, George & Rose, 2016) and 70% (Jones et al., 2019), depending on the respective definition of project success as well as on the methodology applied.

Since the definition of and the methodology for surveying success in projects shape every research on the subject matter, the figures exhibited should not be taken for validated but rather as indicators for waste (Gupta et al., 2019). Waste could mean, that cost and time overruns as well as scope creeping are caused by factors such as waiting for decisions or resources, lack of necessary resources or numerous quality issues. The same term could also designate the fact, that these project shortcomings produce more waste in form of replanning, realignment and increased reporting.

Since waste in projects seems to be a significant yet frequently overlooked and fuzzy topic, this paper intends to shed some light on the topic in four steps:
In the first section, the concept of waste defined in previous works on *Lean Thinking* is reviewed and re-interpreted for the context of projects, resulting in a definition of symptoms of waste which may occur in projects (chapter 2).
Based on this definition, a methodology as well as an indicator, the *Project Management Waste Index*, is defined by which symptoms of waste can be quantitatively and qualitatively measured (chapter 3).
The methodology and indicator have been applied in an overall survey which has been completed in 2021 in the German-speaking countries in 2021 with n=202 respondents. This unveiled a *Project Management Waste Index* of 25,1% in median and the most frequent and severe types of waste in projects (chapter 4).
The same methodology and indicator can be also applied on an organizational level. This yields the possibility to identify organization-specific root causes which can by addressed by measures. This has been carried out in a German engineering company in 2023 which can serve as a Case Study including a method for minimizing waste in projects (chapter 5).
Finally, the approach for measuring and minimizing waste in projects can be viewed as a novel and pragmatic approach to *Lean Project Management* which is applicable to all kind of project management frameworks in every phase of the project in order to attain higher project success rates (chapter 6).

2 Concept: Defining waste in projects

The idea of waste in business activities cannot claim to be a new one. It has its origins in spring 1950, when Eiji Toyoda – then Chief Executive Officer of the Toyota Motor Corporation – and his managers went on a three-month excursion to the USA to visit the large and market-dominating automobile production plants of Ford and General Motors (Ohno, 1989; Womack, Jones & Roos, 1990; Liker, 2004).

The result of the Japanese field study, however, was not to copy the then prevailing production principle of mass production. That would have been the expected result of a best practice study by a national industry at ground level after World War II. Instead, the Japanese delegation discovered a considerable amount of "muda", i.e. waste of resources in terms of time, materials, and people. Said types of waste have been specified as the seven types or “TIM WOOD” (Ohno, 1989):

- unnecessary *transportation* of people, materials, and tools;
- high *inventories* in receiving, intermediate, and final storage;
- unnecessary *movement* of production workers;
- *waiting* for materials or machines;

- *overproduction* of semi-finished and finished products at each manufacturing station;
- *overprocessing* which means redundant operations;
- *defects* in the production process.

Toyota addressed these sources of waste in its *Toyota Production System*, which was based on the principles of stable yet flexible production processes, a continuous and balanced production flow, just-in-time manufacturing, semi-autonomous teams, and immediate defect identification and correction. Said principles were implemented by methods such as *Heijunka*, *Kaizen*, *Kanban* and *Jidoka*.

This novel Production System was then discovered in the mid-1980s by the International Motor Vehicle Program (IMVP) of the Massachusetts Institute of Technology (MIT), in which it was labelled *Lean Production* (Womack, Jones & Roos, 1990). This is because the system appeared to be Lean in three respects: firstly, in terms of responsibilities, which avoided too narrow specialization and thus a large number of specialists and coordinators. Secondly, in terms of quality, insofar as defects were avoided from the beginning, if possible, rather than identified and fixed at the end. Third, in terms of unnecessary work, which was strongly enabled by the flow or *just-in-time* principle.

In this study, it also became clear that the basic ideas of Lean Production could not be limited to manufacturing, but had to be extended to other business activities in the value chain, such as development, purchasing, supply chain management as well as marketing and sales. In other words, the idea of *Lean Management* was necessary subsequent extension of Lean Production (Womack & Jones, 2003).
This paved the way for the spread of the Lean idea to other functional areas and industries, such as the construction industry, IT and software development, financial services, healthcare, public administration and also project management (Poppendieck & Poppendieck, 2003; Staats, Brunner & Upton, 2011; Aziz, 2012; Pautsch & Steininger, 2014; Erne, 2022; Hüsselmann, 2024).

In order to transfer the concept of waste from a manufacturing context to a project context, typical types of waste in projects could be extracted from studies in different project domains (Hüsselmann, 2024). Based on a literature research, seven typical types of waste can be identified. These are comparable, but not identical to those of production (**Fig. 1**):

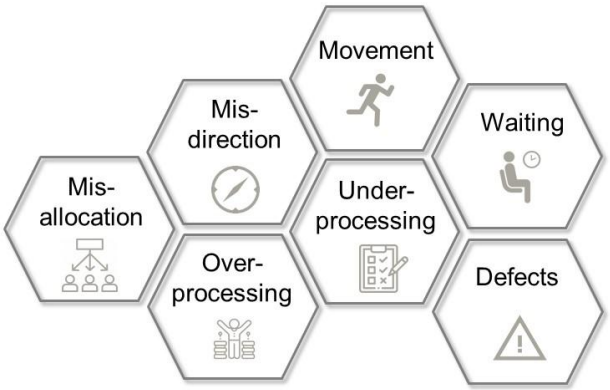

Fig.1: Types of wastes in projects (Hüsselmann, 2024)

- Waiting: Waiting for decisions "from above", for supplies from other organizational interfaces and/or for information to continue working represents a first indicator of waste, since this mostly inhibits any value-adding activities. Causes for waiting are manifold, as several scholars have pointed out. It may be rooted in demonstrative power differences between project stakeholders,

in excessive organizational interfaces, unclear responsibilities or a lack of proper planning (Bailey, 2018). Excessive waiting time in projects might produce project delays, issues in resource allocation as well as excessive projects costs.

- Misallocation: Misallocation refers to the incorrect allocation of resources to tasks. This can relate to human resources (project roles), physical resources (hardware, test beds, etc.) or financial resources (project budgets). It can further manifest itself quantitatively, in the form of incorrect quantities, or qualitatively, in the form of inappropriate tools or skills. Root causes for this type of waste are often located in insufficient project portfolio management resp. organizational resource management. However, further reasons might also be found on the project level (Engwall & Jerbrandt, 2003). In all cases, work results are either not delivered at all, or incomplete, or delivered inadequately.
- Unnecessary movement: Unnecessary movement can refer to unnecessary travel and travel time for face-to-face meetings. A completely different form of motion includes unnecessary changes in project results, processes or organizations. A third kind of movement encompasses multitasking and task switching, which counts for up to 30% productivity losses (Tregubov, Lane & Boehm, 2018). The causes for said three types of movement may be heterogeneous – common is the impact of increased project costs without any added value.
- Defects: Unlike to standardized production processes, a failure in projects is not always clearly and mutually agreed defined. Additionally, recognized defects may be ignored due to time pressure or insufficient judgment skills. Furthermore, it is possible to operate based on incorrect information. As Love et al. (2019) have pointed out for construction projects, rework may occur as results of incorrect actions due to a lack of knowledge, conscious or unaware procedural violations or errors in judgement and decision making. Said causes result in either expensive rework or unaddressed quality issues.
- Misdirection: Misdirection may comprise the initiation of unnecessary or fuzzy projects, as indicated by the survey of Gröger (2004), in which 962 respondents classified the projects in their organizations as ineffective “drought”, “alibi”, “prestige” or “submarine” projects. A different manifestation of this waste type may be unclear priorities, when every stakeholder considers something else as being the most relevant issue (Qazi, Dikmen & Birgonul, 2020). A third form of misdirection implies unclear responsibilities, which lead to numerous changes and "not in my backyard" behaviors (Koi-Akrifi, 2017). Abovementioned appearances of misdirection might result from political intentions, but more often from unintended reactions to time-pressure and unclear project designs. It entails unnecessary effort and duration, rework and/or quality issues.
- Overprocessing: The discussion, what activities are too much and therefore superfluous in projects is usually only decidable from a completion point of view. Overprocessing can refer either to unnecessary requirements from outside the project or to "gold-plating" within the project. In addition, it can also occur due to an overload of information and communication, which can be regarded as a kind of unintended disinformation (Ledzińska & Postek, 2017). In any case in produces unnecessary efforts and project durations.
- Underprocessing: Underprocessing may appear as poor delegation without sufficient consideration of prerequisites, tasks and efforts (Cheng, Li & Fox, 2007). Particularly in agile contexts, insufficient documentation is also a frequently-discussed topic in this context (Voigt et al., 2016). A third manifestation of underprocessing might be insufficient verbal and/or written communication, for example, when deliveries do not meet the recipient's expectations due to unclearly designed requirements. It may result from deliberate process violations or time-pressure, as indicated by Love et al (2019). It causes rework as well as delays in projects.

Abovementioned types of waste can be viewed as manifestations or symptoms which serve as a basis for a methodology in order to identify how much and what kind of waste are to be found in projects. This methodology is being elaborated in the subsequent section.

3 Methodology: Measuring waste in projects

In order to determine the extent and types of waste in projects, a measurement method as well as a key indicator for quantifying abovementioned seven types of waste can be elaborated. This method and indicator is labelled here as the *Project Management Waste Index* (PMWI).

The *Project Management Waste Index* is based on a questionnaire including three significant questions per waste type, which had to be rated by respondents according to their frequency of occurrence as well as their impact on a Likert scale ranging from 0 (never or none) to 4 (almost always or severe) (**Fig. 2**)

	Frequency of Occurrence (F)	Impact of Occurrence (I)	Project Management Waste Index $= \frac{\Sigma [F * I]}{\text{Waste}_{max}}$
Waiting (3 Questions)	0-4	0-4	Waiting = Σ [H * A]
Overprocessing (3 Questions)	0-4	0-4	Overprocessing = Σ [H * A]
Defects (3 Questions)	0-4	0-4	Defects = Σ [H * A]
Misallocation (3 Questions)	0-4	0-4	Misallocation = Σ [H * A]
Misdirection (3 Questions)	0-4	0-4	Misdirection = Σ [H * A]
Motion (3 Questions)	0-4	0-4	Motion = Σ [H * A]
Underprocessing (3 Questions)	0-4	0-4	Underprocessing = Σ [H * A]

	How often does this happen?					What is the impact in case of occurrence					Not answer-able
	never	rarely	repeat-edly	fre-quently	almost always	none	low	notice-ably	signi-ficantly	severly	
	0	1	2	3	4	0	1	2	3	4	
In our projects… …significant taks are only worked off superfically in order to place a tick on the worklist.											

Fig. 2 Questionnaire for measuring waste in projects

On the basis of the questionnaire results, the PMWI as an indicator is composed of the sum of the 21 scored items in relation to the maximum possible degree of waste (**Eq.1**):

$$\text{PMWI} = \frac{\Sigma\ [\text{Frequency} * \text{Impact}\}}{\text{Maximum Waste}}$$

Equation (1) Calculation of the *Project Management Waste Index*

By applying this method and indicator, four research questions can be answered:

- What is the extent and distribution of waste in projects, as measured by the PMWI?
- What are the most frequent and impactful types of waste?

- If integrated in the survey: Are there correlations between structural characteristics, such as the Project Management framework or the industry on the one hand and the PMWI on the other hand?
- If integrated in the survey: Are there correlations between project success indicators and the PMWI?

The PMWI survey has been applied in two cases:

1. In an overall survey, in which responses from n=202 project stakeholders in German-speaking countries have been collected and analyzed in 2021.
2. In an organizational case study of a German engineering company, in which responses from n=14 internal project stakeholders have been collected and analyzed in 2023.

The findings of both surveys are presented and discussed in the subsequent sections.

4 Findings of the overall survey

The overall *Project Management Waste Index* survey was conducted in German-speaking countries in the period April to May 2021. The questionnaire had been distributed via social media channels, newsletters or direct approaches, which represents a Convenience Sampling method (Etikan, Musa, & Alkassim, 2016). 270 people participated in the survey, of which 202 data sets were applicable.

Most participants (almost 50%) answered the questions from their perspective as project managers. PMO managers made up about 15% and project staff about 10%. 56% of the participants had more than 10 years of project experience; the share of participants with project experience under three years accounted for 9%. Thus, the survey consisted of a considerable amount of diverse experience.

The PMWI identified across all 202 applicable responses amounts to an arithmetic mean of 25.1% (median: 24%). This means that a quarter of the "total waste" actually occurs in the respective projects. The statistical distribution of the PMWI visually follows approximately a normal distribution. It is also clear here that 95% of the participants have a PMWI in the range 0-45%. Three participants have a PMWI of 65-75% (**Fig. 3**).

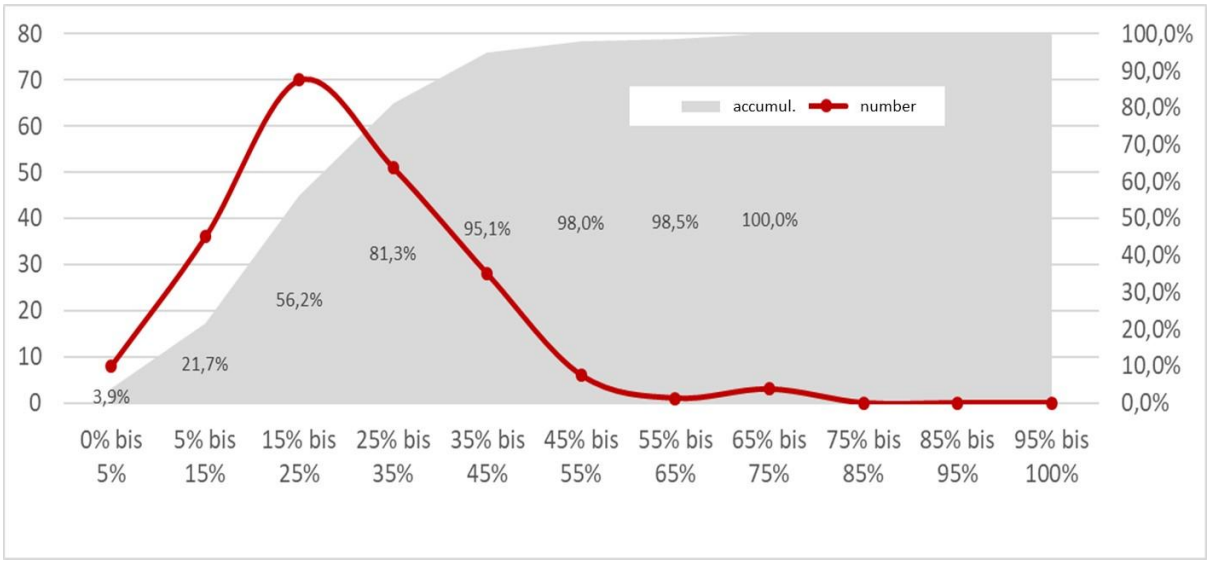

Fig. 3 Distribution and accumulation of PMWI in the overall survey

With respect of the distribution of the seven types of waste, not too much variation could be observed. The average frequency for all of them was between "rare" and "frequent", the severity between "low" and "significant". Nevertheless, it can be clearly seen that unnecessary waiting, misallocation and underprocessing are the types of waste with the greatest overall extent (**Fig. 4**).

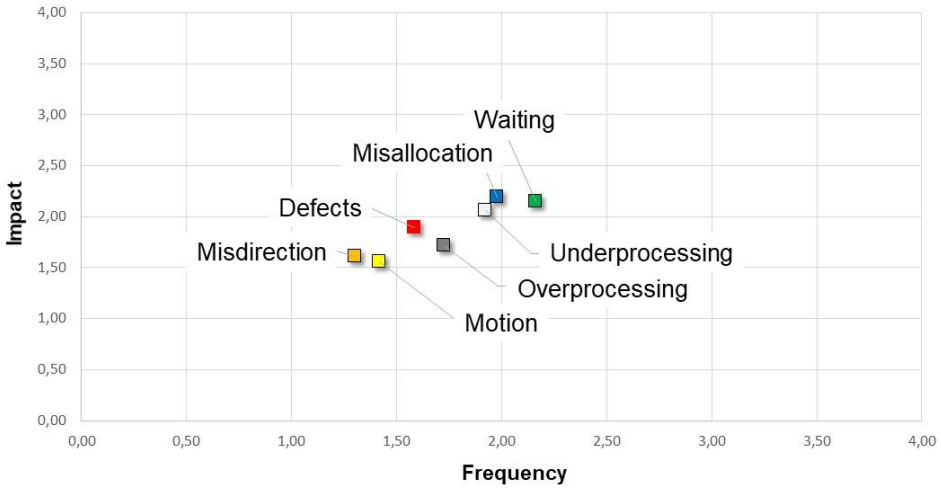

Fig. 4 Distribution of waste types in the overall survey

The following elements can be identified as the manifestations of waste with the greatest extent within each of the types of waste:

- Waiting… …for deliveries.
- Overprocessing… …due to information overload.
- Defects… …due to incorrect information.
- Misallocation… …of personnel capacities.
- Misdirection… …in the form of unclear responsibilities or priorities.
- Motion (Movement)… …as permanent cognitive task switching.
- Underprocessing… …in the form of lack of documentation and communication.

Most of the correlations examined, for example, between the PMWI and specific industries, project types, external or internal clients, project roles, or Project Management frameworks, provide some indications but are not sufficiently significant, also due to the convenience sampling method in the study design. The only exception is the correlation between the extent of waste and project success. For this purpose, the participants were asked for their assessment of how many of their projects are "on time", "on budget" and "on quality" which represent the classical project success indicators. Looking at the top and low performers, there is a strong correlation between the PMWI, i.e. the degree of waste, and performance (**Fig. 5**).

Fig. 5 Correlations between the PMWI and classical project success criteria in the overall survey

The top 10% performers in terms of plan fulfillment reported a clearly lower PMWI, the low 10% performers a clearly higher PMWI. This is particularly pronounced in the dimensions of time and budget, and noticeably less so for the quality item. This can be interpreted as a first indication that the extent of waste, as measured by the PMWI, may also serve as an indicator and possibly even as a predictor of project success.

It is also noticeable that, at the level of the seven types of waste, the correlation coefficient between frequency and severity is 0.927 (Erne et al., 2021). This suggests that, unlike in the theoretically clear model, the practitioners who participated in the survey apparently had difficulties in distinguishing between the frequency of a type of waste and its impact. This is also known as the *availability bias* (Tversky & Kahneman, 2005). It remains an open question of how to avoid this effect in future surveys.

Another limitation of this survey is that it only depicts the symptoms of waste in projects, not the root causes for types of waste like waiting, misallocations and underprocessing. The identification of root causes would yield ideas for measures in order to reduce or even eliminate these waste types. However, this question cannot be answered on the basis of an overall survey. It would require a specific root cause analysis on an organizational level in form of a case study. This is presented in the next section.

5 Findings of the organizational case study

In the first half of 2023, a case study was conducted in a German mechanical engineering company, for which the following goals were defined:

- The amount and types of waste for the project management organization are surveyed.
- The root-causes for the most significant types of waste are identified.
- Strategies and measures for minimizing the most significant types of waste are defined.

In order to attain these goals, the PMWI survey was carried out on the level of the project management organization with n=14 previously selected project stakeholders. After that, the survey results have been

reported back to the participants and the root causes for the most frequent and impactful types of waste have been identified in a one-day workshop with project responsibles, project managers as well as project participants. On this basis and within the same workshop, measures for minimizing the detected root causes have been prioritized and planned (**Fig. 6**)

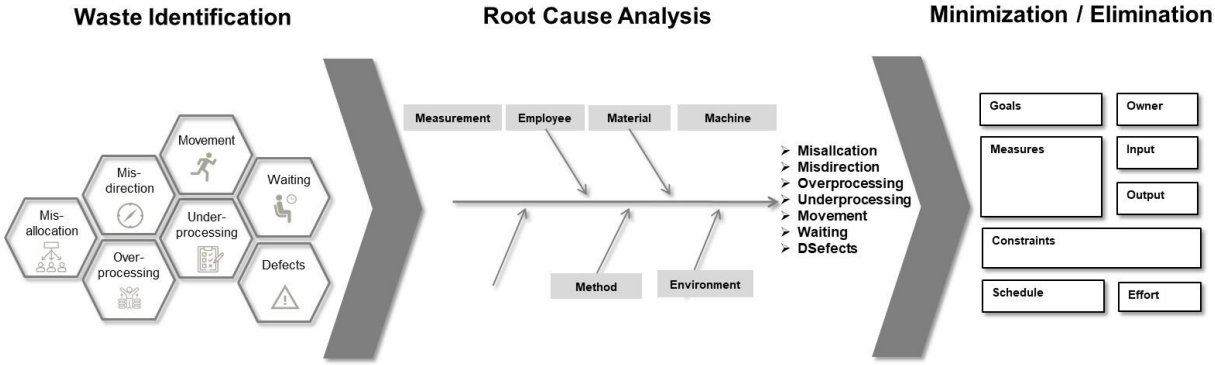

Fig. 6 Process for identifying and minimizing waste in projects on an organizational level

The mean *Project Management Waste Index* surveyed in the engineering company was 30,6%, which is 5 percentage points above the number of the overall survey. Furthermore, the PMWI in external (customer) projects was also approximately 5 percentage points higher than the PMWI in internal (organizational) projects. This difference can be explained by the higher rate of changes and alignment requirements in external projects.

With respect to the types of waste, there are also differences and similarities when compared to the overall survey. In contrast to the overall survey, misallocation with respect to quantitative personnel resources as well as to qualitative skills and permanent task switching between various tasks (i.e. movement) turned out as significant types of waste. Along with the overall survey, waiting for deliveries and lack of documentation (i.e. underprocessing) have been identified as further types of waste with high frequency and impact **(Fig.7)**.

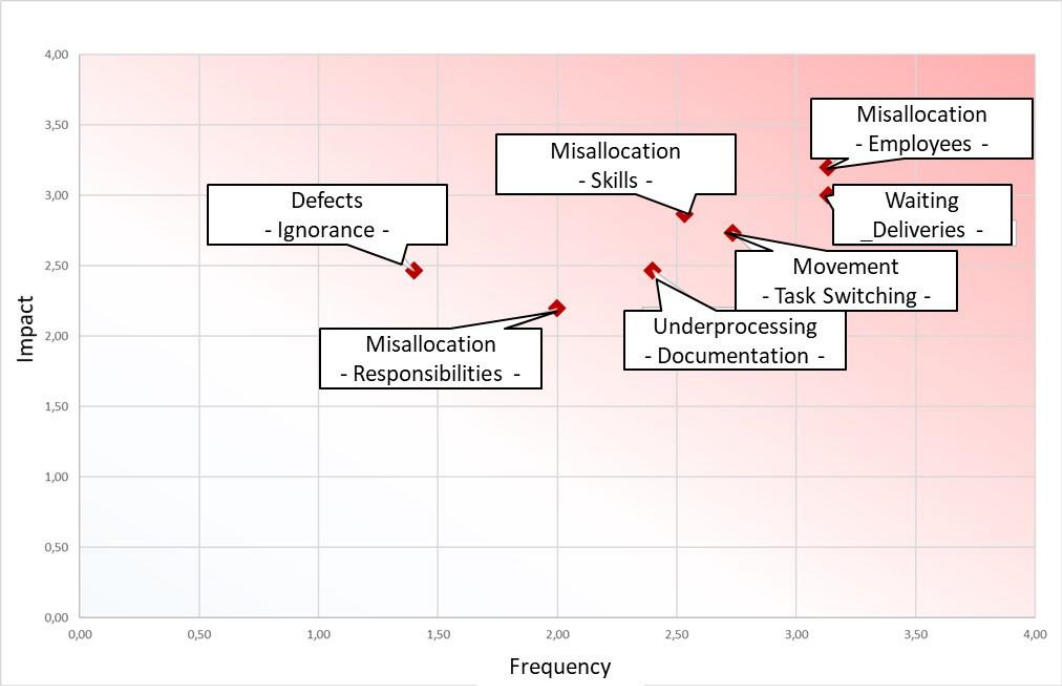

Fig. 7 Distribution of waste types in the organizational case study

In order to identify the root causes of abovementioned waste types, a "typed" *cause-and-effect* or *Ishikawa* analysis according to Hüsselmann (2024) has been applied. This method takes into account that waste symptoms are caused by multivariant factors with mutual relations which constitute a cause-and-effect-network. Therefore, different root causes firstly have been clustered and secondly been mapped in cause-and effect networks in alignment with the perspectives of the workshop participants (**Fig. 8**).

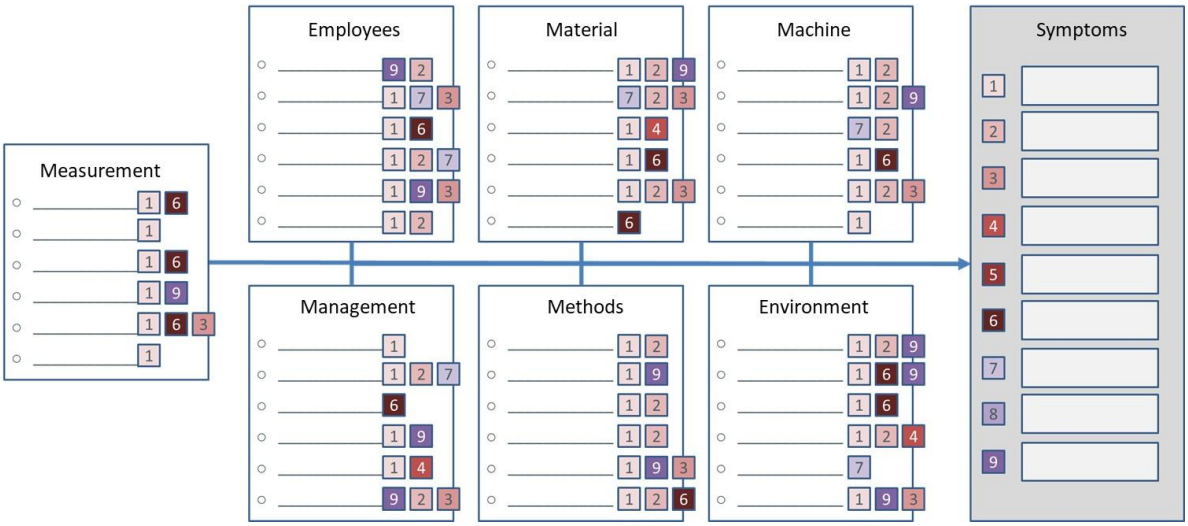

Fig. 8 Typed Ishikawa analysis in the organizational case study (Hüsselmann, 2024)

One exemplary outcome of this method was the following cause-and-effect network: due to a stable management pattern of "Best Case Planning" projects have been constantly understaffed in terms of quantitative personnel resources as well as qualitative skill requirements. This, in turn, produced

continuous task switching as a dominant mode of operations on all sides and – in turn – constant waiting for deliveries which was identified as one significant type of waste in the organization as well as in the overall survey.

After identifying the root cause network of the most frequent and severe types of waste, said root casus have been assessed by the workshop participants according to their impact on the one hand and to the feasibility of getting them resolved in the organization on the other hand. The method employed for the root cause assessment was a *Waste Poker* developed by the authors, in which every participant rated each measure according to its impact and feasibility by T-Shirt sizes (S, M, L, XL). This produced a *Heat Map* of root causes which indicated a prioritization of issues to be resolved: firstly, measures should be taken to address root causes with a high feasibility and impact, secondly those with a high feasibility and a low impact, in the third place issues with medium feasibility and finally the "tough nuts" with a high impact but a low feasibility. This prioritization rationale, which can be labelled as "quick wins first", is in line with John Kotter's (2012) perspective on managing change (**Fig. 9**).

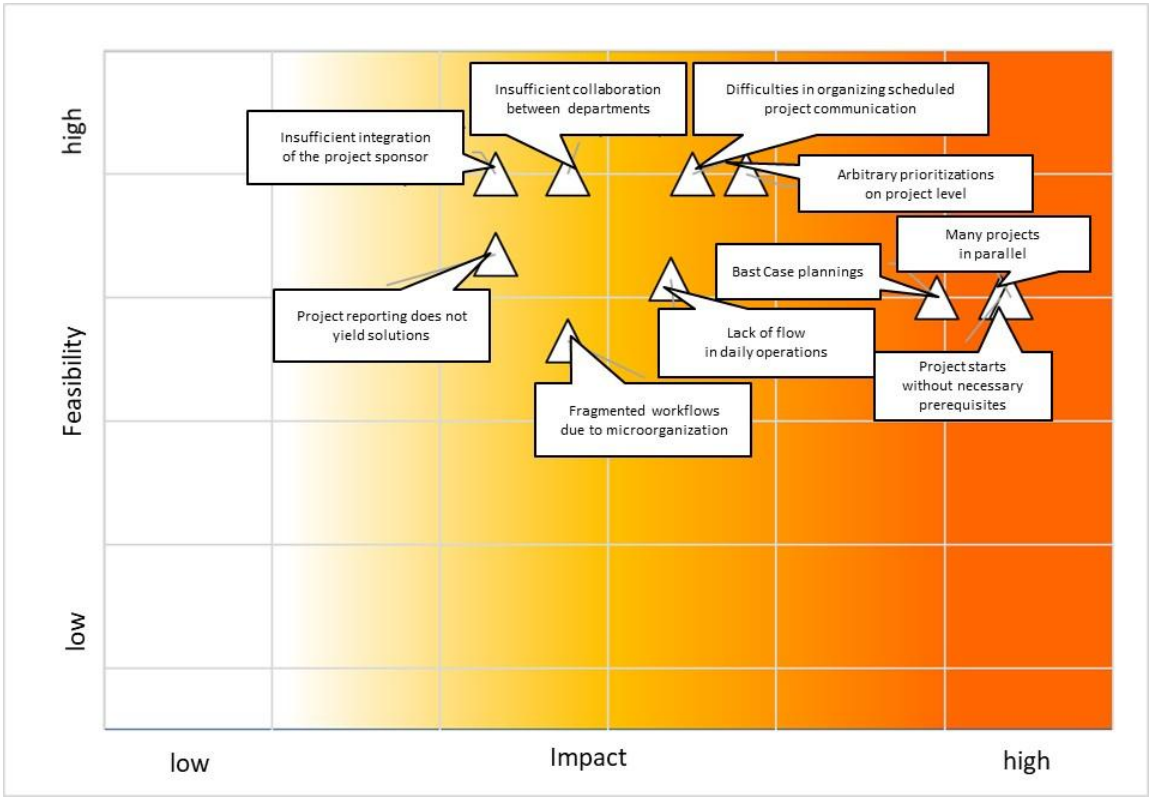

Fig. 9 Heat Map of root causes in the organizational case study

The Heat Map displays clearly, on the one hand, that the most severe challenges in the organizations have been:

- too many projects in parallel,
- project starts without necessary prerequisites,
- *Best Case Planning* as the dominant pattern for scheduling and budgeting.

On the other hand, there are *quick wins* that can be much more easily addressed, i.e.:

- arbitrary prioritizations on the project level,
- poor organization of scheduled project communications,

- insufficient collaboration between departments as project stakeholders,
- inadequate integration of the project sponsor into the project.

By applying the abovementioned prioritization rationale, a prioritized measure list could be defined and subsequently specified in order to minimize or even eliminate the predominant types of waste in the organization investigated (**Fig.10**).

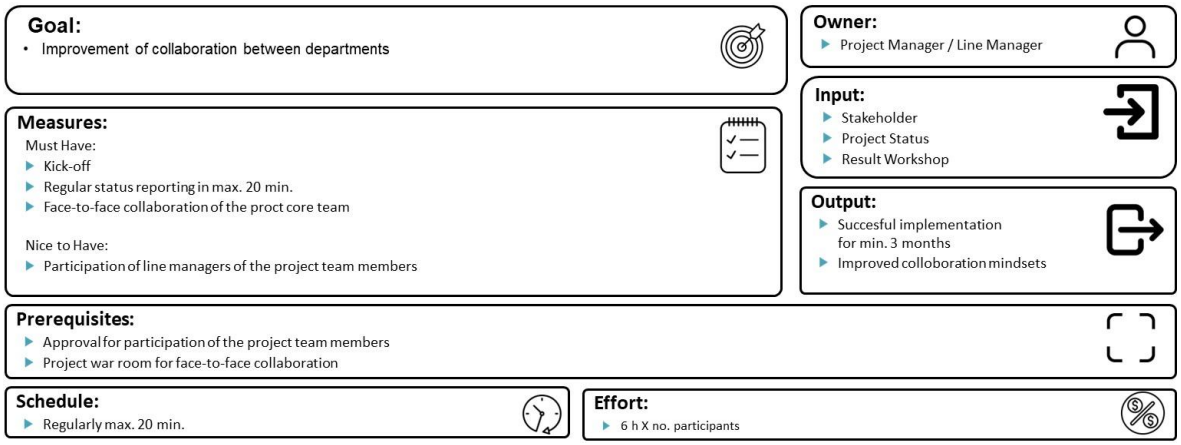

Fig. 10 Example of a measure specification for addressing root causes in the organizational case study

The case study presented has shown that the *Project Management Waste Index* could also be successfully applied to an organizational level and that this use case yields the possibility to identify root causes of waste types as well as adequate measures for minimizing waste in projects.

The key limitation of this case study is that is unknown how effective the planned measures are in reducing the amount and types of waste. This would require a subsequent PMWI measurement in the organization which has not yet been carried out. However, the overall approach points to the direction that by the measurement and minimization method of waste in projects a novel and pragmatic concept of *Lean Project Management* has been developed. This is the topic of the concluding remarks in the next section.

6 Conclusion: A novel and pragmatic approach to Lean Project Management

The presented approach of measuring and minimizing waste in projects has provided answers to the following four questions:

1. What does the term waste in projects imply?
   It implies the consumption of valuable project resources without producing any added value, which has also been labelled as “waste type II” or “pure waste” (Womack & Jones, 2003). Its manifestations in projects are *misallocation*, *misdirection*, *overprocessing*, *underprocessing*, *movement*, *waiting* and *defects*.
2. How can waste in projects be measured?
   These manifestations of waste in projects can be measured by a survey methodology which results in a *Project Management Waste Index* (PMWI) indicating the amount of waste in a project in relation in relation to the maximum possible degree of waste. Beyond this quantitative figure, the predominant qualitative types of waste can also be identified by this method.

3. What amount and types of waste can be surveyed in projects?
   According to our overall survey, the *Project Management Waste Index* differ significantly between projects and project-based organizations around a mean value at approximately 25%. Common types of waste include *waiting* (for deliveries), *misallocation* (of quantitative personnel resources and skills) as well as *underprocessing* (of documentation and communication).
4. How can waste in projects be minimized?
   After identifying the predominant types of waste on an organizational level, the root causes can be identified in an one-day workshop with selected project stakeholders by applying a "typed*"* *cause-and-effect analysis* which displays cause-and-effect networks, a *waste poker* for assessing the feasibility and impact of the identified root causes and by a prioritized measure planning for addressing the most frequent and severe types of waste.

However, also a couple of unresolved limitations and open issues remain with respect to the abovementioned outcomes:

1. The definition of the term waste in projects:
   Not considered in the here proposed definition of waste is "necessary waste" or "waste type I" (Womack & Jones, 2003) which does not create any value for the project customer but is necessary due to the existing organization, technology or regulatory requirements. This may also be a next step which is in line with the current discussion of reducing red tape in and between organizations but has been deliberately omitted in order to make the topic easier to handle.
2. The measurement of waste in projects:
   There might be ways to identify the amount and types of waste more objectively and evidence-based instead by distributing a questionnaire which captures the subjective impressions of project stakeholders. However, the question remains unanswered how this could be accomplished without investing too much effort into the measurement method. If the questionnaire turns out to be the "leanest" method, also this can be improved, e.g. with respect to the abovementioned *availability bias* when participants rate "frequency of occurrence" and "impact" in the same way.
3. The amount and types of waste in projects:
   A still unanswered question relates to the assumption that there might be some typical *Project Management Waste Indices* and waste types in certain project types (e.g. external vs. internal projects), domains (e.g. software projects vs. construction projects) and/or project frameworks (e.g. plan-driven, agile and hybrid frameworks). There are some indications for substantiating this assumption in our research but no significant ones. These questions could and should initiate further subsequent research projects.
4. Root causes and measures for minimizing waste in projects
   There also might be some typical root causes and cause-and-effect networks for waste in projects, which could perhaps also be segmented according to project types, domains or frameworks. It would be a significant contribution if we would know typical waste origins since this knowledge would yield also a list of evidence-based best practices for avoiding these root causes on an organizational project management level.

Despite all limitations and open questions, the here presented approach for measuring and minimizing waste in projects has been proven feasible and significant in the case of an overall survey as well as in the case of an organization-specific improvement initiative. It is applicable equally to plan-driven resp. "classical" frameworks as well as to agile and hybrid approaches. Furthermore, it can be applied in every phase of a project – even if before project start can clearly be considered as being the best point in time. For said reasons, it could be labelled as a novel and pragmatic approach to *Lean Project Management*, for which the theoretical foundations have already been laid (Erne, 2022; Hüsselmann, 2024).

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