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Business Process Management: How to Reduce Process Debt

A Master's Thesis submitted for the degree of
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supervised by
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Affidavit

I, **TATIANA BLOKHINA, MSC**, hereby declare

1. that I am the sole author of the present Master's Thesis, "BUSINESS PROCESS MANAGEMENT: HOW TO REDUCE PROCESS DEBT", 77 pages, bound, and that I have not used any source or tool other than those referenced or any other illicit aid or tool, and
2. that I have not prior to this date submitted the topic of this Master's Thesis or parts of it in any form for assessment as an examination paper, either in Austria or abroad.

Vienna, 12.03.2024

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Signature

Acknowledgment

With sincere gratitude to Dmytro Arekhta, whose consistent belief in my abilities and ongoing support are greatly valued and guide me along my journey.

Abstract

Business processes are one of the key elements of the company ecosystem that emphasize its ability to grow and adjust in the fast emerging and evolving market. Business processes orchestrate the overall business flow, quality of product and its robustness. When the company's processes are well-established and optimized, it directly translates to an enhanced organizational efficiency within the company.

However not all the companies implement formalized processes in their daily operations, nor do they prioritize regular review and optimizations of business processes. This tendency is commonly observed among startups, but it can also be seen in the larger companies. These companies often rely on experienced managers and advanced technologies and consider these advantages as a substitute for well-determined and structured processes. Nonetheless, it can lead to the detrimental consequences. Just like companies can get the “technical debt” from not-optimized technical solutions and processes, they can receive “process debt” from poor determined business processes.

It is crucial to always recognize that time dedicated to process management is an investment in future scalability, performance and resilience. By establishing transparent and well-defined business processes, the path to improvement, performance optimization and enhanced operational efficiency becomes much more attainable.

This work aims to explore the importance of business processes management within the scope of process debt: its origins, current framework and background. Additionally, it examines approaches to managing process debt, exploring strategies and tactics companies can employ to pivot towards integrating business processes and leverage them to foster growth, drive success, and achieve sustainability.

Keywords: Process Debt, Operational Debt, Business Process Management, Business Process Design, Process Efficiency.

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1. Introduction

"Give me 6 hours to chop down a tree and I will spend the first 4 hours sharpening the axe".

The well-known statement, that is attributed to Abraham Lincoln, explicitly and very clearly delivers a two-sided message: each task, even the easiest one, demands the preparation phase; the preparation phase can take a long time and, in some cases, consumes even more time than the task itself.

In other words, preparation, adjustment and planning are the most important and sometimes time-consuming part of the goal-oriented activity. They are so crucial, because they provide efficiency to the applied efforts. Efficiency of the business processes directly contributes to the cost efficiency that is the final goal for each organization.

The statement above also reflects another dimension of efficiency. Sometimes efficiency can be described not only with a time and money, but the complexity of work that should be performed. With good tools (for example, the electric saw) even an average person can chop down a tree. But when the processes are not optimized and the equipment is not prepared, even the easiest task would be a challenge even for the advanced workers. So sometimes the poor established process causes redundant, hard or tedious work.

Therefore, if the company wants to target business excellence, it should leverage business process management. A lot of concepts regarding process management are already well discussed and established in contemporary literature, that is why the novel notion of "Process debt" (PD) is especially intriguing. While still lacking a comprehensive description, it exhibits promising potential for uncovering inefficiencies in business processes through innovative means. In this respect exactly the process debt concept was chosen for researching.

1.1. Research Questions and Research Goals

As PD is a relatively novel concept that is lacking a unified description, the following research questions are essential to investigate:

- describing the origins of PD;
- observing the current findings;
- providing a definition of PD;
- defining the key parameters that are sufficient (the causes, consequences);
- proposing new applied methods to manage and reduce PD.

Research goals therefore are the following:

- compile the state of the art to summarize and evaluate current findings;
- develop a concept of PD further and contribute new ideas and framework for managing and reducing PD pressure.

1.2. Research Methodology

The research goal should be achieved through observing and summarizing the current findings, combining different sources of knowledge, both theoretical and practice-based. And leveraging a combination of different ideas and findings, synthesize some new personal ideas. As the notion is novel and there are not so many research papers, the online articles to the topic would be also observed.

In addition to this, the similar concepts were tracked through the literature, including some of the management and business books.

2. Theoretical Framework

2.1 Process Definition and Key Elements

According to the Information Technology Infrastructure Library (ITIL), a process is a structured set of activities, designed to accomplish a specific objective. A process takes one or more defined inputs and turns them into defined outputs. A process may include any of the roles, responsibilities, tools and management controls required to reliably deliver the outputs. A process may define policies, standards, guidelines, activities, and work instructions if they are needed.

To paraphrase it in more applicable and broader way, a process is a group of logically related activities (steps, operations, procedures), that should be performed in a specific order and manner with help of different inputs from various suppliers to transform tangible and intangible sources into some specific, expected and predictable result, which must meet end-user customer requirements, which was originally planned.

Almost any activity can be named a process and described in this way. However, not all of them align with the business objectives, in other words contribute to the business goals. The processes can be defined as a business process if it creates or adds value in a company value streamline, in other words, meets the business customer's needs.

Therefore, the specific elements of **business processes** should be defined. Regarding to the book Fundamentals of Business Process Management (Duma, 2013) the following key elements refer to business process:

- purpose (should align with the company goals);
- specific events, activities, decision points;
- inputs (physical & immaterial objects);
- actors / stakeholders (human and organizations);
- customers;
- outcome (should contribute to the value chain; can be negative, if a process was unsuccessful).

Each business process has a well-defined purpose, usually it is an output **product** (service can also be named as a product) that should be delivered to a customer. To achieve this purpose, a set of **events** and **activities** are required. Events happen automatically, that means that they do not have a certain duration. Activities are performed by the defined process actors and have a specific purpose, executor and duration. The event may trigger the execution of activities. When an activity is rather simple and defines one single unit of work, it can be called a task. Process includes also the **decision points**

that affect the way the process is executed. A process also involves a number of **actors** (stakeholders: human and organizations), physical objects (equipment, materials, products, paper documents) and immaterial objects (electronic documents and electronic records). The execution of a process leads to one or several **outcomes**. The process should align with the company's goals and the purpose of the process should contribute to the business value chain. Sometimes the purpose may not be achieved or the result of the process is not met, then it represents the negative outcome. The customer is an actor in the process who consumes the output of the process. There can be several customers in the project (Duma, 2013).

The process should be also divided from procedures. A procedure applies to each step and defines how each step can be accomplished. A process is an upper definition and describes what exactly should be done and what result we should achieve. A set of procedures that align to a main goal can combine the process.

To summarize the definition and make it clearer, *a business process is the actors' activities that transforms inputs into outputs under some conditions (time, cost, quality) to deliver the specific products that meet customers' needs, thereby contributing to the value stream.*

As George Sousa et al. emphasize in their study published in Engineering Management Journal regarding business process modeling in engineering work, each business process or collection of business processes may be viewed as an enterprise subsystem with a particular purpose aligned to the total enterprise system's mission. Sousa et al. also claim that business processes, explicitly documented or not, define the enterprise structure. The enterprise structure defines the range or possible modes of behavior, in other words, the performance the enterprise system can achieve. An effective structure enables the generation of value through the production of products so that overall company goals can be achieved (Sousa et al., 2002). In other words, established business process's structure company activities by defining the rules and constraints, adding the value in a company value streamline and meeting the business customer's needs.

2.2. Business Processes Management

Business process management is a systematic approach to ensure that effective and efficient business processes are applied. It is a methodology that is used to align business processes with a company's strategic goals. Main function of a process management is to find all the problems, flaws and potential creeps that can affect a project.

Process management can be visualized in the following streamline:

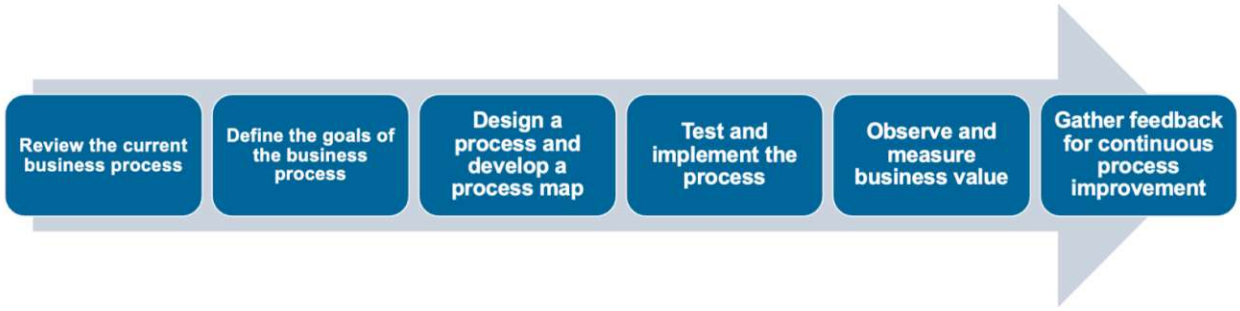

Fig.1: Business Process Management

The main purpose of a business process is to capture the specific sequence of activities and procedures with a defined flow. Therefore, the process needs to be structured or established. That is why the **process design** is the crucial step in process management that helps to find the problems before the process is established and performed, thus to avoid problems by good process design. It is also important to redesign the processes when it is needed. Process design should represent a logical, streamlined path so that the goals of the process may be effectively and efficiently achieved.

Process design includes mapping the business process flow and defining all the components that are involved in its execution. Process design contributes to:

- understanding the customers' demands and therefore process goals;
- establishing the sequences of activities;
- comprehension of the relationships and intersections inside the process and between different processes and work groups;
- discovering barriers and obstacles that can interfere process flow;
- specifying the demands to the suppliers;
- defining the process roles and responsibilities.

As it stated in the book "Business process modeling, simulation and design" by Manuel Laguna and Johan Marklund, a common goal in business process design is to try to reduce the time jobs spend waiting in buffers and thereby achieve a higher flow rate for the overall process (Laguna & Marklund, 2018).

The main and most popular frameworks for the business process design are:

1. **SIPOC**. The abbreviation refers to the scheme Suppliers - Inputs - Process - Outputs - Customer.

2. **Process Mapping**. Visual representation with illustrative descriptions of how the process should flow. This type of process map is usually named as a flowchart and it represents the inputs, outputs, steps, workflows and connections within the process).

3. **Value-stream map**. Visual representation of the flow of goods (materials and information) during the process.

The SIPOC framework as a most popular framework would be examined in more detail.

The classical SIPOC model reflects the combination of the following elements that are important for business and should be considering in business process management:

- Suppliers: providers of inputs into a process.
- Inputs: resources, such as materials, tools, intangible sources needed to complete the process.
- Process: activities that transform inputs into outputs.
- Outputs: the final product.
- Customers: Recipients of the output.

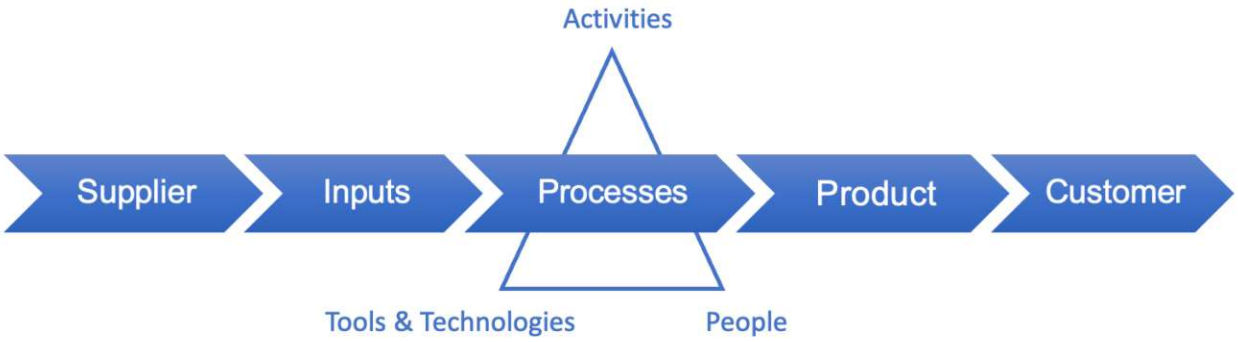

Fig. 2: SIPOC Diagram

The important rule of a SIPOC approach is to start the mapping from the end to the beginning, from the customer to the supplier, although the abbreviation goes from left to right. The right sequence should be therefore:

1. Define the customer and customer needs (the end goal of the process).
2. Describe the requirements that need to be met.
3. Compose a process description.
4. Define the main inputs.
5. Compile the list of main suppliers.

The main focus should be applied to the process part. It includes actors (roles and responsibilities), technologies and tools that should be used and the exact procedure and activities.

2.3. Importance of Business Processes

As the whole current research is dedicated to business process improvement, the importance of establishing business processes is separated in a dedicated subchapter, in order to highlight how crucial it is to the business efficiency and therefore business success.

Establishing solid business processes provide the following benefits:

- visibility into areas of quality, productivity, cost and schedule;
- improving communication and business goals understanding;
- contributing to the planning & execution plans;
- capturing lessons learned;
- helping facilitate the analysis / execution of organization-wide processes;
- basis for training & skills assessment.

The main efforts in establishing business processes are concentrated therefore in discovering and addressing the inefficiencies and imperfection before they disrupt or affect the whole project.

The companies, but rather the individuals, who assert they have no need for business processes, usually justify it by saying that they already have experienced people / cutting edge technologies / great executive managers. However, good assets are not enough to win. As Toyota describes their business philosophy: *"We get brilliant results from average people managing brilliant processes. We observe that our competitors often get average (or worse) results* from brilliant people managing broken processes" (a quote belongs to Fujio Cho, honorary chairman of Toyota Motor Corporation).

The following reasons are commonly cited against implementing of business processes:

1). "Processes interfere with creativity".

Creativity can get along with the processes without interfering. For example, business process design or redesign require the design-thinking and creativity, but also the solid grounds for each decision. It is more likely that creativity in this case covers for

some other traits, like a lack of responsibility, unwillingness to follow some specific rules and even laziness to establish the terms in the beginning of the project.

2). "Processes equal bureaucracy and regimentation".

The overprocessed environment can indeed lead to bureaucracy, but companies can avoid it by deeply understanding the goals and reasons behind each process and regularly observing and removing redundant processes.

3). "Processes are needed when we build a prototype".

The interesting thing behind prototyping is, that by delivering a new product a team would try different approaches and after several circles may get the clear picture, how exactly the product, therefore the processes, should be presented. That means that a lot of processes can be re-worked, combined and consolidated at the end of the prototyping phase to scale the operations and maintain it. That is why the processes are equally important after the prototype is already built.

4). "Processes are only useful on large projects".

The size of the project really matters, but the processes are also important for the small groups and projects to align to the main goals and improve inefficiencies already on a small size and not to inherit it by scaling up.

5). "Processes hinder agility in fast-moving markets".

The agility demands the flexibility, fast speed to deliver the product to the market and react to the new inputs. However, the processes can also be agile and compile the high demands of the fast-moving markets. Thus, the processes may be reviewed regularly to match the customers' demands or can be designed with some sort of wiggle room.

6). "Processes cost too much time and too much money".

The establishment of processes indeed costs time and money. However, it is an investment to the future success, as with other solid infrastructure. Business processes can be named among the assets that are important to support the company stability. Moreover, the ignorance of processes can lead to the persistent money loss through generating the waste during projects or permanent time-consuming activity to fill the process gaps. Exactly this notion would be the main topic in the following chapters.

Eric Ries, an entrepreneur-in-residence at Harvard Business School, describes this dilemma vividly in his article in Harvard Business Review with the self-explanatory name "For Startups, How Much Process Is Too Much?". He states that the companies that insist on building a world-class infrastructure before shipping a product are doomed to "achieve failure," because they take time and energy away from work that directly benefits

customers and therefore starve to become feedback from the market. On the other hand, companies that take a “just do it” attitude without any process at all are also taking a major risk. The key for finding this balance is to understand the importance of feedback loop – reaction to the product from a market in general and from the customers in particular that powers all startups. The rule that Eric Ries suggests to follow: always choose the option that minimizes the total time through the feedback loop (Ries, 2010).

However, this feedback loop can also cause confusion if a company receives controversial feedback and reactions or there too much income information. In these cases, processes also help to structure the market demands and separate the husk from the grain, i.e., better prioritize the changes and improvements. As it summarizes Roman Kumar Vyas, Forbes Business Council Member, without well-defined processes startups can quickly become overwhelmed by complex and rapidly changing demands. This can lead to confusion, inefficiencies and a lack of accountability, making it difficult to maintain momentum and grow the business (Vyas, 2023).

The experts are solid with the importance of the established business processes in the company, including the startup phase. But not a lot of studies and articles contribute to the real challenges or some real action plan to implement it. The contributors of the book Future of Business Process Management presented a process maturity map that reflects the challenging way of advancing the business processes (Harmon, 2014).

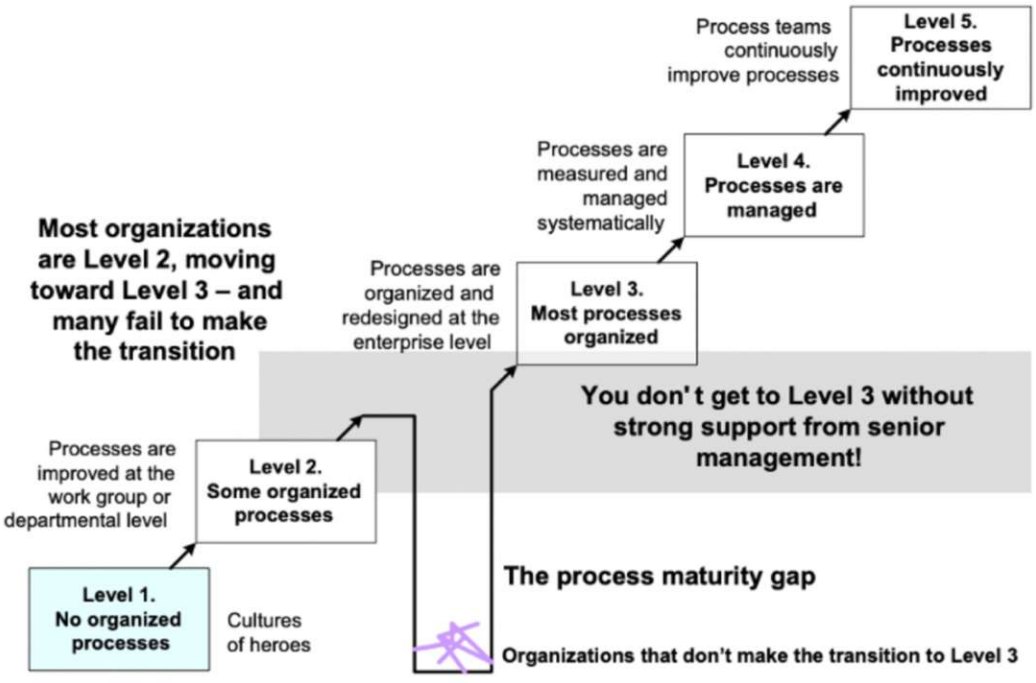

Fig. 3: Process maturity gap

The map is very important for drawing attention and forewarning about the challenges of advancing the processes in the company, especially from Level 2 to Level 3, as they describe it in the diagram. The authors admit that the key factor of crossing this transition is senior management support. They need to provide the budget for it, as well as backing and support, to assure that the organization as a whole gives the process perspective a real chance.

They also admit the holistic approach is needed for a successful transition. Managers need to understand how all of the processes in the company combine into a business process architecture and understand how the different processes are aligned to strategy and value chains and to a variety of enterprise resources. A business process architecture provides everyone with an overview of how all the activities in the organization relate to one another and contribute to satisfying customers. A well-understood process shows how each activity relates to every other and where departments must interface in order for the process to be effective and efficient (Harmon, 2014).

As the authors highlight, organizations achieve their strategic goals by the means of processes.

2.4. Introduction to the Process Debt Concept

Now that the definition and key elements of the business process and importance of business process management are clear, the next step is to examine the concept of process debt (PD).

The more well-known concept in project management is a technical debt that originated from software development. Technical debt appears when teams prioritize the speed of delivery of the product over its quality. They use shortcuts, workarounds or sacrifice the stability and some critical features to release the product faster. What is important here to notice, that it is usually a conscious decision: the developers know that part of the code should be refactored and improved later. But in a given situation it is more optimal to deliver a product faster and borrow some time (and other resources) from the future.

Gartner, a leading company in the research consulting field, points out that *“these sacrifices eventually cause the software to deviate from its prescribed nonfunctional*

requirements, and in the long-term, they can impact performance, scalability, resilience or similar characteristics of the system" (Gartner, Glossary).

Process debt is similar to technical debt and emerges, when the company decides not to establish or invest now in the well-organized processes and prefers an easy immediate solution. It is important to notice that the reason is not only the swiftness. As Clair Samuel notices in her article (one of the pioneering essays about PD), sometimes people just prefer the obvious or common solutions. Often it can be named like "because that is how we have always done it". This means that the PD can be also not the conscious choice, but also the ignorance of some other better and efficient paths (Samuel, 2017).

Thus, PD appears to be actually a payback that originated during the process from the inefficient operative solutions and demands investing time and money to resolve it.

However, just like with the financial debt and loan in the bank, PD can be seen as a tool. It is a tool of "getting ahead" and earning time or sources in a short term, sometimes sacrificing quality over speed. This sacrifice though can be important in order to deliver a product to the market as fast as possible and receive the feedback that is especially important for startups or even for mature companies dealing with innovations or struggling to go through a highly competitive market.

Remember the rule that Eric Ries pointed out in an article in Harvard Business Review (Ries, 2010): "Always choose the option that minimizes the total time through the feedback loop". He also emphasizes that "any change that accelerates learning is a win, and everything else is waste". In other words, on such markets it is important to validate the product in a market as soon as possible and sometimes by any means. The feedback loop is crucial to grow, so the "interest" that would be paid for this debt in the near future is totally accepted and justified.

Waste Reduction and Process Debt

The origins of PD can be also found in lean management and the concept of waste reduction, which was developed and propagated by Toyota in the 1950s. Here is the brief description of it.

According to Toyota principles, there are three types of waste in lean management: Muda, Mura, Muri.

Muda means wastefulness, uselessness and futility, which contradicts the principle that business processes should add value. Still, there are some processes that, although not adding value to the process itself, are necessary to the customer, for example,

different checkups and inspections. They should stay in the project. But the other types of activities add no value in the process and are unnecessary for the customer and therefore should be eliminated.

There are seven of them:

1. Transportation.
2. Inventory i.e., stocks of goods and raw materials.
3. Motion i.e., excess movement of machines or people.
4. Waiting.
5. Overproduction.
6. Over-processing.
7. Defects.

Mura means unevenness, non-uniformity, and irregularity. Elimination of fluctuation at the scheduling level can help to manage this issue.

Muri means overburden and can result from Mura. Good design can help to deal with it by evenly distributing the workload and not overburden any particular employee or equipment.

All of the types of waste can be avoided and eliminated by good process design. Muda can be mitigated by regular process monitoring and its redesigning and improving.

However, PD drives attention slightly in the other direction, then the waste reduction concept. First, the framework and the term "Process debt" draw inspiration from the well-established concept of technical debt, which has gained significant traction within the software development era. PD resonates also with the challenges inherent in startup environments and the ever-evolving landscape of fast-paced markets. Thus, PD can be seen as a more contemporary refactoring of the waste concept. Secondly, PD by its name reflects the payback, or sort of penalty (or the interest in the terms of a bank loan). Because of its naming it is easy to align it to other sorts of inefficiencies and sub-optimal decisions across the company and particular projects, thereby considering debts in a holistic view.

As Malakuti and Heuschkel put it in their study, to effectively manage *technical debt* in large-scale companies, we need to proactively identify *debt at each part of the value stream,* identify the cause-effect relations among them and manage them accordingly. This indicates a need for a holistic debt management approach, which enables us to move from reactive decision making to proactive and conscious decision making for debt management across the value stream (Malakuti & Heuschkel, 2021).

To summarize, PD reflects and puts attention to the gap between the ideal conditions (perfect processes with no waste) and the current situation, and this gap can be provoked by the broad number of conditions, starting with novelty of the product and the changes that are currently applied, finishing with poor process culture and ignorance. Companies can eliminate this gap leveraging lean management approaches with Mura, Muda and Muri, i.e., “waste concept”. In other words, PD is a general concept, thus the waste management itself is a specific tool to crossing the chasm.

The Importance of Process Debt Concept

In the scientific field a topic of PD is not a popular notion. The term “technical debt” appears in more than 16,000 articles in Google Scholar, whereas the "process debt" OR "operational debt" only in 1300 (the research request was made on 14.02.2024, no timeframe was set). And even only a few of them, less than 10, concentrate on PD as a major topic.

However, process debt management is an important step in the business process management paradigm and holds a significant role in continuous process improvement, amplifying the ideas of lean management. When executive managers and experts try step by step to remove all the obstacles during production to improve productivity and cost efficiency, exactly the processes by themselves are the great spot of interest and the source of advancement. And the more complex the production processes are, the more holistic approaches should be developed to investigate the processes and company efficiency.

Business efficiency is an optimal way to achieve the business goals using minimal efforts and resources. Among main sources of business are usually named time, people, raw materials, intangible sources and money. The processes are some boundaries and connections that brace all the sources and orchestrate them in the best way.

Process Debt vs Operational Debt

In the literature, online sources and studies can be found two general terms: operational debt and process debt. They are essentially equal and authors of scientific papers refer to them as synonyms and describe in the same notions and examples (see Nolan, 2019; Martini, 2020; Malakuti & Heuschkel, 2021). The direct comparison of two different names was not performed in any study, and the reason for it can be found in its resemblance and similarity. Indeed, an operational process is an element of the business processes, that is why distinguishing among them in the current paradigm of debt management examination and, at least in the present general level, gives no advantages. Interesting to admit that the private contributors of the online articles prefer to use the

“operational debt” term, whereas the scientific studies (the only exception is Nolan, 2019) concur to the “process debt” term.

According to the above, the current study provides the concept of “process debt” on any activities emerging from the substance of the business processes, including any operational activities, therefore “process debt” term refers to the “operational debt” as well.

2.5. Summary

A business process is the actors’ activities that transforms inputs into outputs under some conditions (time, cost, quality) to deliver the specific products that meet customers’ needs and contribute to the value stream. Established business processes structure company activities by defining the rules and constraints, adding the value in a company value streamline and meeting the customer’s needs.

Business process management is a systematic approach to ensure that effective and efficient business processes are applied. It is a methodology used to align business processes with the company's strategic goals. Main function of the business process management is to find all the problems, flaws and potential creeps that can affect the project. It helps originally design efficient processes and maintain them in a proper level, redesigning and adapting them regularly. The main efforts in establishing business processes are concentrated in discovering and addressing the inefficiencies and imperfection before they disrupt or affect the whole project.

However, in the conditions of limited resources a balance should be struck between the investment in solid processes and fast market delivery or allocating it from other applied activities. As a market feedback loop is crucial to conquer the market share and sustain, the preference should be given to it in the fast-moving markets. Nevertheless, processes can also help to constrain complex and rapidly changing demands and prioritize the importance once in alignment with overall company goals.

The process advancing over time and maturity demands holistic approach throughout the company, principally by the participation of the company executives and establishing budget, general policy and overall support.

The concept of process debt originates from the similar concept of technical debt which has gained significant traction within the software development era. PD resonates with the challenges inherent in startup environments and the ever-evolving landscape of

fast-paced markets. PD can be seen as a more contemporary refactoring of the waste concept. It intersects with lean management approach of waste reduction (Muda, Muri, Mura), but highlights the gap between the ideal processes and the current situation and also reflects, by which degree companies can borrow time and money from the future to meet current customer demands.

Process debt management is an important step in the business process management paradigm and holds a significant role in continuous process improvement, amplifying the ideas of lean management. The more complex the production processes are, the more holistic approaches should be developed to investigate the processes and company efficiency.

In the current study the process debt equals the operational debt, whereas both concepts describe the same approach and there are sufficient differences that can interfere with the current study goals.

3. Process Debt: State of the Art

In the previous chapter the concept of Process Debt was described in general. In this chapter PD is examined in detail, by providing the current state of the art with simultaneous assessing current approaches and theoretical notions.

Several available scientific studies, insights from books and also online articles had been analyzed and summarized. Each of the sources has its unique value. Scientific studies have a solid background and leverage scientific theoretical approach. Whereas the articles by the practitioners, people who are involved on a day-to-day basis in business activities, give another valuable dimension of the research field and show another perspective. Leveraging knowledge of all of these sources helps to dive deeper to the concept of PD and have the whole view from theory to practice. It is also important to notice that scientific studies are relatively new, from 2019 and later. The online articles are also novel (the oldest one is from 2017).

One of the most comprehensive and valuable studies about PD was prepared by Antonio Martini and his colleagues. The researchers conducted the life sessions with four international companies by interviewing 16 people (the number of participants from each company has varied from three to six). The results of empirical study with a combination of theoretical parts made the basis of their paper with detailed examination of PD. The original study was named “Process debt: A first exploration”, presented in an Asia-Pacific Software Engineering Conference and published in 2020. Later they enriched the study with observation of one more company and also extended the theoretical part and conclusions. Although this other paper is not yet peer-reviewed and therefore not officially published, some of the insights are worth noticing and would be also presented in this chapter. It should be also mentioned, that the important limitation of the whole study is that it relies on interviews, observations and quantitative data collection with a limited set of organizations, moreover, the organizations were only the software development companies.

3.1. Definition and Origins of Process Debt

The definition of PD is not yet unified and it varies from the approach that the author uses. Martini et al. (Martini et al., 2020) give the following definition:

Process debt is the occurrence of sub-optimal process design, divergence from optimal process or deficiencies in the infrastructure that might be beneficial in the short term. However, such issues might cause both a short-term waste and might create a

context in the long term where a high negative impact is suffered by the process stakeholders.

The scientific definition is usually complex and overloaded, that is why it is also interesting to look from another perspective, from the people who describe their personal work experience.

Clair Samuel (Samuel, 2018) defines the operational debt in a slightly different way: *The real cost, in time and money, incurred by choosing an "easy" solution instead of creating something resilient.*

Dave Owczarek, who is working with the concept of PD in the domain of SaaS (Software as a Service) technical operations, points attention to the risk factor and place it as an important dimension with defining PD, because "weaving risk into the approach provides a mechanism to set priority based on cost and risk rather than on generic inefficiencies, lack of resiliency, or demand for features". Hence, he defines PD *as the work required to fix process gaps that present risks to business operations* (Owczarek 2022, 1).

However, it seems to be more reasonable to describe PD in some measurable and sufficient money / time / source terms, because it would be clear to the stakeholders that these are some important tasks that need to be considered and faced. Therefore, the following definition can be more appropriate from strategic point of view:

Process debt is a payback, usually in time and money, that was originated in the past by choosing an inefficient solution and that is required to be managed to eliminate negative impact.

In the previous chapter PD was compared with technical and financial debt, but a more interesting and clearer comparison is presented by Dave Owczarek and Laura Nolan.

Dave Owczarek (Owczarek 2022, 2) points out that if someone takes on financial debt, he or she repays the loan through a series of regular payments. Those payments include both money towards the principal amount and an interest payment to the bank. In technical debt, the interest payment is the added complexity and time required to work with the section of code containing the debt. There is not necessarily a requirement to pay down the principal, although this is often the subject of much debate. Similarly, with PD, the only required payment is interest.

Extending this thought with Nolan notion (Nolan, 2019): she speculates that technical debt is like credit card debt - acquired part by part over time. Thus, PD is more like a mortgage: it can be paid down over time leading to ownership of a stable, well-automated

system. However, sometimes people do have problems paying off their mortgages. Nolan also admits that the worst-case scenario here is when a team has so much operational debt that they don't have cycles to work on fixing it, instead they are forced to spend most of their time on toil - tactical work that doesn't improve their systems in the long term.

Dave Owczarek notices that indeed an interest in this "debt" metaphor is a toil, and to be more precise, it is actually time times toil (time x toil), in other words, toil multiplied by time. Toil is the kind of work that is not contributing to the value chain and tends to be manual, repetitive, automatable, tactical, devoid of enduring value, and that scales linearly as a service grows.

Owczarek warns: "time times toil" is the total interest you are going to pay until you fix the underlying problem. For every month that you don't fix it, you are paying the toil in interest. Leveraging the relatively simple metaphor of the toil pile allows Owczarek to develop a deeper understanding of PD concept and to make it easier to envision potential solutions. He admits that the toil pile, for example, may be a vivid metaphor for describing the work, but it is also an important dimension in understanding the problem and finding a solution. (Owczarek 2022, 2).

Can companies avoid PD? It is almost impossible. Like with the mistakes, only the one who is not doing anything makes no mistakes. Each new project, innovation or scaling the business would lead to PD in the first place. The main challenge is not to repeat, escalate and propagate it and at the same time to minimize the negative impact and consequences of PD.

In the present dynamic environment, there is a notable demand and widespread popularity for the agile philosophy. Consequently, the agile approach may exert additional pressure and therefore PD, as it plays a significant underlying role in generating challenges, particularly due to its emphasis on time, fast implementation of changes and cost efficiency. But it is not always the case.

Martini et al (Martini et.al., 2020) based on the interviews with the project actors identified the following **accumulation patterns** for PD:

1) Sub-Optimal Process Design.

The processes were poorly established at some degree at the very beginning or the poor design emerged during the ongoing phase.

2) Process Divergence.

The processes were relatively effectively designed by the process owner, but then poorly performed or not followed precisely by executors.

3) Infrastructure Deficiencies.

The problems were caused by some issues in infrastructure. Since there is no other independent function, where infrastructure flaws can be considered, Martini et al. find it important to highlight it as PD. Moreover, the infrastructure issues were named directly by the interviewees as part of PD.

As it is pointed out in Robert Sutton book “Scaling up excellence” (Sutton, 2014), process problems can be produced by an overprocessed environment. Sometimes the processes are so complicated that employees struggle to follow them. It can be described as a combination of first two patterns: overcomplicated processes’ design leads to the poor performance or avoidance to execute them or pushing further to the late deadlines.

Dave Owczarek (Owczarek, 2022 2) suggests taking into account the circumstances by which PD is emerging. He sets aside intentional and unintentional causes and careless / careful acts of process owners or process executors.

This hypothesis can be visualized by the following quadrant:

	Careless	Careful
Intentional	**Accept the risk** *Workaround to meet a deadline*	**Process Debt is analyzed and embraced. Concrete plan is prepared** *Postpone the work until future opportunities*
Unintentional	**Ignorance** *What is this feature? What’s wrong with not doing it?*	**“Unknown unknowns”, project creeps** *Reluctantly put it into future plans; We discovered it already in a production*

Fig. 4: Quadrant of origins of Process Debt

This approach allows us to understand the roots and origins of PD and understand how to react to it and avoid the same problems in the future.

The most important quadrant is ignorance, the dangerous mixture of careless behavior and unintentional approach. It can appear because of the knowledge lack or avoidance to take additional responsibilities or tasks. This type of problems should never appear next times, because after lessons learned the team should be prepared.

Next intense area is “unknown unknowns”. These situations were not foreseen before and because of the time pressure, lack of people or other influential factors, the team is forced to push it into future plans.

Another area is intentional, but careless approach. It happens often and can be described as a trade-off between speed and quality. If the team still needs to maintain the proper quality of the product, they would pay for it with some non-optimal, sometimes time-consuming work-arounds or other imperfections, without solid plan, when exactly it would be reworked and improved. However, in this situation a team knows the risk and accepts it. That can be actually a good trade-off, and the “debt” would be paid later by the next interactions in the production.

The last quadrant is a best situation, where an intentional approach meets with a careful behavior. A team makes a conscious decision to go the easy way this time, but keeping the plan for future improvements in mind (and a lot better - already written plan).

A company should avoid constantly repeating the “ignorance” pattern, but analyze every situation and try to make careful decisions or at least each time evaluate the risks.

This quadrant considers the human input in the decision making and somehow rates the accuracy and personal impact, which can be ambiguous. Dave Owczarek warns not to make personal judgments during this analysis. For comparison: “was this decision carefully made?” with “did this person make a careful decision?”. The possibility of constructive communication is way higher in the first example then in the other one.

3.2. Process Debt Types

In the study by Martini et al. (Martini et al., 2020) the following types of PD are presented (the full overview may be seen at Figure 5).

1) Activity-Specific Debt.

Processes are created for many different goals and may involve many different activities. It is possible that one specific activity is sub-optimal and not the whole process as a whole, admit Martini et al. in their later research (Martini et al., 2023). Different activities inside one process can be flawed: for example, a sub-optimal prioritization (can be called prioritization debt), a sub-optimal certification (certification debt) and so on. In addition, many activities are context-dependent, meaning that they appear in some companies and not for others, or they appear with different names.

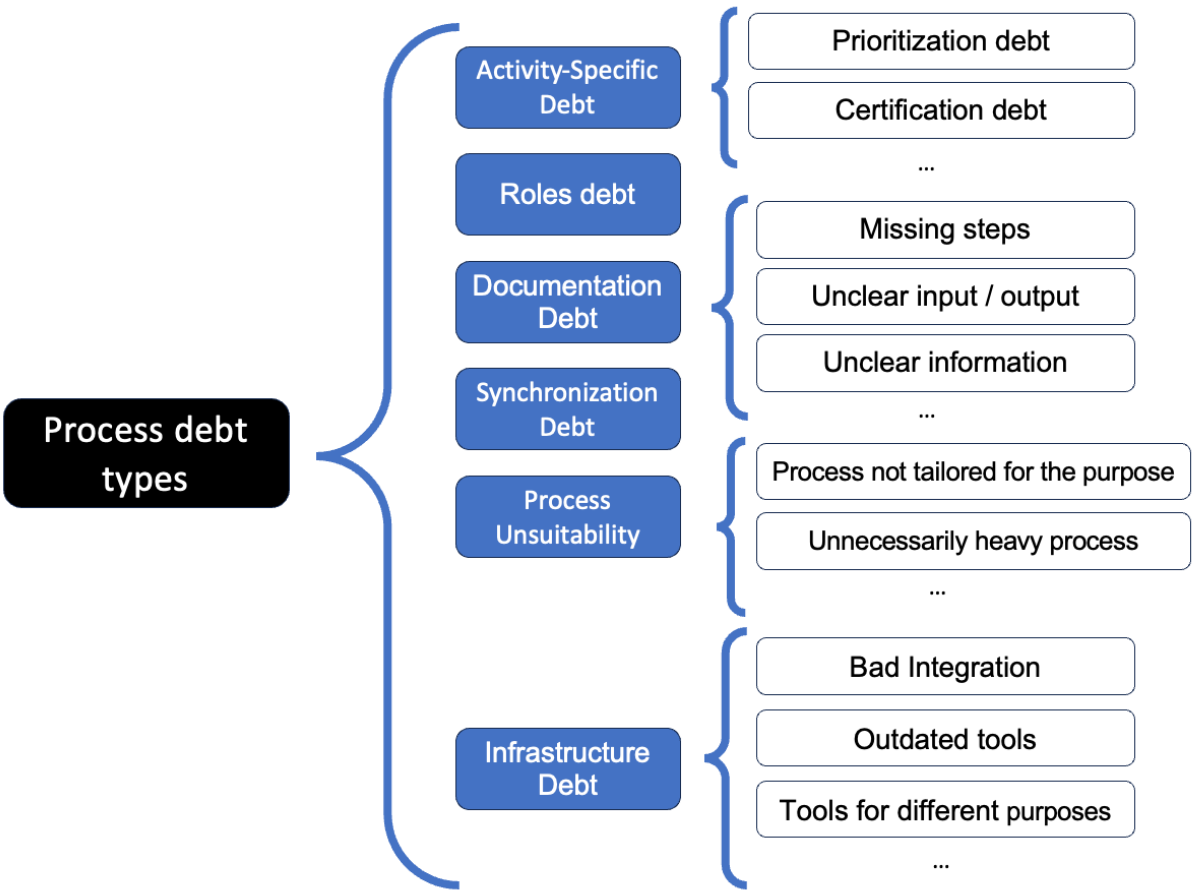

Fig. 5: Process debt types

2) Roles debt

Activities are performed by the specific persons and sometimes an assigned role in a project and responsibilities can be poorly explained, mapped or can hinder the activities that are not explicitly described, understood and in the end performed by the employees. That leads to the mismatching between assigned roles and actual responsibilities.

3) Documentation Debt

- too little information;
- too detailed instructions;
- not enough clear information (too complicated / technical language).

The correct project documentation is very important for each project not only for the ongoing period, but also for further reflection, analyses and re-use for further projects.

Martini et al. admitted that the lack of documentation was recognized as one of a major source of PD both by process designers and by process executors from across all studied cases. At the same time having too much information may also lead to overhead, just like the lack of it. Process owners should also consider “speak the same language” with the stakeholders in order to avoid problems with comprehending the information.

4) Synchronization Debt

The contributors involved in a project are also likely to participate in multiple processes that are intertwined and need to be synchronized. If these interconnections are not well organized and managed, that can lead to the sufficient problems: some of the processes can be disrupted, some important steps could be skipped, the information could be not communicated in time, not to mention the overall confusion and overhead. Moreover, different teams can use different project management methods (in their research in 2020 Martini et al. described the situation, where one team used Scrum and other Kanban, and the pull-requests each two weeks from the first team were overwhelming and blocked the activity of the other). It is important to foresee it in the beginning and take actions for smooth synchronization between the different processes itself, as well as between processes and individual workflows.

5) Process Unsuitability

Some processes might not be suitable to support the business needs of an organization. An explicit example from one of the companies was the situation, where a software team inherited a waterfall-like process approach from a hardware product and they should have provided further reports according to the waterfall, but that was not suitable due to iterative agile software development approach. The difference with synchronization debt is, that in the first case the processes might be optimal but not well synchronized, while here one or several processes itself are just not suitable for the needs of all the stakeholders.

6) Infrastructure Debt

As was mentioned above, infrastructure debts are considered to be a part of PD. Project infrastructure can be divided into two subcategories: tools to carry the process and tools to design a process. The ongoing risks are concentrated in the first one, but project owners should pay attention to both of them, as well as avoid repeating the problems in the future. An example of infrastructure can be considered some intangible tools such as managing software or collaborative services such as Jira, Microsoft Teams, Slack, SalesForce and also tangible tools, starting from an office equipment to the extent of manufacturing equipment, set of machines and so on.

In other work, prepared by Malakuti et al. (Malakuti et al., 2021), the types of debt were split in an easier way and described in general through the term “debt management”. For instance, they discuss “people debt” or “infrastructure debt” at the same level as process debt. However, the tools to deal with all of these debts are almost the same, that is why it adds more complexity to the topic, so the approach by Martini is more relevant.

Another interesting approach in defining the types of PD was suggested by Laura Nolan (Nolan, 2019) with concentrating on more applied sides of PD. She identified and described the following categories of work that, if not automated, would consequently lead to PD. It is focused on software processes, but it can be scaled to other industries as well. If one would try to lay these categories to the types of PD, presented by Martini et al, the best match would be some **specific subcategories of activity-specific debt**.

1) Routine maintenance and housekeeping that happens on a schedule.

Regularly minor but important changes and updates, like managing backups, regular updates, updating certificates.

2) Managing change over time.

Major activities, but still pre-planned, for example migrations, capacity planning, infrastructure upgrades.

3) Routine per-customer work.

The necessary presetting for the customers, for example: account configuration, preparing report templates, managing permissions, sending invoices. Similar activities are often provided for potential customers, in other words – leads. A lot of products now have trial versions that also sometimes need to be pre-set. There are also some procurement procedures, in order to comply with them some of the special activities should be performed. The enterprise lead also needs a lot of attention and pre-set activities in a pre-sale phase to win the negotiations and proceed with the contract.

4) Non-routine work that scales with the system’s growth.

These are the activities that need to be performed by request, connected to the scaling up of the business, shifting to a different paradigm, or can be caused by customer requests or new project challenges. This work should also be planned in advance. Some examples are turning up new instances of the systems, dealing with new feature requests, investigating performance issues on behalf of customers.

5) Recovery from routine failures and managing bugs and other mistakes.

The failures like software bugs, machine breakdown, network problems, loss of a hard drive are the part of the technical process and happen unexpectedly. There are also problems that can occur on a client side and other incidents.

The sixth category was not named by Nolan explicitly, though it was later mentioned in her paper, that is why it worth to notice and describe here as a specific category:

6). Unknown unknowns.

These are the situations that cannot be foreseen and considered, but should be kept in view in order to react quickly and allocate the resources to solve the issue. They are different from regular failures: non-casual or routine, sometimes it is not a failure itself, but project creeps, that means some unexpected situation that took place during execution, including absence of key process performers due to sleekness, force majors, technical exceptions and so on.

Nolan proposes the following approach for managing and planning PD. First, track what your team is spending its time on now. If your team already has a lot of operational work, it may need to be reduced before you can afford to launch something new.

A good example is SRE Teams and their aim overload. Originally developed in Google, SRE refers to “site reliability engineering”, and SRE teams are made up of software engineers who build and implement software to improve the reliability of their systems. In Google, SRE teams aim to spend under 50% of their time on operational work. In other words, their work is intentionally planned in a way to allow them to easily switch to other required tasks. It should be noticed that one of the important tasks of SRE teams is to accumulate technical knowledge (Beyer, 2018).

The second phase, according to Nolan, is to estimate exact activities that need to be optimized.

As Nolan also admits, the zero operational work should not be a goal of a company. Indeed, some of the tasks are performed rarely and there would not be any positive return on the investment of time. Some of the processes are too novel or unique and do require human skills.

3.3. Causes of Process Debt

The next step is diving deep into the causes of PD. And again, in the study by Martini et al. (Martini et al. 2023) a good theoretical base is proposed.

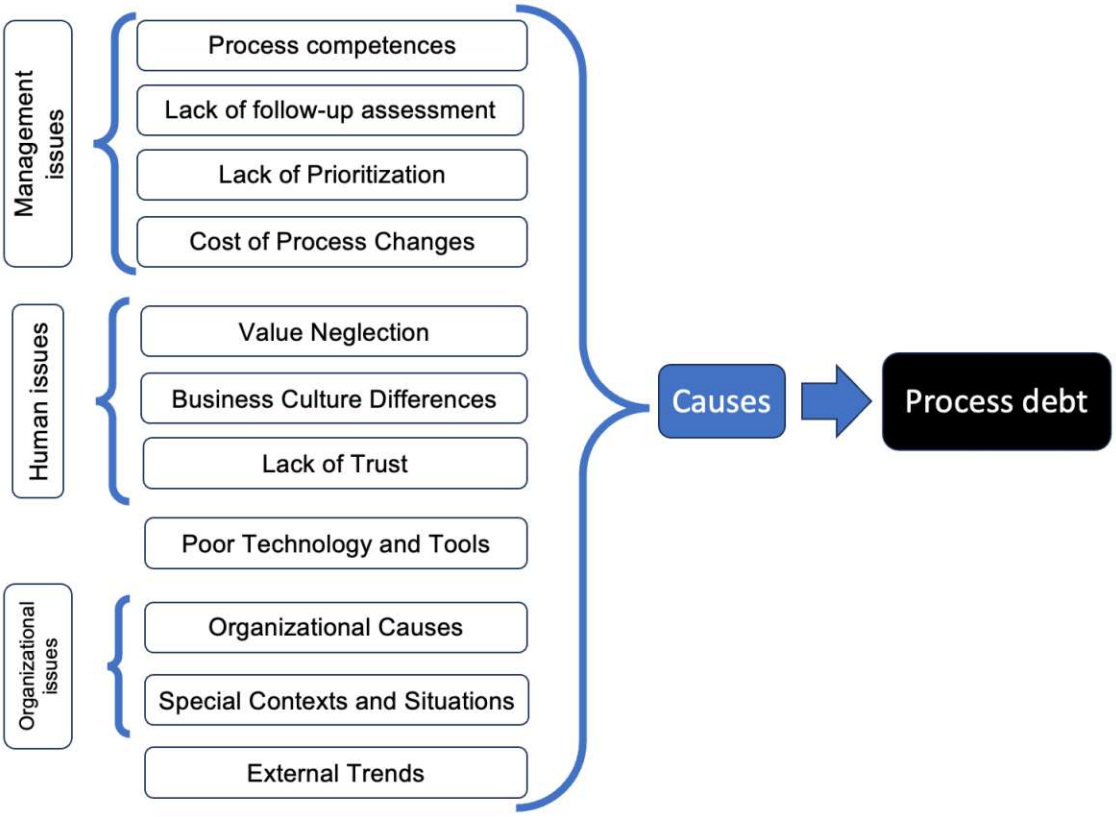

Fig. 6: Causes of Process Debt

Below the clarification for each of the causes is presented with comments and adjustments for the current work.

1). Process Competences

The lack of proficiency in establishing, managing and maintaining the processes is the most common problem. As it was admitted by some of the interview participants, it is important to have a responsible person for managing processes and to have managers who understand the value of processes.

2). Lack of Follow-Up Assessment

When the process is designed and implemented, the two-sided communication between a process owner and the stakeholders should be established with regular follow-ups. It helps identify the current problems, receive feedback and prevent miscommunication that therefore may lead to the growth of PD.

3). Lack of Prioritization

Similar to technical debt, PD issues are quite often not managed because they are not prioritized as important to be fixed. In some dimensions it is a meta-problem, because

to be prioritized, first the issue needs to be admitted and estimated. But if the company is not mature enough to assume that PD is a real problem that is important to deal with, there would be no room for prioritizing. That means, because of the lack of framework, practices and words of wisdom about PD, companies struggle with PD. This issue would be discussed in more detail in the next chapter.

4). Cost of Process Changes

Sometimes it is clear that some of the process should be revised and changed during the process. However, Martini et al. (Martini et al., 2020) forewarns that the cost of trying to remove PD can be prohibitive, especially if the value and the interest is not clear and assessed. One of the companies from this study reported the case, as they changed some of the processes during the project, but afterward it appeared to be wrong, so they paid nearly double cost to get back to the correct ones, so they would be even more precautious in the future.

The first four causes, specified by Martini et al, can be classified as management issues that were produced by some problems in the operating procedures. Therefore, leveraging general level of management skills can contribute to eliminating these issues.

5). Value Neglection

This is the situation of contradiction between the process owner and the process executors or stakeholders. If it is not clear how exactly a given process brings value to the organization or it is too poorly explained, that can lead to problems with its execution. On the other hand, it should be admitted that every process needs to be designed with a clear purpose and value. Although this factor may sound subjective and not so sufficient, the interviewees from Martini et al. research (Martini et al., 2023) named it as the second most important cause of PD.

6). Business Culture Differences

Several issues can be identified at this level, for example, a lack of software culture in the organization. As well as a culture / proficiency difference among teams and individuals (different experience, motivation, leadership styles, etc.) can contribute to the PD and therefore should be considered by the process owner.

7). Lack of Trust

This issue is not so obvious and sometimes hidden. A good example is a person with some specific competence, who is reluctant to share a knowledge or expertise, because other people can take over his job. It is sometimes also an “ego” issue, when a person feels confident when only he or she has a specific expertise and other colleagues are

forced to refer to this person. It is important to mitigate situations like this by nurturing trustworthy culture.

These three causes above are connected to human behavior, therefore they can be adjusted by developing better company culture.

8). Poor Technology and Tools

This aspect refers to the importance of infrastructure (both physical and non- physical, such as software) to perform all the processes smoothly and support fast deliveries. This issue was named among the most critical causes of PD among interviewees in the research by Martini et al. (Martini et al., 2023).

9). Organizational Causes

This type of PD originated from the specifics of organization, for example, related to the structure (role and responsibilities are not clear determined, that may lead to the role debt), the scale (information may not easily transfer from one team to another, especially with the distributed teams) or the stakeholders' distance (communication is disturbed and corrupted through several levels of managers).

10). Special Contexts and Situations

The special domains, context, specifics and personnel should be taken into account during process design and implementation.

11). External Trends

Adopting external trending processes that are not suitable for the company can lead to PD. Several of the participants of the survey, conducted by Martini et al. (Martini et al., 2023), described external trends that affect how processes were adopted in the company.

3.4. Process Debt Consequences

Martini et al. (Martini et al., 2020) have split the consequences into two kinds of negative effects, that can interfere between each other. They admit that besides the generation of a long-term interest (in other words, the bill to pay later in terms of people or money), process sub-optimality can often lead to initial waste (of time, effort, budget, etc.) for the stakeholders. The initial waste can in some cases be reduced by refining the process during the project, therefore it can be mitigated on time. However, in many cases, such negative effects can also become a long-term issue. It should be admitted again, that the interviews to the Martini et al. study was conducted among software development

companies, that is why the focus is switched slightly to this environment, however, it can be scaled to other industry as well.

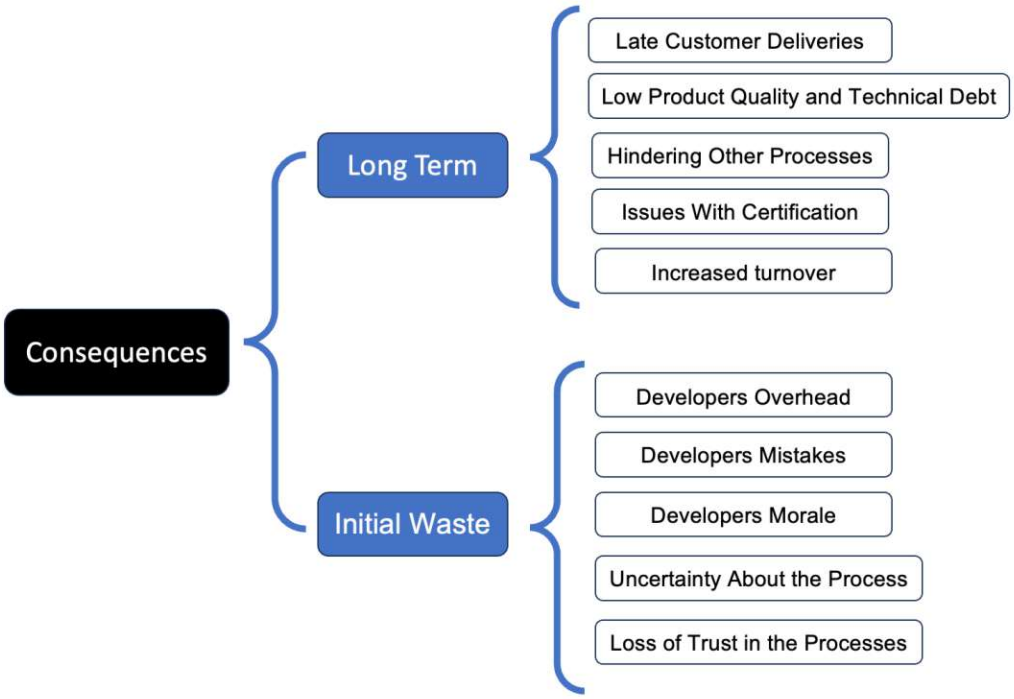

Fig. 7: Consequences of process debt

1. Long-Term Consequences

- Late customer deliveries;
- Low product quality and technical debt;
- Hindering other processes;
- Issues with certification;
- Increased turnover.

All the consequences in this section are self-explained. First two consequences affect the customer directly and therefore are the most important. Interestingly, interviews' participants in Martini et al. research also highlighted low product quality as the most impactful consequences, although they are manifesting from the customer side. That shows the quality of a final product has a big impact on the employee's satisfaction. Issues with certifications or compliance may be crucial and affect the customer later. Eventually frustration due to PD and a bad communication inside the company may lead to the loss of talented and qualified staff and personnel turnover in general.

2. Initial Waste

- Developers overhead;
- Developers mistakes;
- Developers morale (tedious work);
- Uncertainty about the process
- Loss of trust in the processes

The focus here concentrates on the negative effects from sub-optimal processes on the process executors, more specifically on the developers. In their study authors admitted (Martini et al., 2020), that even the developers' mistakes can be dramatically reduced by the optimal processes. According to the interviewees, it is commonly the case that developers prefer to work with processes that allow them to feel productive. The flaws in the processes contribute to the often switching between the tasks, unnecessary actions (for example, redundant reports or manual fulfillment of potential automated tasks) and general miscommunication inside the project. That leads to mistakes, overhead costs, sort of resentment among the employees and even loss of trust in the processes itself. It should be admitted also, that these consequences promote the ground for even more PD.

The accumulation of PD may also have a snowballing effect. If the company nurtures the culture of permanent urgency and always prioritizes speed over quality, it can be really hard to deal with it further. "The more it is allowed to spread, the more infectious it becomes", - warns Sagi Eliyahu in his essay (Eliyahu, 2021).

3.5. Managing Process Debt

After examining causes and consequences of PD, the reasonable question arises, how the company can manage it. Usually there are some strategies to avoid, prevent, reduce and mitigate different effects, situations or forces that interfere with our goals. In the case of PD, no clear descriptions in research papers or the private articles were observed to address all of these reducing activities, only partially some of them. This is also the reason why the ideas for this section were taken from different distributed sources, like books and online sources.

3.5.1. Avoidance & Prevention of Process Debt

Instead of avoiding, not repeating

As was discussed before, there is no chance to avoid PD completely, the more important not to repeat the same mistakes and step by step reduce the amount of

"unpredictable" and "unintentional" PD (according to the quadrant by Dave Owczarek, Figure 4). And that is why a proper mindset is very important to be aware of the possible problems and also find the balance between overcomplicated processes and bureaucracy and smooth project maintenance.

Awareness & long-term thinking

After analyzing all the available publications, it can be emphasized that the awareness of PD is a first and important step to manage it. Awareness can be further defined as a willingness and readiness to acknowledge the existence of a problem. It is not a strategy itself, but the mindset and governance principle that helps identify, understand, evaluate, prioritize and fix PD.

However, Selby Cary (Cary, 2023) warns that no matter how loud someone shouts about PD, it's hard to get people to acknowledge it or even prepare a mitigation plan unless something really goes on fire. That is why it is important to cultivate "long-term thinking", and therefore a lot of involvement from the organization is important.

Waste management

As it was stated in chapter 2.5, PD concept intersects with lean management approach of the waste reduction strategy (three types of waste: Muri, Muda and Mura). However, PD emphasizes the gap between the ideal processes and the current situation and reflects by which degree companies can borrow time and money from the future to meet current customer demands. That means that these concepts are focused in different dimensions, but the lean management approach can leverage PD reduction. Figure below clearly describes these dependencies (figure from: Auer, 2014).

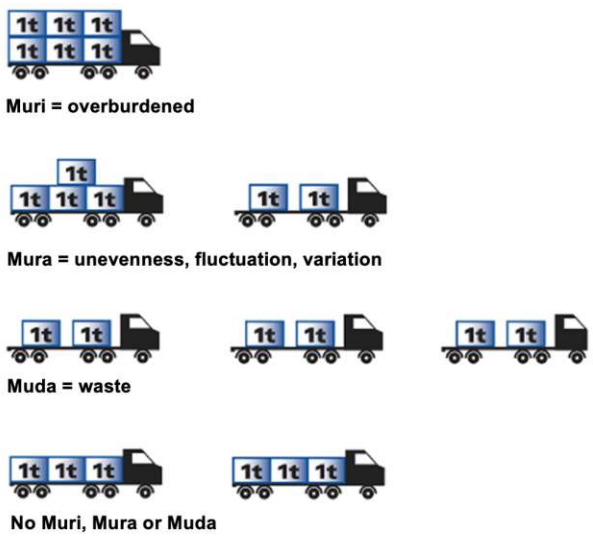

Fig. 8: Muri, Mura, Muda and the waste reduction strategy

As it is explicitly shown, specifically Mura can play a key role to balance the tense and reduce fluctuations that can cause other negative consequences (including Muri and Muda). Another important direction is proper process design and process maintaining.

Culture of continuous improvement

Nigel Simpson (Simpson, 2020) describes in his article the common situation: PD accumulated so heavily that it impacts the business operation in a critical way. In this situation (and usually only at this point) the resources are allocated, people are assigned and changes begin to happen. Simpson says that "over time this becomes institutionalized as normal organizational behavior: things break, issues become pain points, debt becomes too big to ignore, you fix it". But as he notices, it does not always have to be this way. He suggests to prioritize resolution of PD instead, not to allow it to spread so far that major "improvement projects" would be necessary. He sees the solution in *creating a culture of continuous improvement* where debt resolution becomes virtuous, timely, and celebrated.

Nigel Simpson also sees the value in permanently questioning the ongoing complex processes and interdependencies to understand the initial disposition. As he named it directly, "Zoom out until you can see the "why?" clearly".

The good questions to ask are:

- Why are we doing this? Does this process still make sense?
- How can I simplify this?
- What would happen if we stopped doing this?
- What is the experience like for the consumer of this process?

Understanding the initial background

The consultancy company Archetype (Archetype, 2022), that is specialized also in resolving PD issues, suggests to understand the initial background of emerging PD and address the underlying inefficiency. It can be, among others, infrastructure replacement, management methods shift or even paradigm shift. They also suggest having operational sprints, like in a Scrum methodology, to improve processes.

3.5.2. Mitigation Strategies

It is time to return to the study of Martini et al. (Martini et al., 2020) with interviews of several software companies. After summarizing the results of these survey, they propose the following strategies to mitigate the PD, that were named directly by the interviewees

or was discovered after additional examining the processes documentations that are used in this companies:

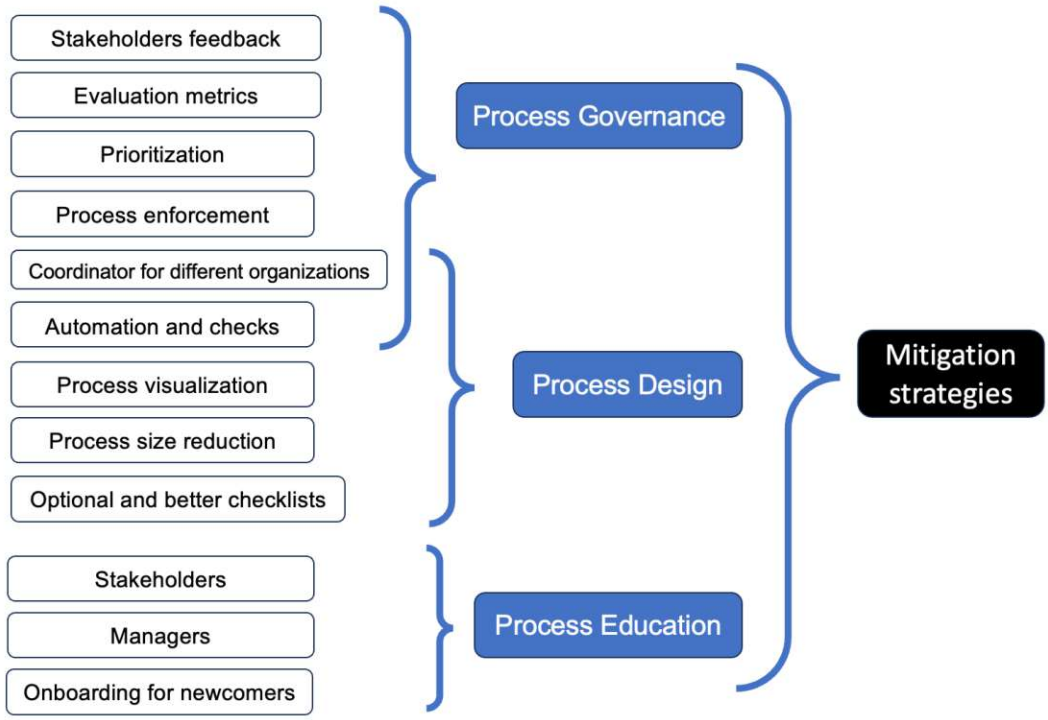

Fig. 9: Mitigation strategies to reduce process debt

Under “Process Governance” the study reveals the strategies that can be employed by the process owners and stakeholders to reduce the chances of accumulating PD or to increase the chances of changing the processes to reduce PD. Under “Process Design” are described the strategies that can be made when a process is either been designed from scratch, or when an emerging process is improved and optimized.

Stakeholders feedback: one of the effective strategies to understand where PD hides in the organization is to ask the stakeholders and actors involved to report on hinders such as **delays**, **lack of quality, time waste,** etc. Some PD might be difficult to measure in practice, and the stakeholders are the only ones who can observe if there is an issue related to the process.

Evaluation metrics: proactive approach for process owners is to self-analyze the key metrics of project success, for example, understanding the **speed** with which the process is executed or estimate the **quality** of the final product. However, some metrics still demand two-sided communication. Among these metrics are the **satisfaction** of the stakeholders (for example, via surveys or direct contact).

Prioritization is another sufficient strategy. As it was already discussed, PD is inevitable, so during any project there would always be options and opportunities to

improve the processes. That is why prioritization plays a crucial role. It is important to provide the list of PD issues with the defined priorities (for instance, based on cost / time / benefits / availability), so the responsible persons (Project manager, Project Owner, Team lead) can consider the list and allocate resources.

Process enforcement means that the project manager makes some of the tasks or steps mandatory. It is an effective strategy for some compliance processes, for example, an external certification process. The consequence of skipping some important compliance because of the time pressure is crucial, moreover, this activity is connected to the third-party organizations that are out of control during the project and therefore should be addressed with more attention.

Coordinator for different organizations. It is important to foster efficient communication and support information streams among the stakeholders both inside and outside the company. For example, it is important to speak the same "language", including special wording and slang, as well as make updates regularly and receive feedback. It is preferable to have a specific coordinator who forms the bridges and can maintain effective communication directly.

Automation and checks. The process owners and executors can decide to implement automated steps of the process, and to build automated checks that the process is indeed followed. Still, it is a question of allocating resources. Prioritization should be made to evaluate this step properly.

Process visualization. One of the ways to identify PD is to visualize the process. The bottlenecks, procedures, redundancy or insufficient activity can be easily seen after proper visualization. Process visualization can also include data-driven approaches. The different processes, performance indicators and other productivity parameters can be examined through dashboards and other business intelligence systems in order to improve some of the processes.

Process size reduction. In some cases, processes were inherited as a legacy or were pre-defined, but not revised to be improved or simplified. In other words, some of the processes should be eliminated in order to reduce PD.

Optional and better checklists. To help executors follow the processes, often the checklists with the main steps of the process are used during the project. However, they are often outdated or not optimal. In fact, checklists are especially useful the first time a process is in use, while after a while, when process executors have already learnt the process and they find following the whole checklist tedious and time- consuming.

However, the most interesting direction of the mitigation strategies is **Process education.**

Returning for a moment to the section, where were described, which situations often cause PD:

1. Process competence
2. Lack of follow ups
3. Lack of prioritizing
4. Value Neglection
5. Culture issues
6. Lack of trust
7. Tech and Tools
8. Costs of process change
9. Organization causes
10. Special Context
11. External trends

The first six of them, it means more than a half, are a direct consequence of the non-optimal human behavior. On one hand, the threat can emerge from the side of not well-prepared process designers, on the other hand – from not well-motivated members of the team, who are not informed, ignorant or do not understand the value of such processes for the company.

Our mindset forms the activity. If there is a culture in the company with the focus on process optimization and the clear message about the importance of processes and procedures, then everybody in the company at least would be aware of it and hopefully would inherit (at least partially) it in their day-to-day work life or attitude.

The special manager education should help process owners to establish good processes, to nurture good communication streams with the stakeholders and to understand how to better prioritize the PD issues. Regarding to the other employees, especially process executors, during the education it is more important to clarify the importance of process management for preventing a lack of trust, value neglection and also bringing the company to a common denominator, that means, try to softly shift the attitude. And in future plans even cultivate the new process culture, leveraging the principles of continuous improvement. The same approach should be implemented in an onboarding process for the new employees.

One of the important points here, that education should concentrate not only on **how** to deal with PD, but also **why** a company needs to mitigate PD: align it to the general company's goals to be more effective and efficient, so the mitigation of PD is one of the means to achieve it.

As PD is inevitable during the project and the mistakes occur, the more important question is how not to repeat them over again and to share the "lessons learned" insights with other teams. For deeply analyzing the mistakes, it is important to refer to its origins. Which intentions and thoughts we followed, making a decision, that lead us to the wrong path? Was it the direct consequence of our decision or other circumstances had emerged, that were above our control? And finally – what should we do next time to avoid similar problems? Is it concrete biases or perhaps the wrong mindset or some other influences?

Chris Argyris and Donald Schön (Argyris, 1996) describe the two types of learning in the organization, they call them "single-loop learning" and "double-loop learning". Single-loop learning involves changing processes when a problem occurs in order to prevent the same problem in the future, so the actions are modified to achieve the desired results. A double-loop learning happens when time is taken to understand the factors that influenced the effects, and the nature of this influence is called the governing values. Examination of the governing values help to fix the initial problem, so the desired result would be expected not only in the given situation, like it is by the single-loop-learning, but also by other similar events.

The simple example is a miscommunication between a manager and a customer. Correcting the wrong received message itself is a single-loop learning, but if a manager would try to understand why this has happened in the first place - if a manager has not made enough or clear updates, if a customer has other expectations and so on, that is already would be a double-loop learning. The changes based on this type of understanding will be broader.

Hence, the single-loop learning is about asking, “are we doing things right?” while double-loop learning is about asking, “are we doing the right things?”. Martini et al. emphasizes that if company focuses only on a single-loop learning, the underlying cause of PD will not be solved, and the sub-optimal process will continue to exist. Therefore, they argue that to reduce PD, companies need always to conduct a double-loop learning.

Additional Tools: SOP and IROP

The two additional tools should be added to the strategies above, that refer to some sort of regular actions and how to deal with exceptional situations.

Standard operating procedures (SOP)

Josh Kaufman in the book “Personal MBA” (Kaufman, 2010) introduces the following tool to deal with some repeated actions that recur inside the project or even the company - “Standard operating procedures” (SOP). *Standard operating procedures is a predefined process used to complete a task or resolve a common issue.*

As Kaufman admits, SOP reduce the friction that he sees as one of the big enemies of productivity. Instead of wasting time and energy solving a problem that has already been solved many times before, a predefined SOP ensures that you spend less time thrashing and more time adding value.

However, he warns that SOP should not lapse into bureaucracy and micro-management. If the SOP requires effort without providing value, it is a friction.

The main purpose of SOP is to minimize the amount of time and effort to complete a task or solve a problem. Kaufman also suggests reviewing SOP regularly, on average every 2-3 months.

Managing irregular operations (IROP)

Every company faces uncertainty and exceptions, but some industries can have severe examples and be affected more.

A good example of preparing for irregular situations is presented in the Robert Sutton's book "Scaling up the excellence" (Sutton, 2014). He describes a case of JetBlue Airways, an American company that was lifted off as an ambitious start-up in 1999. JetBlue had grown from a few planes to over a hundred, but after the ten years of operating still suffered from process insufficiency, leveraging their success mostly by the "heroic" mindset, as Robert Sutton described as in his book. When unexpected problems have occurred, employees were doing something beyond the possible or considered in their functional statements to keep flights on schedule or accomplish other important activities. But the severe weather conditions in July and August 2008 that caused more than 800 flight cancellations revealed that JetBlue has systematic coordination and communication problems. After that crisis the director of customer experience Bonny Simi (who faced herself the problem, struggling to fly from one coast side to another) claimed an ambitious goal: to establish the special process protocol for managing irregular operations (they named it IROP) during the bad weather. As it is described by Sutton, "she was convinced that the best way to do it is to stop relying on individual heroics or a top-down approach and instead recruit frontline crew members to root out and repair trouble spots and build in better communication within the company and with the customers". Even her team was skeptical at first about the success of the initiative. It really took a huge amount of work, including detailed process mapping, considering the gaps and potential flaws, and hundreds of small improvement projects. The first big test for the new framework was the ice storm in New York on February 10, 2010, affecting John F. Kennedy International Airport. The whole JetBlue system was recovered a day later and the delays cost the company only about $500,000. In comparison, after the similar or even weaker disruption before, it took the company on average six days to return to normal and cost about $41 million. In other words, well-established processes and protocols helped to save not only a lot of time and money for the company, but also for their customers who could travel with minimal disruptions, despite the huge weather problems.

The table below combines the applicable typical PD types by Laura Nolan (Nolan, 2019) that were presented in subchapter 3.2 and reducing methods that can be applied. SOP refer to the "Standard operating procedures" (SOP) by Josh Kaufman.

№	Process Debt Types	Time Reliance		Task	Strategy
		Regularity	Expectancy		
1	Housekeeping routine, Compliance	Regularly	Planned	Prepare SOP, review, update	Automate
2	Manage changing	When needed	Planned	Prepare SOP and scale, review & update	Automate
3	Pro-customer routine tasks	Per customer or product	Relatively expected	Prepare several instances and scale	Automate to the possible limits
4	Non-routine work (for scaling up, per request, etc.)	When needed	Planned	Unique in some cases → be ready	Learn
5	Problems & Failures	Unexpected		Be ready and allocate resources	Learn each time to avoid in the future and to be prepared
6	Unknown unknowns				

Table 1: Action plan to reduce process debt

3.5.3. Prioritization of Process Debt Remediation

When the team notices some issues in processes and discovers several instances or manifestations of PD, how should they react and prioritize them?

Owczarek emphasizes that the main role in considering PD should play the costs to handle consequences of PD, namely the interest, and the cost to its reduction. As with some financial debts, if the interest is low and one can leverage the opportunities of fast money, should he or she really care? The interest in PD case, according to Owczarek, is a toil pile or in other words - the manual repetitive boring work that could be automated (Owczarek, 2022 2).

Owczarek offers another quadrant solution to present the idea of dependencies between the “interest” that need to be paid for PD, in other words, a toil. And the costs for the improvement, the correction of PD or, in other words, for remediation. The quadrant below is given with some corrections in wording and description to reflect the idea more clearly (Owczarek, 2022 3).

	Low Toil	High Toil
High Costs of remediation	**Postpone** *(unimportant)*	**Hard case** *(may need an intervention)*
Low Costs of remediation	**Not a real problem** (second priority)	**Just do it** (first priority)

Fig. 10: Quadrant of process debt remediation

The first task to concentrate on is clearly: high toil with low costs to fix it. The manager should prioritize activities and solve the issue. Unfortunately to the managers and other stakeholders, it is a rare situation.

The next one is low toil and low cost of correction. It is recommended to solve it as well when it was first discovered, because the forward motion can probably move the problem to the other part of the quadrant.

When the “price to pay” for PD is low (it takes, for example, not a lot of time to deal with some small tasks that can be theoretically automated) but the costs to improve are high, the task can be postponed, especially if the resources are limited.

The most challenging scenario is the last one: high toil and the high costs of remediation. The examples of the situation can be, that the team has limited time to deal with an issue; a debt project competes with other important project and therefore has less priority; a debt project is more complex, requiring other teams or experts to join.

Owczarek says that the last case is the most important and that the team can tend to embrace the current PD because it is hard to allocate all the resources that are needed. Or the strategy would be just to wait for better conditions to make a solution more feasible to stakeholders. In any case, it is important to escalate an issue to the executive managers and make some sort of intervention for highlight the current PD.

3.6. Process Debt as a Tool

Another interesting opportunity, described in the PD research, is an idea of using PD as a tool. If a company is successful, it is almost inevitable that at some point PD will surface.

The consultancy company Archetype (Archetype, 2022) admits in their article, that PD not always bad and in a small dose can be healthy. They point out, that *management should not let perfect become the enemy of great*. Fast delivering MVP (minimal viable product), albeit accumulating some PD, also helps to have quick feedback that is very important, especially for startups and companies who are working in the innovative or highly competitive market. It resonates with Eric Ries' statement (Ries, 2010) always to choose the option that minimizes the total time through the feedback loop.

As Martini et al. highlight in their last study (Martini et al, 2023), a key point revealed by observing PD in the longitude, a bit paradoxical though, is that removing PD often introduces new PD. This means that more than one strategy and activity should be applied, and in terms of debt more than one repayment might be needed to compensate for poor processes. And therefore, the main goal should be to avoid repeatedly emerging situations that produce and accumulate PD. Particularly, some of the corrupted processes can be replaced with even less efficient processes, which is why the careful decision-making process should be provide before changing something. In other words, there is no exceptional need trying to automatize or fight every imperfection by any means.

3.7. Summary

In the current chapter state of the art for the process debt concept was presented. Considering all the ideas and approaches, the following definition of the concept is established: *Process debt is a payback, usually in time and money, that was originated in the past by choosing an inefficient solution and that is required to be managed to eliminate negative impact.*

It is almost impossible to avoid PD. Like with the mistakes, only the one who is not doing something makes no mistakes. Each new activity, project, innovation or scaling the business would lead to PD in the first place. The main challenge is how not to repeat, escalate and propagate it and also how to minimize the negative impact and consequences of PD. it can be emphasized that the **awareness of PD** is a first and

important step to manage it. The lean management philosophy with the **culture of continuous improvement** and the waste reduction strategy (eliminating Muda, Muri and Mura) should be nurtured and applied in the company. The proper process design and further maintenance are

The three **accumulation patterns for PD** are **Sub-Optimal Process Design** (the issues that originate mainly from process owner side) **Process Divergence** (the issues that originate from the process executors' side) and **Infrastructure Deficiencies** (the issues connected to the poor tool and environment) (Martini et al, 2020).

Another dimension to look for the patterns is approach depending on an actor's behavior: intentional and unintentional causes and careless / careful acts of process owners or process executors. Careless unintentional patterns, caused by ignorance, should be avoided in the future.

The different PD types can be separated, such as **Infrastructure Debt, Documentation Debt, Synchronization Debt, Roles debt, Process Unsuitability and Activity-Specific Debt.** The several instances of activity-specific debt can be highlighted:

- Housekeeping routine and compliance
- Manage changing
- Pro-customer routine tasks
- Non-routine work for scaling up
- Recovery from Problems & Failures
- Unknown unknowns.

The causes, consequences and mitigation strategies can be visualized with the following map, presented on Figure 11.

When the team reveals several instances of PD, they can be prioritized by the two parameters: the costs to handle consequences of PD and the cost to its reduction.

Another interesting opportunity, described in the PD research, is an idea of using PD as a tool. If a company is successful, it is almost inevitable that at some point PD will surface. However, that is not always bad and in a small dose can be healthy. Management should not let perfect become the enemy of great. Fast delivering MVP (minimal viable product), albeit accumulating some PD, also helps to have quick feedback that is very important, especially for startups and companies who are working in the innovative or highly competitive market and the guiding rule is always to choose the option that minimizes the total time through the feedback loop.

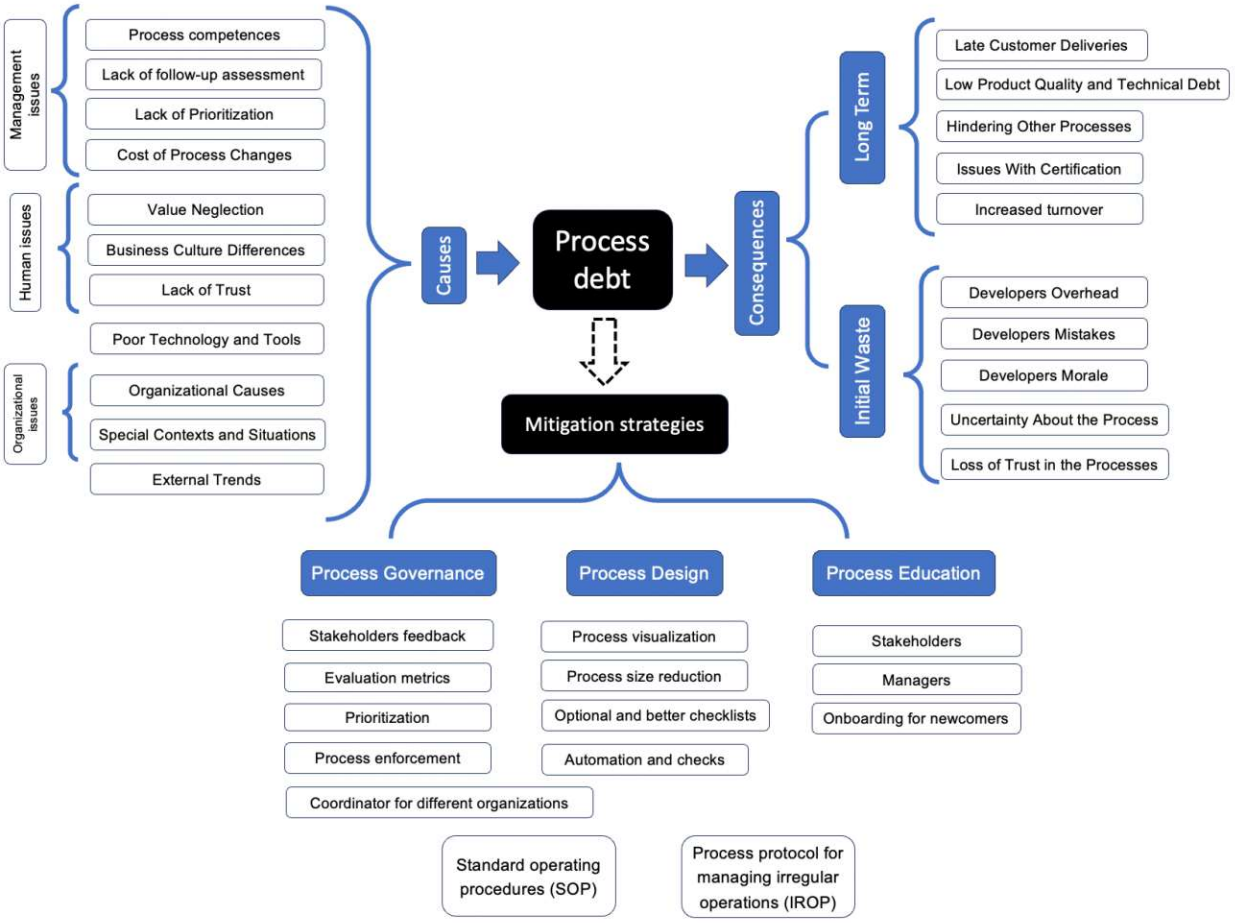

Fig. 11: Process debt map of causes, consequences and mitigation strategies

4. Process Debt: Developing a New Framework

To the New Framework of Managing Process Debt

In the previous chapter state of the art was observed through several studies, professional books and personal opinions in the public web-sources. As a topic is relatively novel, there are not so many theoretical inputs. On one hand it limits the current grounds, but on the other hand gives more opportunities to contribute new ideas and provide new approaches to the topic.

Research papers are written in a specific way and are constrained by the methodology guidelines. Whereas the articles with the personal opinions are mostly written by the experienced managers, who faced the phenomena during their work and came up with their thoughts and practice advice, in order to share them with the community (good examples are Clair Samuel, Sagi Eliyahu or Dave Owczarek).

In this chapter a balance between these two approaches would be kept to introduce the new framework for managing PD. The framework includes 3 main approaches:

- Process debt triangle to visualize the dependencies;
- Key Tactics & Strategies to reduce PD;
- The new organization role or the entity to handle PD in the company on a regular basis.

4.1. Process Debt Triangle

The classical project management triangle, that was using since the 1950s, reflects the connections between three main parameters: **time, costs and scope**. The less time and cost the project has, the poorer the quality would be. On the contrary, if quality is the main priority, the team should invest more money and time to achieve it. Moreover, one dimension can be compensated by another. For example, less time and more scope of work with the same quality can be achieved with more costs for its execution.

Fig. 12: The classical project management triangle

With the similar analogue, the process debt triangle visualizes main dependencies and therefore challenges that a project usually has. Three main parameters that define PD can be named as **Market Delivery Speed, Product Complexity and Novelty, Human Input**. In this case the bigger the triangle, the worse our situation with PD is.

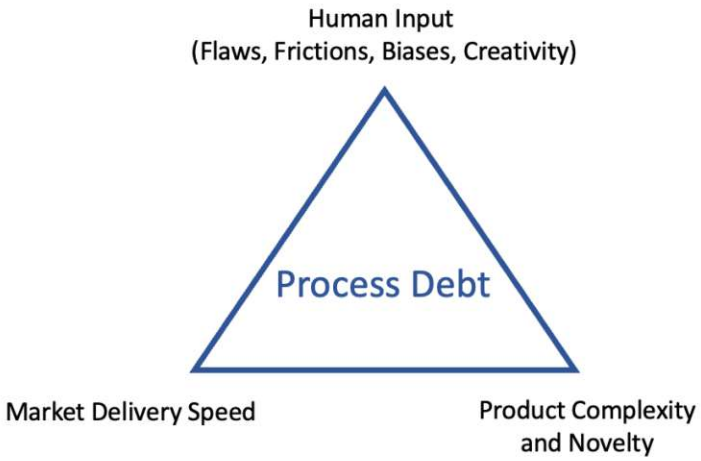

Fig. 13: The Process Debt triangle

Market Delivery Speed

In the highly competitive and innovative market the speed of the product delivery is the cornerstone issue. As it was mentioned before, the feedback from the market is very important, to understand if the company and the products are moving in the right direction

and what changes or improvements should be made. A feedback loop, continuous two-sided communication between the market (customer) and the production team is crucial and should be prioritized. In this situation PD can grow, however it can be used as a tool. The company consciously does not invest time in the process establishment, because these processes can be changed and adjusted on each iteration. Only when the production process becomes rather a routine than an innovation, there is a strong necessity to switch to the operation mode and specify processes.

Product Complexity and Novelty

The more innovative the product is, the more novel processes the company should apply. As it was mentioned in the previous paragraph, if the exact process is not yet sure to be required in the next production cycles, it is arguable if it should be well established. The complexity of the products also contributes to the PD. Complex products may already have good designed processes, but the probability of poor execution is much higher in comparison to the commodity.

Human Input (Flaws, Frictions, Biases, Creativity)

As it was discussed in the previous chapter, a bunch of problems are emerging because of a human behavior. Team members can be unaware of the whole processes or big picture, as well as process ignorance or different mindset may lead to the process inefficiencies. Some of the biases' examples are the prejudgments such as "processes do not work", "if we automatize someone's work, we would not need this person anymore". Employees' frictions may manifest through the intentional avoiding some of the responsibilities or postponing the assigned tasks. Another connected problem is "silo thinking", when employees or the whole teams are not aligned with each other and responsible only for the small piece of work, without considering the company strategy as a whole or the project goals in particular. On the bright side of this triangle corner stands creativity. This is something that is not yet automated and still belongs to human nature and can be aligned to the complex and innovative products. The price to pay is the probable mistakes and flaws by the imperfect human nature. However, mistakes are totally normal for human nature and should not be considered as a critical problem, but should be always kept in mind by the process designers

Process Debt and Cost Efficiency

The PD inside the triangle can be also recognized as a cost efficiency. Indeed, PD pays off as the additional human hours that are spent to cope with some emergency situations or to compile the work that could be automated early. And as PD, cost efficiency

represents a long-term objective, requiring ongoing efforts towards continuous improvement. Therefore, the strategies to reduce PD are leading to cost efficiency and company's goal is to constrain the triangle accordingly. How can it be achieved? In the real market situation, the first two parameters – *market delivery speed* and *product complexity and novelty* – are usually the ones that cannot be sacrificed. That is why it is a most common situation that the *human input* can be adjustable and adaptive, therefore, the main focus of process managers should be concentrated on this factor. In the next part of this chapter the exact strategies would be examined.

Company Maturity and Process Debt Triangle

The additional remark that should be noticed and considered, but it stands outside of the triangle, is the size and the maturity of the company. If there is a startup with 10 people that regularly communicate with each other and that are specialized in the specific area, the overprocessed environment would be redundant and can on the contrary disturbed the company. It also would demand time that is more logical to allocate in some activity that has a higher return on investment. However, when the company grows, the pivot moment of the maturity should be tracked to be ready to invest the time and money in establishing the processes.

4.2. Tactics and Strategies to Reduce Process Debt

As it was described in the previous chapter, Martini et al. (Martini et al., 2020) see the three main domains that accumulate PD: **Sub-Optimal Process Design** (the issues mainly from process owner side) **Process Divergence** (the issues from the process executors' side) and **Infrastructure Deficiencies** (the issues connected to the poor tool and environment). That means that approaches to reduce PD should be connected also to the following domains: managers, team members & infrastructure. It is also important to consider the lifecycle of the project: pre-phase or the preparation phase before the project starts; execution the project and the post-phase, when the project is completed. In the same study Martini et al. also established some mitigation strategies, that are also can be found in the previous chapter. However, it seems more feasible to separate the tactic and strategic approaches. In this part would be presented new outlook with some reconsiderations of previous notions.

4.2.1. Tactics to reduce Process Debt

Below is established the tactical activity that help to mitigate PD. For more convenience glance they are given in the project-based examples. However, the important notice here that these tactics should be implemented not only to the specific projects, but also to the general processes in the company. For example, the hiring processes, the invoicing procedures, some of the technical routine or mandatory tasks. It is recommended to take such an inventory on the regular basis.

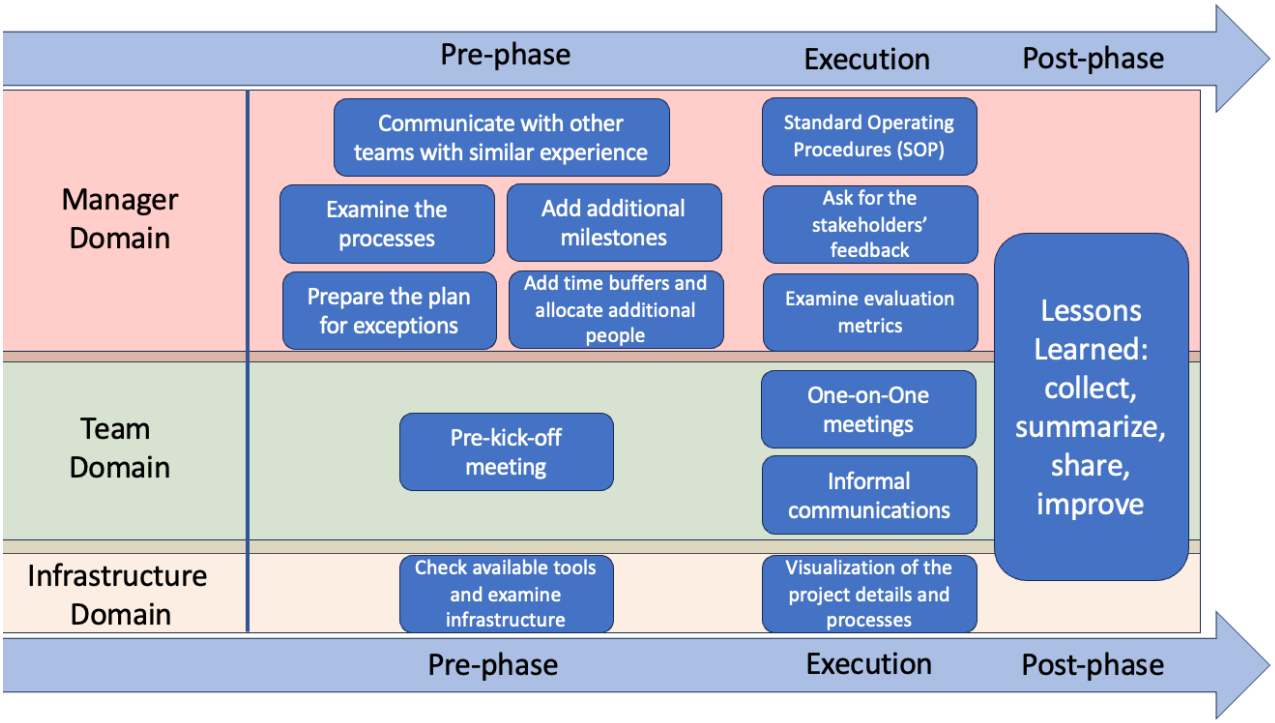

Fig. 14: Tactics to reduce Process Debt

Manager Domain

To this domain belong project managers, process owners and other actors, who are responsible for managing, maintenance and controlling the process. It also includes the tasks that involve the stakeholders or company executives.

The main pre-phase mission is to **avoid process deficiencies by good process design**. It can be achieved by preliminary **examining all the processes**. The questions that should be asked, among others, are:

- Why are we doing this? To which exact project goals does it contribute?

Some of the processes could have been inherited a long time ago and are not relevant anymore.

- How can I simplify this?
  The simplification should be always kept in mind while establishing the process, in order not to over-complicate the work and not slide down to bureaucracy.
- Can this process be automated? This question can be referred to Nolan's study (Nolan, 2019), where she explained different activities (routine housekeeping, managing changings and others) and to what degree can they be automated.

It is also important to **communicate with other teams** that already have similar projects or experience. It can be fostered by regularly updating the company knowledge base or conducting the special meeting to share an experience.

Besides that, a good practice is to **add some additional milestones** that are connected with routine operations, involve third parties or refer to compliance tasks. A good example is certification, that should be done in a specific time and usually demands some tedious, but need-to-be-done activity. If it would be marked as a necessary milestone, the process executor would be binding upon to execute it.

The strongly recommended approach is to prepare the **plan for exceptional situations** that can occur. One of the examples was given in chapter 3, with JetBlue Airways and their special process protocol for managing irregular operations, that was established after some of the crucial consequences and disturbance, caused by severe weather conditions. This plan helps JetBlue Airways to save millions of dollars, when similar situations emerge again.

This is how managers can prepare for some of the situations that are foreseen from project plans. But there are always fields of uncertainty that are hard or impossible to predict, they can be named “unknown unknowns”. The reducing strategy can be to **add time buffers**. The more novel and complex the project is, the larger the time buffer should be. However, as time is a sensitive business source and sometimes cannot be easily adjustable and, on the other hand, time is often a derivative of human hours, hence another approach can be applied. The **additional team members can be allocated** before the project has started to pull them easily to the project in the moment when they can be required. There can also be some freelance or outsourced team members, but the important thing is that they are already familiar with the project / company culture / process approaches, in other words, ready and prepared, to easily dive deep into the execution. They can be also invited in some general project preparation meetings to be acquainted with the project.

During the execution process the project manager should **maintain the processes' efficiency**, that means also to change / update / improve the processes if needed.

Standard operating procedures is the novel approach from Josh Kaufman (Kaufman, 2010) that helps to deal with common issues and helps to reduce friction. They can be multi-functional and originate from any department and activity in the company.

The approach to stay reflective and conscious and **ask for the stakeholders' feedback** and **regularly examine evaluation metrics** originate from Martini et al. study. Evaluation metrics can be set by the manager and reflect the inner markers that are important to the project, whereas the third-person feedback shows the external overview and may be the valuable source of insights. That is why both of these techniques are important, and they contribute to the proper mindset and reflection about ongoing processes and the willingness to acknowledge if something goes not properly right.

Team domain

The team domain refers to the activities that involve team members, especially process executors. As it was pointed out in the PD triangle, the team and team members' behavior are the important variables for coping with PD. As a project officially starts with kick-off meetings, the special **pre-kick-off meeting** is suggested to conduct. The idea behind is to involve team members in an open conversation and show the project details before the official start, along with evaluating the team and understanding their demands and personal traits. It is also important to get to know each other, especially if the team is distributed around the globe, team members have different cultures and other backgrounds, which is more and more common in the contemporary company environment. In this meeting a manager should present the project plan and company culture traits to be sure that everybody is on the same page, therefore the future misunderstandings can be avoided. Moreover, in this meeting a concept of PD should be presented with the aim to be aware of it during the project executions by all of the team's members. This refers to the idea that awareness plays a sufficient role in PD mitigation.

As the pre-kick-off meeting is an important step, during the project it is essential to maintain a supportive and open environment. It is especially vital to have a friendly community to tolerate mistakes and listen to new ideas. It can be supported with **one-on-one meetings** (not all the people are ready to discuss sensitive questions in front of the whole team) and **informal conversation before / after the meetings** or at the end of the workdays. If the team is distributed and there are only online meetings possible, several minutes before and after the established calls can be used as a metronome to synchronize and harmonize the team spirit and make sure everybody is aligned to the project goals.

However, it should not be the artificial constraints or forced talks. The balance should be held, because unnatural conversations can be unhealthier to the team culture, as the absence of them.

Infrastructure Domain

Infrastructure domain involves all the environment that is used to support the operations. It includes the machines and other tools to produce the product, as well as some other tools that indirectly contribute to it, such as office equipment, laptops and also software. The parameters to be revised are, for example, the working conditions of machines or the compatibility of the different software tools. That is why the main focus here is **to check the available tools, inspect the infrastructure** and also make sure that team members are familiar with them. As visualization was named as a helpful approach to understand different processes, its interconnections and bottlenecks, in other words to comprehend a big picture (Martini et al., 2020), it is recommended that a process designer and a project manager themselves **have a special tool to describe the project details graphically**.

Lessons Learned

The final stage of every project is a "**lessons learned**", and unfortunately, it is the most underestimated phase. It is common that with the end of the project all the activities are immediately stopped and only congratulations and farewell letters are sent. It can be a good practice to ask every member of the team to remark and highlight, what was done good, not optimal, what can be improved and what they learned in the end.

For the goal of continuous improvement, company needs to have a continuous internal feedback loop. That means properly collect, summarize, share and improve the processes. All of these activities contribute to mitigation of PD.

- **Collect**: the data should be carefully collected from team members.
- **Summarize**: a post-collect step is necessary to consolidate the results.
- **Share**: the results should be shared not only with stakeholders, but preferably with all the people within the company who are interested in it, the best way is to upload it to the intranet, knowledge base or other company database.
- **Improve**: the last and the most important step is to implement the new finding to the current activities, that means in most cases actually to update or even change the current processes.

It is clear that the most crucial step in lessons learned practice is *implementing*. But who should be responsible for this? A project manager has already finished the project and is getting a new one, moreover, he is not responsible for processes along the company. A process designer can be assigned to some specific processes inside the company and have the specific competence accordingly, but probably a coordinator or supervisor may need to support. It seems like there is a gap in the responsibilities that is important to the continuous improvement of the processes and therefore mitigating PD. The dedicated manager can fulfill this role. This idea would be exposed later in this chapter.

4.2.2. Strategies to Reduce Process Debt

Strategy is the action plan to achieve goals in the long-term run. That means that the activity within the strategy scope may not give immediate results but in the long run would make a difference and result in a payoff.

Considering the knowledge collected in the previous chapter - the current state of the art - the following main activities can be classified as strategies: **continuing education** as a tool to upgrade employees' skills (both management and executors) and help to transfer the knowledge inside the company and **establishing the new senior role** inside the company.

Continuing Education

As it was admitted by several contributors to the PD concept through studies and online articles, the awareness is very important to trace the issues, admit the problems and be ready to change some of the activities.

The first goal of the education should be to develop the **special mindset and critical thinking** in the company, also through the onboarding process for the new employees. The special dedicating training and educational material should be prepared and conducted to support this type of conscious thinking. It is also important to nurture the openness culture where mistakes are the source to learn and progress, but not to blame someone or shift it to the personal level.

Second goal of the educational process is to pull up the **overall management skills** that help to avoid deficiencies during the projects. One of the main accumulating patterns for PD are management flaws: poor designed and poor maintained processes within the

company or a project. That is why the special training for managers with the focus on processes would be valuable.

The third main goal is to **transfer the knowledge** inside the company. A dedicated well-trained person can leave a company or even switch to the competitor and take all the knowledge with him or her. It can be very crucial to the company, if the specific competence was not distributed or well documented. This human asset problem is especially important for the startups, as not so many people work there by default and each of the actors usually have a broad and deep competence. This also means that often there is no possibility to have another employee with the same or similar knowledge, because it is redundant and expensive. That is why another strategy is preferable, which is to document all the special processes, competence and activities. Moreover, regular training or lectures should be performed to share the knowledge. Of course, it would not substitute the real expert with the broad experience in the field, but it definitely can help to maintain the processes and not to lose some valuable information due to probable absence of the exact person or even after leaving him or her the company.

It is important to notice the effect of lack of trust that was admitted by Martini et al., when the expert is not motivated to share the competence because of the fear of losing a job (Martini et al., 2020). This should be kept in mind and transparently addressed, that the transfer of knowledge is a part of the overall processes, but not some sort of preparation of substitution of some of the employees with others or by the artificial intelligence algorithms. The additional lectures and training can be also supported by a bonus system, in order to make it more pleasurable for the employees.

Another dimension in education process is the depth and comprehensiveness of learning. As it was described in the previous chapter, the double-loop learning is needed to fully cover PD issues. In other words, employee should be taught to think about the reasons that lead to the problems, not only in the direction of mitigating the consequences.

Along with the education, another strategic approach to mitigate PD in the long run is establishing a new specific entity in the company, a role or even department. It is a novel paradigm and would be detailed described in the next subchapter.

4.3. The new organizational role

As it was firstly postulated by Alfred Chandler in 1962, **the structure of organization follows strategy**. The exact phrase from Chandler was that “Strategy is the determination of the basic long-term goals of an enterprise, and the adoption of courses of action and the allocation of resources necessary for carrying out these goals." (Chandler, 1962).

That means that the company should adjust the structure and the established entities and executive roles depending on its long-term goals. For example, if the company wants to prioritize the research and development activities, the good solution is to form a dedicated R&D department that would report directly to the CEO and have independence from other entities, including separate budgets.

As Sagi Eliyahu has raised this question in his article (Eliyahu, 2017), if we already manage the financial and technical debts regularly and the entire departments exist precisely for that purpose. Why wouldn’t we do the same with our process debt? One of the participants of Martini et al. study also admitted that it is important to have a dedicated person who manages the processes and understands the value of processes (Martini et al., 2020).

However, the executive level of dedicated position is arguable. First, the advanced budget for this position should be required. Second, the executive position provokes more potential controversial side-effects as a delimitation of authority. Third, the executive role also brings a lot of political responsibilities, but not direct actions. Hence the influential role can be beneficial and more essential in this higher hierarchy position. Thus, another approach can be applied. The separated executive position as “Chief process officer” can be implemented in a relatively short term as a temporary function during the pivotal moment or other situations, where a lot of new processes must be designed, established and managed, in order to have a precise focus on process improvements. And after this period, for example 1-3 years, this executive position can be transferred to the operational department and transformed to some sort of senior director role.

Senior director of process (SDP) can be the part of Chief operation department or, in the large companies, part of Project Management Office and responsible specifically for business process management. Further would be examined in details the main reasons to establish this role, the background and the key responsibilities.

According to the lean management principles, the most efficient production emerged from the bottom-up approach, where the managers on the shop floor are responsible to make the local decisions and mediate the production processes. That is why SDP should

always listen to the shop-floor managers and receive the regular reports from them, also with the process situations and preferable changes. SDP himself / herself should report to the head of the department, where he or she belongs - Project Management Office director or Chief operating officer.

4.3.1. The reasons to have a special entity

The following reasons and factors contribute to setting a dedicated role, whether it would be an executive level person or a senior director.

1). Special authority

The main reason, why it is important to establish a dedicated role, is the special authority and power that SDP would have. As Te Wu and Zhu Zhu admitted in their paper in Journal of Business Strategy Projects, even the Project management office often lacks the authority and legitimacy to fully carry out the expected function (Wu & Zhu, 2021). Therefore, the specific person should be assigned for process governance.

2). Cultivate long-term thinking and culture

As Selby Cary points out (Cary, 2023), the company should not only propagate some approaches, but also align to them itself, that means also to show it explicitly. The separate role, especially executive one, is a best illustration of processes' importance in the company.

3). Support education process

The education in this case includes supervising special training, maintaining the lessons learned, supporting and updating the knowledge base of the company regarding the processes.

As was already discussed, the educational strategy to mitigate PD is very important and therefore should be supported by a specific person. Indeed, there can be a special entity or the person in the HR department to support training and employees' development in general, but it is better to have also the ambassador and responsible person to maintain the training for process development. The dedicated person is also needed to supervise the knowledge transfer from "lessons learned" practice and to put it carefully to the company knowledge base.

4). Independence from the specific project, product or methodology

A dedication to the processes, but not the exact teams / products / projects or even methodologies, makes SDP a better expert in his field, who advocates the instruments, but not biased by the substances. The process-oriented approach helps a person on the position be the expert in this field and improve exactly this proficiency.

5). Objective third-part view

As SDP acts separately, he or she can have a fresh view for every project, not being biased by the other activities or influences.

6). Advocate the process importance

The important role of SDP is to provide a strong lobby for the process approach. In the situations where processes can be sacrificed or neglected, someone from the supervisor or executive position should always either support process-oriented approach or in some cases suggest a work-arounds or mitigation plan.

4.3.2. Company background

When is it reasonable to establish a dedicated executive role or senior position for process governance in the company? The diagram at Figure 15 addresses this question. It shows the dependencies regarding the key company characteristics, such as size, maturity and others. The dark parts reflect at what level it is reasonable to assign a special position for process management. Indeed, it is not obligatory for all the companies, for example, the startups or other companies with up to 10 employees do not need such a department or dedicated person. The information flows easy and fast, there are probably not so many projects running at one time and also not so a lot of already inherited experience. However, mature companies should consider to establish not only a dedicated person for the process governance, but a dedicated department, as a Project management office, to provide even more authority to support the operations and processes in the company. Explanatory text to the diagram is provided below.

Maturity level. This level reflects not only how long the company exists, but how strong is its position on the market. Whether it is a startup that is scaling up or the company that after several years has a stable income, it is enough to consider to have a dedicated position in the structure.

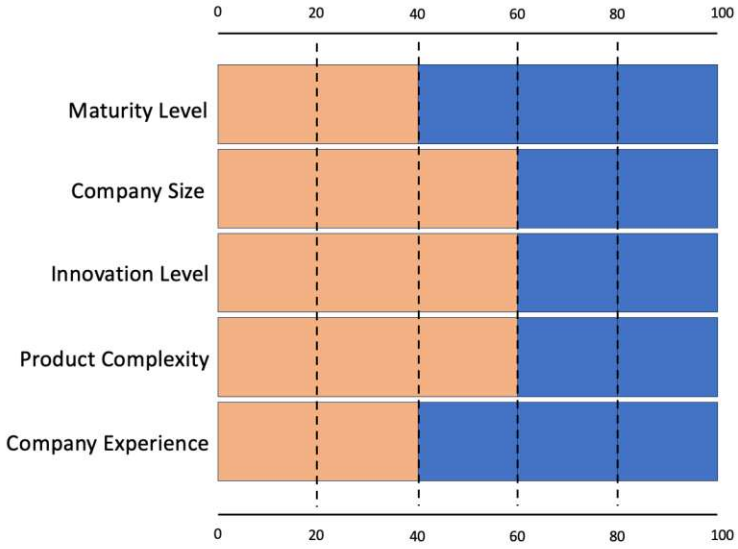

Fig. 15: Company background for establishing a dedicated role for process governance

Company size. In general, it is recommended to have at least 50 employees to allocate a dedicated person for processes, but of course the deviations are possible. A good example, if a small company will be merged with another, the big and mature one, it is worth establishing and consolidating the processes, so at least before and during the transition period the dedicated position, even better an executive role, such as a Chief process officer, would be needed. The company size is the only absolute parameter in this diagram, because the special entity makes less sense if there are not a lot of people in the company and communications are usually good conducted and stable. Moreover, in the small companies each new position (that means the additional related costs) should be well optimized and validated.

Innovation level. Innovation level defines in general new novelty of the product and regarding this, if company can reuse, inherit or replicate some previous processes, techniques, or methodology. If there is a completely new or partially new product, SDP can contribute to establish new processes and align them to the other activities and projects in the company, as well as to the general strategy.

Product complexity. This parameter refers to the degree of processes needed to produce a product as well as comply with standards. For example, if a company does not manufacture some specific product, but performs some sort of services that depend on the qualification of the manager (consulting is a good example here) the complexity can be nearly zero. The compliance procedures, such as certifications or special external authority demands, increases the product complexity.

Company experience. This means how familiar is the company with different methodologies, practices, product delivery. It differs from maturity level, because it talks more about familiarity with current trends. For example, a company with a 20 years history can be mature, but it can still operate in the old fields and not be ready mentally to adopt a process paradigm shift. The dedicated position would not help to cope with this rigidity. On the contrary, a young company with an agile approach can easily adopt new technologies and improve their results with excellent process management.

There is no parameter that connects to the company profit or income, because the main focus here is not the absolute, but the relative measures (excluding only the size of the company, but it is rather stable and easy to evaluate). In each market the numbers can be different. Moreover, profitability can be the question of income distribution, external investments and does not reflect the real situation on the market.

It is important to notice that it is not necessary to comply with all the criteria. For example, if the company is rather small but establishes innovative products and is also experienced enough in their field and has a strategic goal to make it cost efficient, the good advice is to establish a specific position for process management.

4.3.3. Key responsibilities

A dedicated person, Senior director of processes or in some cases a Chief process officer, should have an authority to support and perform the following activities:

1. Define the process management strategy and related objectives for the company;
2. Observe and improve the processes;
3. Design new processes;
4. Document company processes and extend a company knowledge base;
5. Prepare and validate the educational materials and trainings;
6. Make regular reports of process improvement;
7. Prepare the “Failure protocol” to coordinate the activities in the exceptional situations.

1. Define the process management strategy and related objectives for the company

This is one of the key executive roles of SDP. As a CEO defines the general strategy and development of the company, SDP is responsible for more applicable activities: how

exactly the strategy can be put into practice, by what rules, processes, approaches and tools. SDP also ensures that the main objectives align with the company strategy.

As was admitted by Nigel Simpson (Simpson, 2020), sometimes PD results from a disconnect between reality and outdated policy or strategy goals. In some cases, it is more preferable to update the policy than try to fill a gap. That is why the position of SDP is so important to coordinate the processes with the bird-eye view of the company activities and strategy.

The maintaining efficient processes and sustained reduction of PD, but not the zero PD should be the main goal of SDP activity. The zero PD is hardly achievable and also can be harmed to the business, when the processes go blindly ahead, apart from the business goals such as fast delivery to the market, that is why SDP should balance processes consciously, with consideration of market situation.

2. Observe and improve the processes

SPD should not be an expert of every aspect of the work. It is impossible and not necessarily, because this person should rather use and leverage the expertise of the other employees.

A senior process director also observes the processes and monitors the process compliance, in other words, supervises if they are well designed, performed and maintained. It is arguable if SDP should *control* the processes, alternately stated, to stay always nearby and receive some sort of regular reports of how the processes are performed. Although it may sound logical on the first glance, in practice it would be too bureaucratic, exhausting and time-consuming for the process manager. So strict control can be applied in some exception situations, when the deadline of the project probably would not meet or the manager performs poorly. However, the control is not necessary in the regular situations and it is more efficient to have one initial dedicated person who is responsible for the process. It would nurture the trust culture within the company and raise the level of responsibility and motivation for the dedicated process owner.

As it was mentioned before, some of the processes, such as special operations procedures from the tactical activities, should be also reviewed regularly.

3. Design new processes

Still there are some of the processes that are not yet designed and implemented, but need to be in accordance with process management strategy or after lessons learned session or reviews. As it is usually not so easy to allocate resources to some “out of project

scope" activities, SDP would be the best role to take over these tasks. However, he or she should not design all new processes in the company, but only those who have no clear process owner in accordance with some dedicated project or department.

4. Document company processes and extend a company knowledge base

The main focus of SDP work is continuous improvement, that is why this role fits the best to maintain and extend the company knowledge base. Knowledge base is a sort of library of information about a company, its products and services, technologies, projects. The best analogy is Wikipedia, and often the knowledge base is organized indeed like a local Wikipedia. It does not mean that SDP would be the only contributor, but he is the one who should maintain it and improve.

5. Prepare and validate the educational materials and trainings

Aside from the company knowledge base, other educational materials are critical, such as regular training, knowledge transfer within the company and between different projects, departments and divisions. As processes are the part of overall the continuous improvement strategy, SDP should play an important role to foster, support and coordinate these activities and be responsible for relevant learning inside the company. Nurturing the goal-orientated culture through education is also an objective of SDP.

6. Make regular reports of process improvement

The regular reports are some sort of performance indicator for SDP and should reflect the current state of processes, work done and achievements, next steps and directions of future development.

7. Prepare the "Failure protocol" to coordinate the activities in the exceptional situations.

As the company cannot avoid PD, possible problems should be considered and the exact plan for exceptional situations should be conducted. In chapter 3 was given the example of JetBlue Airways with their special process protocol for managing irregular operations, that helped them to save millions of dollars even in exceptional situations like the severe weather conditions. The plans for the minor issues should be performed by a process designer, while the major and sufficient problems should be revised by SDP.

4.4. Summary

In the current chapter the new framework of managing PD was presented. The framework includes a Process debt Triangle – a visual diagram to express the accumulation of PD, as well as key tactics and strategies to mitigate its consequences. Figure 13 visualizes the dependencies between Market delivery Speed, Product Complexity / Novelty and Human Input. The bigger the triangle, the worse our situation with PD is. The PD inside the triangle can be also recognized as a cost efficiency. It is a long-run race and demands some special strategies and tactics to work on it. Therefore, the strategies to reduce PD are leading to cost efficiency and our goal is to constrain the triangle accordingly.

Key tactics to reduce PD are described in a Figure 14 and follows the logic of PD triangle.

Key strategies are the **continuing education (including** a **special mindset and critical thinking**, pulling up **overall management skills** and regularly **knowledge transfer** inside the company) and **a new senior position for business process management.**

The important business concept postulates that the structure of organization should follow strategy. That is why if the process excellence and cost efficiency are the strategic goals of the company, it is important to reflect it in the company structure and give the special authority for process governance to the dedicated person. The position can be established inside the operation officer department or Project management office as a senior director of processes. Another approach for the pivotal moment of scaling up the business is to establish executive role, such as Chief process officer, to meet the same goals.

Not all the companies should go this way. It depends on the current state, the major background would be the company size, maturity level, innovation level, a product complexity and a company experience, though it is not necessary to comply with all the criteria.

The reasons to establish a new role in the first place are the advantage of special authority; cultivating long-term thinking and culture; supporting the education process, independence from the specific project, product or methodology; objective third-part view and advocating the process importance. In some sense the specific role brings the “unspoken” influence, that should be also the indirect goal of his/her activity.

A dedicated person, SDP or in some cases a Chief process officer, should have an authority to support and perform the following activities:

1. Define the process management strategy and related objectives for the company.
2. Observe and improve the processes.
3. Design new processes.
4. Document company processes and extend a company knowledge base.
5. Prepare and validate the educational materials and trainings.
6. Make regular reports of process improvement.
7. Prepare the “Failure protocol” to coordinate the activities in exceptional situations.

On the following page on Figure 15, a mind map is presented summarizing the process debt concepts outlined in chapter 3 and 4.

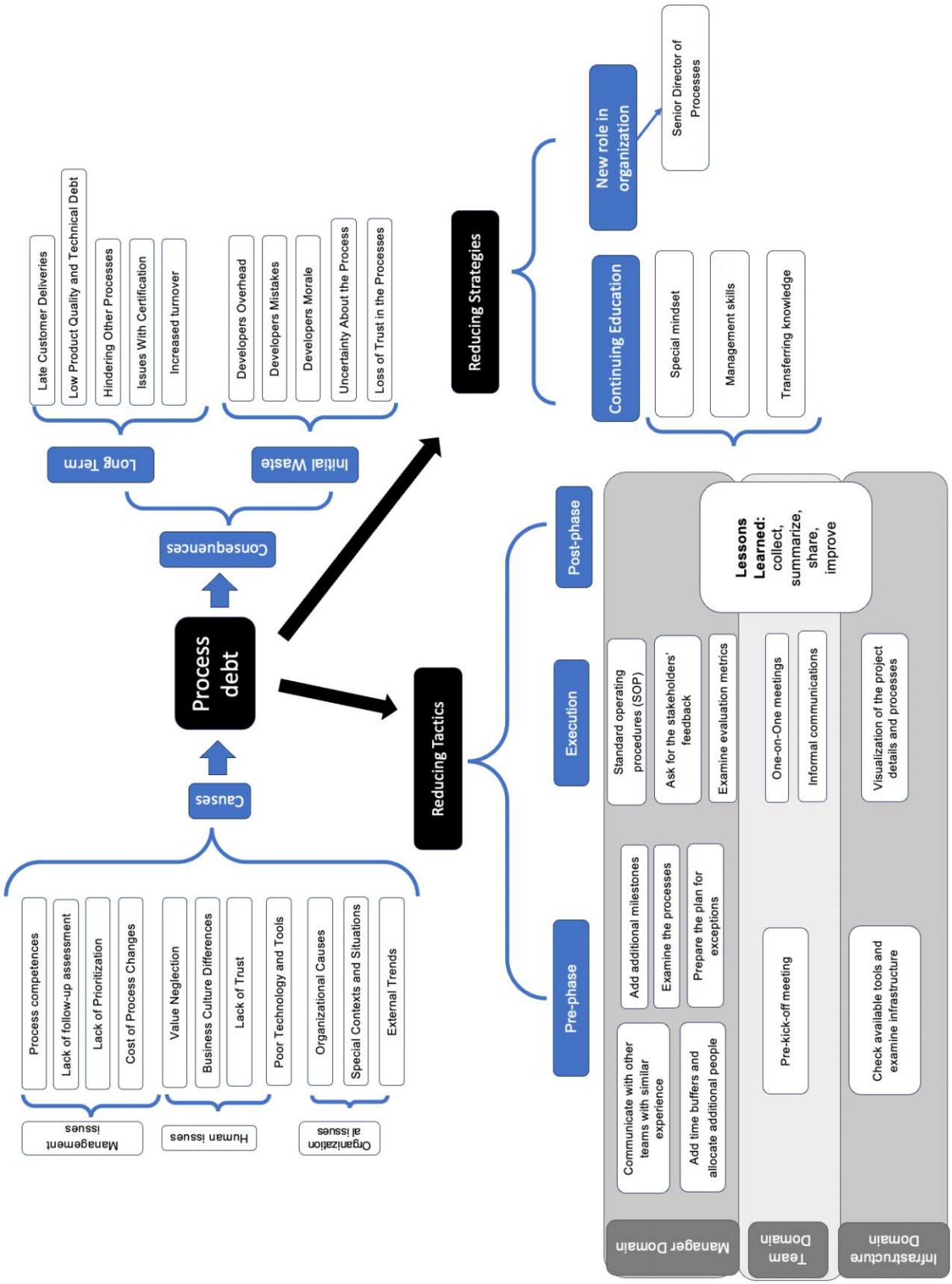

Fig. 16: Process Debt Mind Map

5. Summary and Outlook

In the summary of final chapter would be summarized the most valuable findings of the study. All the research questions were addressed during the study. The origins of PD were described in Chapter 2. In Chapter 3 a definition of PD was provided, the current findings were observed and the key PD parameters were described. The current conception is provided by the mind-map in Figure 11. In Chapter 4 new approaches and frameworks to manage PD were proposed. Below are described the most important findings in each chapter.

5.1. Key Findings

Business processes are critical for the company's efficiency. To establish and maintain effective business processes a systematic approach in the form of business process management is applied. Process debt concept originates from lean management and amplifies ideas of waste reduction strategies and continuous improvement and can be seen as a more contemporary refactoring of the waste concept. PD draws attention to the gap between ideal processes and current situation. It reflects a payback that needs to be addressed because of the poorly established or sub-optimal processes or inefficient decisions.

The more complex processes a company is developing, the more holistic approach should be implemented to look at them in a bigger picture and make sure they work well together across different projects.

The current concepts about PD are summarized in the mind map in Figure 16 (page 63).

One of the intriguing ideas behind PD is using PD as a tool. If a company is agile and prioritizes fast speed delivery to the market and fast reaction time to implement the changes, it is almost inevitable that at some point PD will surface. It is not always a bad sign and in small doses PD can help to win some time or allocate sources to other important activities. The guiding rule to follow is always to choose the option that minimizes the total time through the feedback loop from the market.

In Chapter 4 some new approaches to manage PD were proposed.

The Process Debt Triangle (Fig. 13, page 45) is a framework that helps in a simple way to visualize the dependencies that directly contribute to PD. At the same time, it also

shows how the company can influence PD and mitigate its consequences. The triangle consists of the Market delivery speed, Product complexity and Human input.

As the *time* constraints and *product specifications* should not be compromised, the only dimension that a company can leverage with the full force is *human input*, in other words - to invest in a human capital. The most valuable strategy here is to invest in education, training, knowledge base and advanced company culture. It can take time, but it is a strategy that would pay off in different dimensions, improving the overall proficiency level of employees.

Another important direction is to reduce the unconscious accumulating patterns of PD that are emerging from ignorance or indifference. Prioritizing speed before process excellence and consciously deciding to fill the process gap in the next sprint or iteration is a business decision. Whereas repeatedly ignoring a better solution without considering the risks and consequences and preparing a mitigation plan is a poor practice that should be avoided. Thus, using PD as a tool should be always grounded by the full consideration of its negative and positive sides and deliberation.

Another novel idea that was described in the study is establishing a new position that is dedicated to process excellence. Depending on the company market situation, the role can be assigned to a dedicated person in the operational department (as a Senior director of process) or even lift it to the executive position (as a Chief process officer). The latter step can be justified in a limited time, for example 1-3 years, to influence changes in pivoting moment and to support paradigm shift.

The reasons to establish a new role in the first place, among others, are the advantage of special authority and cultivating long-term culture; advocating the process importance and to grant a special authority for managing processes to a specific entity. In some sense the specific role brings the “unspoken” influence, that should be also an indirect goal of his/her activity.

The important activity to be performed by the dedicated person are including aligning process management strategy overall in the company, documenting company processes and extending a company knowledge base, prepare the “Failure protocol” to coordinate the activities in the exceptional situations.

Several baselines were observed throughout the studies and highlighted above.

1). Using PD as a tool

The name of PD reflects not the negative impact, but the price to pay in the future, usually in terms of time and money. Understanding this notion as a sort of trade-off is very important. The interesting fact is, that the original name of the current study was referred "how to avoid PD". But the deeper the information was examined, the clearer it became that achieving zero PD across the company should not be the goal; rather, a company should aim for a smart balance between agility, fast delivery, feedback loops, and process excellence.

2). Holistic approach.

The debt concept repeat itself through different dimensions, such as the most popular - technical debt and financial debt. PD captures this connection and reflects, that the attention and force should apply in all these dimensions in order to achieve the goal of efficiency. Moreover, company has different projects and a lot of processes behind them, so it is crucial to see the company and every project as a sub-system, consider intersections between them and align them together.

3). Continuing improvement

It is important to keep in mind that once established, business processes should be always reconsidering due to always changing environment, market fluctuations and changes of customers' needs. Originated from lean management, continuing improvement remind always to be aware of the process's actuality. It should be a regular practice to align business processes to companies' goals and market directions, establish new processes regarding new demands, as well as asking if some of the processes are still needed and eliminate redundancy.

4). Proper mindset

The awareness of the problem and its acknowledgement is a very important step to face it and find a solution. The idea behind PD concept is to draw attention and to be aware of possible negative consequences, in order to prevent or not allow to scale. The education approach in mitigating PD complies with this idea and contributes to the overall awareness. The proper collecting of lessons learned after each project, careful storing company knowledge base and regular knowledge transfer through training are one of the important backgrounds to nurture the proper mindset and culture, although they may seem not so important. This research work is another contribution for promoting this notion and pay attention to business process establishment, maintenance and excellence.

5.2. Discussion

The current research was based on different articles, including private contributors with no special theoretical background and a few studies, because the topic is relatively novel. Although the private contributors submit the applied and practical approach and valuable dimension, their opinions can be somehow biased and should be validated.

As it mentioned before, the study by Martini et al (Martini et al., 2020 and 2023) was performed with the software development companies, so only one specific industry was observed. Therefore, further research is required to validate current findings, extend it to other industries and domains and to provide more evidence behind.

The novel framework, described in this study, was performed only on theory, by synthesizing current ideas and extending it to other potential solutions, so the practice still needed to test and prove it.

The theoretical framework always has room for discussion. Thus, in the current topic it can be arguable even to separate PD concept to the special domain and to develop a specific approach to define it. However, it seems justified, starting from paying attention to the concept and ending with specific possible solutions, emerging from the special domain and inheriting some of the methods from similar areas.

Another discussion is to define the borders for the concept. In the study by Martini et al. (Martini et al., 2020 and 2023) almost every issue during the project could be referred in some degree to the process debt, because the outlines are too broadly described and the origins of every problem can be tracked down to some sort of manager, namely process owner, or to process executor deficiency. In order not to push it too hard, the formal settings are required to address the issue to the correct origins.

5.3. Future Directions and Challenges

According to the current specifics, described above, the following directions are preferable for the research.

PD should be examined in manufacturing industries, including engineering, and the development and production lines are the most intriguing to observe. The starting point can be from the similar interviews, as Antonio Martini with the colleagues has performed, to make an initial baseline and compare the results. If there are enough current studies

investigating origins of process issues during the project, even a meta-analysis can be performed to address this question.

As there are a few scientific studies regarding the PD concept, any other direction would also be a valuable contribution.

However, the most intriguing direction can be focusing on a concept of PD as a tool to leverage current sources and pay for its later. It is not well described, to what degree can a company borrows its sources, like time and money for example, to make it profitable and not to go deficiency or even bankrupt. Can a company easily calculate the risk and potential negative consequences, considering current assets? These questions are the most interesting and applicable in the field of PD.

Finally, it is interesting to justify some of the theoretical suggestions and framework in the practice and to verify its congruence to the daily business practices, especially in the manufacturing.

Among the challenges should be named blurred borders of the exact PD concept (that can also be the direction of future work) and further demarcation it from other similar domains.

5.4. Conclusions

In this study process debt notion was observed in order to deeply understand business process management and ways to achieve business efficiency. Although different concepts are presented in this field, PD shows unique traits that help to see the process issues from the new perspective and leverage some specific toolkit to improve processes, such as strategic educational approach or specific tactical steps to foster process thinking.

Current state of the art consists mostly of the private articles and lacks the solid studies. In this work a novel framework was presented, combining the current findings and hypothesis. More studies are needed to foster the topic, especially in application to some manufacturing and engineering projects.

This work is encouraging other researchers to examine this domain and to improve the theoretical and practical framework. It is also a contribution to the expanding the notion and nurture the proper mindset to track the process problems on its origins and

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List of Tables and Figures

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List of Abbreviations

PD	Process Debt
SDP	Senior director of processes