

VUZF UNIVERSITY - SOFIA

Department of Finance and Insurance

ABSTRACT

**of a dissertation for the award
of educational and scientific degree "Doctor"**

**CREATING A GOVERNANCE MODEL
OF DIGITAL TRANSFORMATION OF BUSINESS ENTITIES
IN THE DIGITAL ECONOMY
THROUGH PROCESS MINING METHODOLOGIES**

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**Supervisor:
Assoc. Prof. Dr. Radostin Vazov**

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Dissertation committee:

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CHARACTERISTICS OF THE THESIS

The dissertation proposed for consideration has a total length of 191 pages and consists of an introduction, three substantive chapters and a conclusion.

Additionally, a list of the main scientific and applied contributions, a list of publications on the topic, literature used, a list of figures included and two appendices are provided. The volume of the main text is 184 pages, and the dissertation includes 67 figures and 4 tables.

The first two chapters outline the methodological and contextual framework of the study.

The first chapter provides an overview of the scientifically applied paradigms that determine the choice of methodological approaches with a detailed focus in the area of business analytics and requirements management, while the second chapter clarifies the technical aspects of managing digital initiatives, the models for process management and development, and some basics related to phenomena from new concepts related to data science, namely the process mining paradigm.

The last chapter presents a detailed analysis, presenting a cross-section of new paradigms supporting the management of digital innovation and the implementation of the Process Mining methodology as an innovative model for managing processings and solving the main tasks related to the management of large data sets, resources and the required rapid adaptation to the evolving digital economy.

The author of the dissertation is a PhD student at the Department of Finance and Insurance of the VUZF UNIVERSITY - Sofia.

The defense of the dissertation will take place on2024 at .. at of the VUZF UNIVERSITY - Sofia, at a meeting of the Dissertation Committee appointed by order of the Rector.

The materials are available at at the VUZF UNIVERSITY - Sofia.

INTRODUCTION TO THE PROBLEMS AND RELEVANCE OF THE RESEARCH

Following the social and financial crisis triggered by COVID-19, the security imbalance in Europe due to the war in Ukraine, the unstable political environment and the ESG transition to achieve sustainable outcomes for the environment and society, the world is changing at a rapid pace to achieve long-term stability and balance. The needs and expectations of business and society are also evolving. New business models are emerging that are changing purpose and requiring adaptation to new roles and skills. Given the current global economic challenges (economies shrinking, energy and resource costs rising, and living standards continuing to decline) a look at the potential of the digital economy is enough to demonstrate why it should be at the centre of the global economy.

Technological advances have brought a plethora of opportunities. From artificial intelligence and big data to cryptocurrency and blockchain, we are constantly faced with inevitable technological challenges and paradigm shifts. The World Bank estimates that the digital economy contributes more than 15% of global gross domestic product (GDP) and has grown two and a half times faster than the physical world's GDP over the past decade¹. It is estimated that the digital economy is worth US\$14.5 trillion in 2021 by 2025, the digital economy is projected to be worth US\$20.8 trillion. The key question facing businesses now is what is the right way to plan, manage and develop their digital transformation that can deliver financial results?

According to Gartner, 87% of business leaders believe digitization is a company priority, yet only 40% of organizations have undertaken large-scale digital initiatives.² The gap between aspiration and achievement is widening for enterprises that are trying to transform to a digital business. Without a shared organizational vision, digital transformation efforts will continue to be ineffective.

Most organisations are delivering digital projects, which doesn't mean they are a digital business. What's missing is the right mix between digital optimization and transformation. There needs to be a compilation of best practices with a clear business focus and with

¹ The World Bank. 2023. <https://www.worldbank.org/en/topic/digitaldevelopment/overview>

² Digitalisation Strategy for Business Transformation | Gartner. Gartner, 2021. www.gartner.co.uk/en/information-technology/insights/digitalization#:~:text=Eighty%2Dseven%20per%20cent%20of,enterprises%20attempting%20digital%20business%20transformation

predictability that leads to the ability to create configurable roadmaps according to business type.

In the fast-paced information age, end-users of products and services are extremely demanding faster delivery of functional applications, services and products, expecting high quality at a competitive price and, of course, excellent performance. The rapid pace of digitalization is putting businesses under serious pressure and escalating transformation efforts to maximize efficiency and effectiveness, maintain and grow market share and optimize profits generated respectively.

In the last decade there has been continuous modernization, geographical separation of teams, introduction of iterative methodologies, new service-oriented architectures and composite applications, strong development of web technologies, new mobile and cloud platforms. Technological prerequisites are combined with workforce development and utility model change. The end result and growth is not based on increasing the volume of resources but on their automation and knowledge-based value generation. These factors, combined with the speed and velocity of technological innovation, the expectation of rapid delivery of a finished product, and the explosive expansion of digital markets, place new demands on process management and investment risk.

According to The State of Project Management 2021 Annual Report³, the following trends are observed for successful business digitization:

- Many organizations seek to reap the benefits of project management without truly understanding its value or showing a willingness to integrate it into the company culture. In doing so, organizations waste approximately 11.4% of all resources. Statistics show that underestimating project management leads to 50% of failed projects. Fifty-eight percent of organizations openly admit they don't understand the value of project management.

- Only 46% of organizations make project management a cultural priority - despite statistical evidence that a mature project management process makes an organization much more likely to deliver projects on time and on budget.

- This explains why 34% of project managers do not use risk management and why 42% of them do not use any formal methodology.

³ The State of Project Management Report. In: *Wellington*, <https://wellington.co.uk/publications/state-of-project-management-research/>

- Currently, only one in four organisations use any kind of project management software. The rest work with Excel, paper or a mix of tools with sub-optimal integration. As a result, 54% of organizations lack the ability to track KPIs (key performance indicators) in real time.

- Artificial intelligence will change the game - but not yet. Globally, 85% of CEOs believe AI will "significantly" impact their business in the next 5 years. Sixty-three percent agree or strongly agree that AI will have a greater impact on business than the advent of the internet.

The coronavirus pandemic and the resulting social distancing in the early 2020s forced companies that had not already done so to move to a remote working model. It adds additional complexity and complications that impact productivity. This reality also requires a new adapted model for managing digital initiatives, including taking into account the social structure of companies.

Research in this direction is as follows:

- **83%** of the workforce is experiencing burnout from the high volume of online communication;
- COVID-19 increased burnout by **12%** within 2 months;
- **73%** of employees report burnout;
- **20%** of employees cite an unmanageable workload as the primary cause of "burnout."⁴

The mix of poor business management, pressure for better results, coupled with the absence of good project management practices, as well as missing and chaotic processes pose a serious problem for business digitisation. The issue of managing and auditing the investments already made based on real data and usability also remains contentious.

All of the aforementioned circumstances create the conditions for integrating into organizations increasingly innovative and more comprehensive management solutions and models to conveniently monitor the planning, creation, time and budgeting processes of companies, as well as ensuring the timely delivery of finished products and services with the

⁴ Addressing Employee Burnout: Are You Solving the Right Problem?, McKinsey & Company, 27 May 2022. www.mckinsey.com/mhi/our-insights/addressing-employee-burnout-are-you-solving-the-right-problem

qualities and characteristics that consumers expect. The input parameters of the study indicate a clear need for the introduction of process innovation that leads to the expansion and improvement of techniques and technologies for the production, operational support and distribution of products and services in the digital economy.

Technological innovation drives economic growth and competitiveness. The introduction of process innovation, supported by technology that improves the overall processing based on real data, is able to fundamentally change the market balance between companies, as well as give serious added value to businesses based on a proper understanding of consumer needs and behaviour. This dissertation explores the concept of incremental innovation and improvement of existing processes in digital transformations based on a relatively new discipline in the data science family - Process mining methodologies.

OBJECTIVE OF THE DISSERTATION

This dissertation aims to analyze the impact of organizational factors on the process of business digitalization and to show the opportunities for process optimization at the company level through the integration of Process mining methodologies. Through a comparative analysis, the main business areas will be examined and an innovative synergistic model for managing venture investments in the digital economy will be presented. The end result will be a developed and adapted model (process innovation) for managing digital transformation. Its main focus is to achieve business efficiency and effectiveness through continuous process optimization and high levels of customer and staff satisfaction.

DISSERTATION TASKS

The tasks to be solved in order to achieve the aim of the thesis are as follows:

- On the basis of the results of the theoretical study on the topic to further develop the conceptual vision of a common innovative governance model. To present a conceptual innovation framework covering the life cycle of a digital initiative (BA/Agile/CMMI/Process mining) and an example of integration with existing automation systems.
- To investigate and analyse the level of readiness for the implementation of a common working model between Business Requirements Management and Agile Management methodologies.

- To elaborate in detail a comparative analysis of different agile models for the development of digital products (Agile).
- To investigate and analyse the degree of readiness for the implementation of a common working model based on the CMMI system and a selected agile methodology for the production of digital products.
- To investigate and analyze the status of relatively new approaches of systems and models for process optimization based on real data Process mining. To investigate the possibility of integrating the described concept as a general approach to an innovative model for automated processing of large information/knowledge sets, covering all major business domains.
- To analyze the results of the research, making generalizations and conclusions with guidelines for implementation, use and further development of the process innovation.

OBJECT AND SUBJECT OF THE STUDY

The study was conducted on innovative business projects in the digital industry. The research covers the entire lifecycle from business case inception through validation, execution, deployment and optimization with a primary focus on model management and investment protection, including strategic development. All the properties of the objects under study are examined, integrated into a system of interrelated elements.

The subject of the research is the analysis and tracking of the design of corporate social systems and their accompanying technologies related to the overall cycle for the production of innovative products.

The main areas for analysis are:

- Develop and manage business requirements (digital economy).
- Agile methodologies for digital project management.
- Quality management systems and models in the field of digital products.
- Process mining as a missing link between Data Science and Process Management.

Turning real data into values and actions for organizations.

- The study was conducted under the following subject area constraints:

1. The research builds on the existing and evolving business analytics system maintained by the International Institute of Business Analysis.⁵

⁵ IIBA | BABOK | a Guide to the Business Analysis Body of Knowledge®. iiba.org, 2018.

2. The research focuses on Agile methodologies for the production of innovative products and their manifesto⁶.

3. The research builds on the existing and evolving system for assessing and describing software development quality in the Carnegie Mellon University Software Engineering Institute (CMMI) Capability Maturity Model Integration (CMMI) organization⁷.

4. The research covers the relatively new discipline of Process mining for the discovery, management and optimization of business processes based on real data from operational business systems.

MAIN HYPOTHESES OF THE STUDY

The study tests the hypothesis that the available models and methodologies for digital product management are not universal and their application should be the result of a consistent, focused and systematic study of the technological and social environment of a company. The correct and gradual integration of the given components into a common innovation model will lead to the improvement of the competitiveness of business entities in the process of their transformation towards a digital knowledge-based economy.

The working hypothesis is that the integration process between the following organizational components (domains) should be stimulated:

- Business Analytics;
- Agile methodologies for the production of digital products;
- quality assessment and description system;
- process optimization systems based on real data.

The synergy model should be technology independent. It will provide a description of what needs to be done rather than a definition of implementation. The choice of technology, vendor and platform should be left to the customer.

⁶ Manifesto for Agile Software Development. agilemanifesto.org, 2023, agilemanifesto.org/

⁷ CMMI Institute.

MAIN ISSUES NOT COVERED

The study does not address the following thematic areas:

1. Human resource management in the context of digital transformation (recruitment, retention and development processes) and the social impact of technological innovation.
2. Network and information security (cyber security).
3. Standardisation, standards or technical specifications in the field of information and communication technologies (ICT) especially in the part of technologies with "horizontal relevance". These are technologies whose application has a wide impact in different technical areas, in the context of ICT infrastructure and ICT standardisation.

RESEARCH METHODOLOGY AND TOOLS

The choice of methodology for the study should take into account the specific nature of the objective and respect the principles of precision, discretion and ethics. A variety of forms, methods and means shall be used to achieve the stated aim and objectives. They are applied in accordance with the nature of the research process in its different stages as follows:

Theoretical analysis and summary - to analyze a variety of sources (books, articles, reports, etc.) that provide information on the problem of applying digital transformation in business entities. The results of the analysis of this scientific literature served as a basis for the identification of the more important for the study principles and requirements for an integrated model of digital transformation management.

Survey - aimed at the population of participants identified in the scope of the study (senior and operational management). The chosen instrument was the focus group method, with the different functional units (departments) of a company as the objects. However, what is specific is that an in-depth interview was not used but an anonymous survey. This ensured a more accurate and clearer picture of the current situation regarding the organisation of work processes, stress, workload and performance in relation to the desired working environment.

SWOT analysis - the method is used as intended to objectively evaluate the components involved in the management model (product creation, project management, process management, operational support).

The methodology used to organize and conduct the research process is based on principles and requirements that are consistent with the nature of the research, as follows:

Objectivity - the principle reflects the need for impartial and disinterested achievement of the stated aim and objectives and verification of the hypothesis.

Transparency - this is a basic principle that is associated with the requirement to achieve a high degree of clarity about the aim and objectives of the study (data recorded; instruments used for interpretation; sources etc.).

Comprehensiveness and applicability - the principle reflects the desire to achieve the most correct and complete coverage of the study. This requires gathering sufficient information from authoritative sources to enable the effects and usefulness of the innovation to be correctly determined.

Prioritization - requires the research to focus on the most relevant case studies falling within the scope of the topic, the stated aim and objectives. The matter related to digital transformation cannot be covered in its entirety by a single study.

1. METHODOLOGIES AND BEST PRACTICES IN THE FIELD OF PROCESS RESEARCH (PROCESS MINING)

The digital economy constitutes a large part of the modern economy and involves the use of ICT in the creation, distribution and management of goods and services. The advantages of the digital economy are undeniable, but there are also some challenges that need to be addressed:

- effectively managing and protecting corporate and personal data throughout the product/service lifecycle;
- Easy access and mass adoption of standardisation-based technologies to secure economic development;
- regulation and adaptation to different digital models for business and innovation and protection of intellectual property and fair competition rules.

Here we should also pay attention to the main resource of the digital economy, namely data. The "three V's"⁸ of data are concepts that summarize the key characteristics of data in a digital environment. The three Vs, namely volume, variety and velocity, are factors that create the challenges associated with the size, variety and processing speed of information sets and help to formulate strategies and solutions for effective knowledge management and analysis in

⁸ The three Vs; volume, velocity, and variety.

the digital economy. On this basis, it can be reasonably concluded that business processors need advanced digital governance models and new tools for real-time monitoring and analysis.

Digital governance is a framework for establishing accountability, roles, decision-making and change management authority for an organization's digital presence. Having a well-designed digital governance framework minimizes effort and cost and ensures digital business maturity.

Let's also look at some examples of digital transformation management frameworks (Figure 1.1).

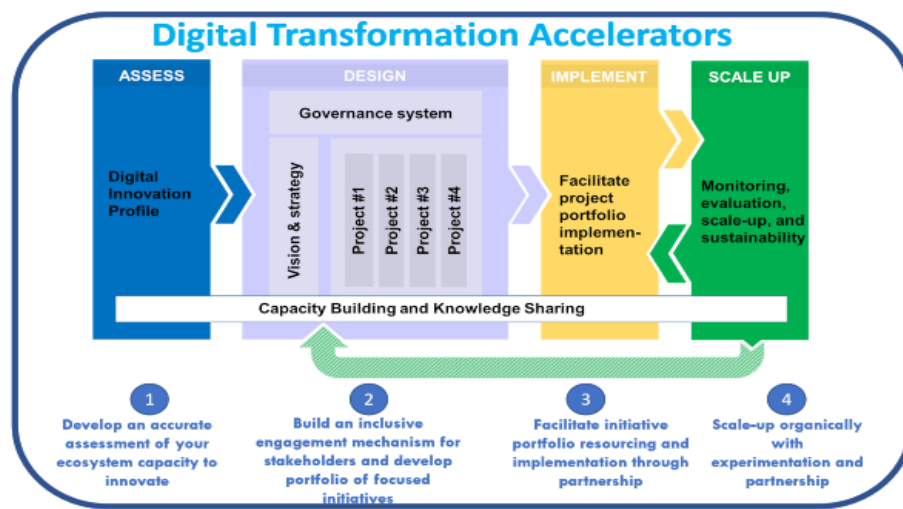


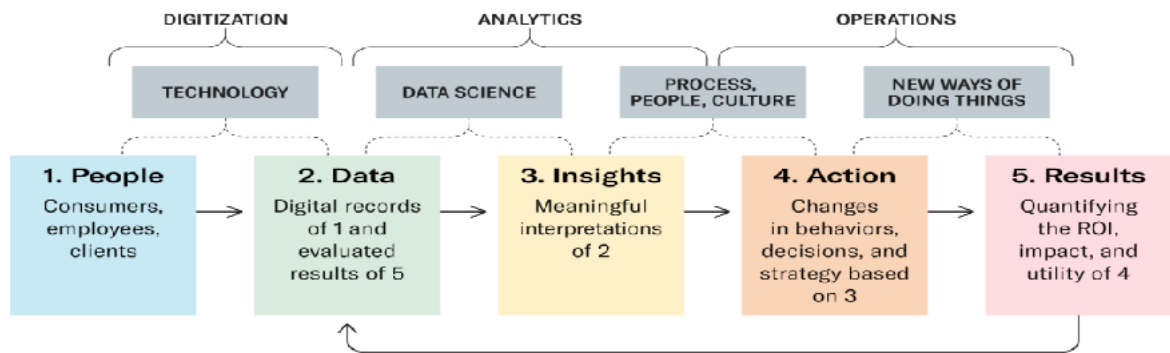
Figure 1.1. Digital transformation accelerators

According to Thomas Chamorro-Premussick⁹ (Figure 1.2), there are five necessary components to carry out an organization's digital transformation. To successfully digitise their business, what many companies lack is a systematic approach to implementing change.

⁹ Chamorro-Premuzic, Tomas. The Essential Components of Digital Transformation. In *Harvard Business Review*, November 23, 2021. <https://hbr.org/2021/11/the-essential-components-of-digital-transformation>

The 5 Essential Components of a Digital Transformation

Mapping the journey to becoming a data-centric organization.



HBR

Figure 1.2. Key components of digital transformation

As another good example, LNS Research's Digital Transformation Framework (Figure 1.3)¹⁰ is designed to help industrial companies figure out how to connect all these simultaneous and interrelated initiatives.

DIGITAL TRANSFORMATION FRAMEWORK

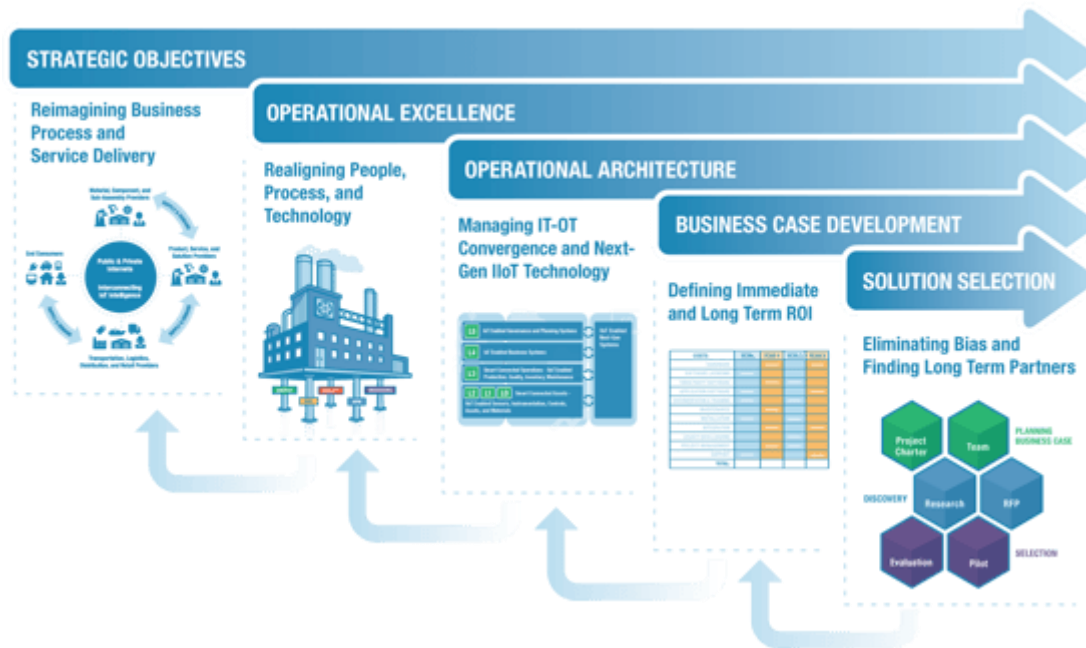


Figure 1.3. Digital transformation management framework

¹⁰ Making Digital Transformation a Reality: Connecting CEO Vision with Technology Innovation [MondayMusings]. Lnsresearch.com, 2016. blog.lnsresearch.com/dx

What are the common components that we could highlight in any governance framework at the moment:

Strategic Goals: At the highest level, companies today need to think about how new technologies are transforming products and business processes across the value chain and the delivery of connected services.

Operational Excellence: People, process and technology are at the heart of operational excellence initiatives. Leading companies today have developed maturity models to help set goals and growth plans for people, process and technology capabilities, along with measurement programs to evaluate performance across all areas of operations.

Data centric: If companies want to scale the knowledge they have about their customers and employees and replicate it across a large organization and in much more complex and unpredictable situations, they need to have data - widely accessible and retrievable records of interactions with users, employees and customers.

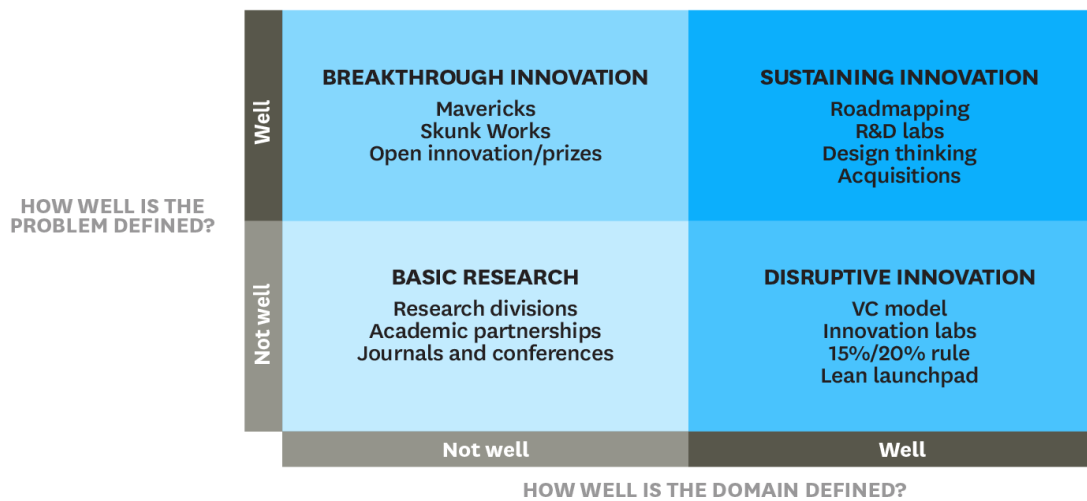
Insights: Although data is hailed as the new fuel of the future, just as with oil, its value depends on whether we can cleanse, refine and use it to maximum business effect. Without a model, system, framework or robust data science, all data will prove useless.

For the purposes of this dissertation, we could align all components into the following conceptual framework for governance:

- Strategic objectives - requirements management and business case creation through a tailored business analysis model;
- management and creation of products/services through an adapted project management model;
- Operational excellence and supply management through an adapted model of developed suitability (capacity);
- Data work and value creation - introducing process mining to the organisation that applies data science to discover, validate and improve work processes.

Innovation in the process areas described can improve the efficiency or effectiveness of existing methods. Possible innovations in the given domains are directly related to production, delivery or customer interaction (Figure 1.4).

4 Types of Innovation



SOURCE GREG SATELL

© HBR.ORG

Figure 1.4. Types of innovation

It is important to note again that data for the past few years shows that the digital economy generates about \$15.5 trillion, or about 17.4% of global GDP¹¹. Also, in the European Union (EU) Commission's Digital Economy 2020 report, the digital economy accounts for around 22% of EU GDP and provides jobs to more than 11.9 million people¹². These figures vary from source to source and change over time as the digital economy continues to evolve and change, especially in the wake of the pandemic and changes in the socio-political situation in Europe.

These trends raise particularly pertinent questions related to the losses from failed digital transformations, which range in particular magnitude given specific circumstances and project scales. Failed digital transformations lead to significant financial losses for businesses. These include direct costs of developing and implementing new technologies, acquiring necessary resources and investing in staff training. Unfortunately, when transformations are mismanaged, there is also a direct impact on business operations in the form of lost productivity and efficiency. Another direct effect is the loss of customer confidence and market share. The loss

¹¹ The World Bank. 2023. <https://www.worldbank.org/en/topic/digitaldevelopment/overview>

¹² The Digital Economy and Society Index (DESI). *Shaping Europe's Digital Future*, 2014. digital-strategy.ec.europa.eu/en/policies/desi

of trust and reputation is particularly critical in some sectors of the economy, especially in financial services and investments.

The topic of this dissertation is significant and topical and focuses on the need for process innovation to provide a framework and approach for the implementation of a new model of process engineering in the core processes of the organization. This is a model that aims to improve efficiency, productivity and competitiveness through innovation in internal processes and working methods based on the integration of Process mining as a core medium for analysis and monitoring.

Let's also summarize what is the state of the described components of the conceptual model for managing digital initiatives at the moment.

Requirements Management (Business Analysis)

Requirements management refers to the process of forming, documenting, and maintaining software requirements and the relevant area of software engineering as part of the process of creating a product or service.

In the current situation, companies should gain insight into their data and processes so they can decide how best to move forward. That's why business analyst jobs are on the rise. Without their help, it's difficult for companies to ensure that they reduce waste, increase efficiency and maximize profitability.

Project management methodologies

Many consider project management to be a modern discipline, but in fact it is not. The basic concepts of this field date back to the late 19th century. Chronologically speaking, project management theory has been influenced by a century of developments in scientific, social and business methodologies.

Project management has continued to evolve over the last two decades, with two significant trends emerging: bottom-up planning and top-down planning and revision.

Bottom-up planning supports simple project designs, with shorter cycles, effective collaboration between team members, and their active participation in decision making. These trends are widely known as agile project management (Agile).

Planning and revising from top to bottom. This trend is characterised by a pattern of decision-making at a senior management level. It encompasses the entire portfolio of projects that the organization must have, as well as the information methodologies and technologies responsible for the proper flow of information in the organization.

What is the state of project management and trends in 2023 can be tracked in The State of Project Management Report, an annual report created, owned and published by Wellington¹³. (Another highly reputable source is Finances Online.¹⁴)

- The lack of business satisfaction for portfolio management projects is growing at around 5% year-on-year.

- The main reasons for the project's failure remain a change in the organisation's and project's priorities and unclear requirements.

- Somewhat or very dissatisfied with the current level of project management maturity in their organization was 52% of respondents. The figure has risen steadily since a 45% rating in 2016 (Wellington, 2020).

- Somewhat or very satisfied with their level of project management maturity is 35% of organisations (Wellington, 2020).

- Of the projects in Australia, 61% have highly engaged sponsors (KPMG, 2020).

- Of project management professionals, 58% work remotely, while only 14% work together in a central office (Project Manager, 2021).

- Based on job profiles, there are approximately 603,120 project managers in the United States (Zippia, 2021).

- The average age of project managers in the United States is 46.6 years (Zippia, 2021).

- 60% of project managers in the US are men and 36% are women (Zippia, 2021).

- From July 2020 to June 2021, there were 306,300 business and financial project management professionals in the UK. On the other hand, there were 79,400 IT project and programme managers and 64,800 construction project managers and related professionals (Office for National Statistics, 2020).

- Thirty-six percent of project managers remain on the job for one or two years. However, only 18% stay for 3 to 4 years, while 15% stay for 5 to 7 years (Zippia, 2021).

¹³ The State of Project Management Report. In *Wellington*. <https://wellington.co.uk/publications/state-of-project-management-research>

¹⁴ 101 Essential Project Management Software Statistics: 2023 Market Share & Data Analysis. In *FinancesOnline*. <https://financesonline.com/project-management-software-statistics/>

- Fortune 500 companies employ 29% of US project managers. Other top employers include technology companies (15%), financial companies (10%), healthcare companies (6%), and telecommunications companies (5%) (Zippia, 2021).

- By 2030, there will be a demand for 25 million project management employees to fill global talent requirements (PMI, 2021).

- 2.3 million people will need to start project management-oriented jobs each year to address the talent shortage (PMI, 2021).

- Project management training is provided by 61% of organizations, while 47% have well-defined careers for project professionals (PMI, 2020).

- Almost one in five project managers has thought about leaving their job in the last year (Girl's Guide to Project Management, 2021).

- Having some type of certification for their role is required of project professionals by 51% of organizations (PMI, 2020).

- Without access to real-time project KPIs, 54% of project management practitioners are (Wellington, 2020).

- 61% of project managers most often or always apply a particular project methodology (Wellington, 2020).

- Some form of risk management is always or predominantly engaged in by 60% of Process mining practitioners (Wellington, 2020).

- Technical skills in talent development to support successful projects are prioritized by 68% of organizations, while 65% prioritize leadership skills (PMI, 2020).

- About 36% of project management practitioners spend one or more days per year collecting project reports (Wellington, 2020).

- The Scaled Agile Framework is the most popular scaling method with 37% of organizations implementing it (Digital.ai, 2021).

- Most project managers (59%) manage two to five projects simultaneously. 15% work on just one project, while another 15% take on more than 10 projects. Meanwhile, only 11% do six to 10 projects at a time (Girl's Guide to Project Management, 2021).

- Customer satisfaction (59%), business value (58%) and business goals achieved (50%) are the top three Agile transformation metrics (Digital.ai, 2021).

The threat of a global recession skews all economic forecasts for 2023, as GDP growth in almost all countries is expected to slow: the International Monetary Fund (IMF) forecasts

around 3% economic growth in 2023, down from the 3.4% growth expected in 2022.¹⁵ The outlook is even more sobering for advanced economies, which drive much of the world's project activity. However, while many companies are trying to respond to this downturn, there is still a serious talent shortage. These specifics are expected to sustain demand for project managers, especially those with developed complex skills that can help organizations cope with a turbulent environment.

Process management and development models

CMMI originated in 1987 as the Capability Maturity Model (CMM), a project of the Software Engineering Institute (SEI). The Institute is a research center at Carnegie Mellon University established and funded by the U.S. Department of Defense. The U.S. Air Force funded research at SEI to create a model (abstract) for the military to use as an objective evaluation of software contractors.

There are three different models based on the CMMI framework:

- CMMI for Development, a process model for process management and improvement in software development organizations;
- CMMI for Acquisition, a model for organizations to initiate and manage the acquisition of products and services;
- CMMI for Services, a process model for organizations that helps them implement and manage services.

By its nature, CMMI for development is a natural choice for process improvement in the digital industry. It can be proven to increase the efficiency of software development processes, as well as processes for planning, managing and controlling development activities. The idea of CMMI is to guide organizations towards process improvement by enabling them to predict the outcome of their defined and managed processes. Predicting process outcomes (including timeframe and product quality) leads to lower risk of budget overruns, quality issues, and schedule non-conformance. CMMI supports a good level of integration with other methodologies and best practices, such as Agile, PMP, and Six Sigma. This is because CMMI does not define how the development of a digital product should be done, it defines what needs

¹⁵"IMF Annual Meetings Recap | October 13, 2023." IMF, 4 Oct. 2023. www.imf.org/en/News/Seminars/Campaigns/2023/AM2023-daily-recap-day-5#:~:text=The%20IMF%20forecasts%20growth%20of,economies%2C%20according%20to%20IMF%20projections

to be done to improve development processes. CMMI supports Agile by providing a frame of reference for successful development environments. PMP (Project Management Professional) as a representative of waterfall models for project management is also supported due to overlap between PMBOK knowledge areas and CMMI process areas.

The Process Mining Methodology (Process mining)

Process mining is a young technology that celebrates its 20th birthday in 2019. Its creator is the Dutchman Wil van der Aalst (professor at RWTH Aachen University), known as the "godfather of process mining".

In the late 1990s, while studying workflow and workflow management at The Eindhoven University of Technology (TUE) in the Netherlands, Aalst realised that existing business process research methods, such as staff interviews and workshops, could only produce a limited and incomplete set of models based on subjective and fragmented information. Parallel to this conclusion and at the same time, business systems such as ERP are entering different departments of companies and are being successfully integrated and developed into the IT infrastructure of businesses. This is an important point that determines the future development of the discipline.

Also indicative of the current state of the discipline is a Gartner study [that expects](#) the market for process modeling to grow to \$2.3 billion by 2025, at a double-digit CAGR of 33%.¹⁶ The key drivers for this continue to be accelerated digital transformation efforts, increasing process visibility requirements due to remote working, and growing demands for operational resilience.

In early 2023, after almost two decades of development of the discipline, the first *Gartner Process Mining Magic Quadrant 2023* was published (Figure 1.5) .

¹⁶ Forecast Analysis: Process mining, Worldwide. *Gartner*, 2021. www.gartner.com/en/documents/4007520



Source:Gartner, Inc

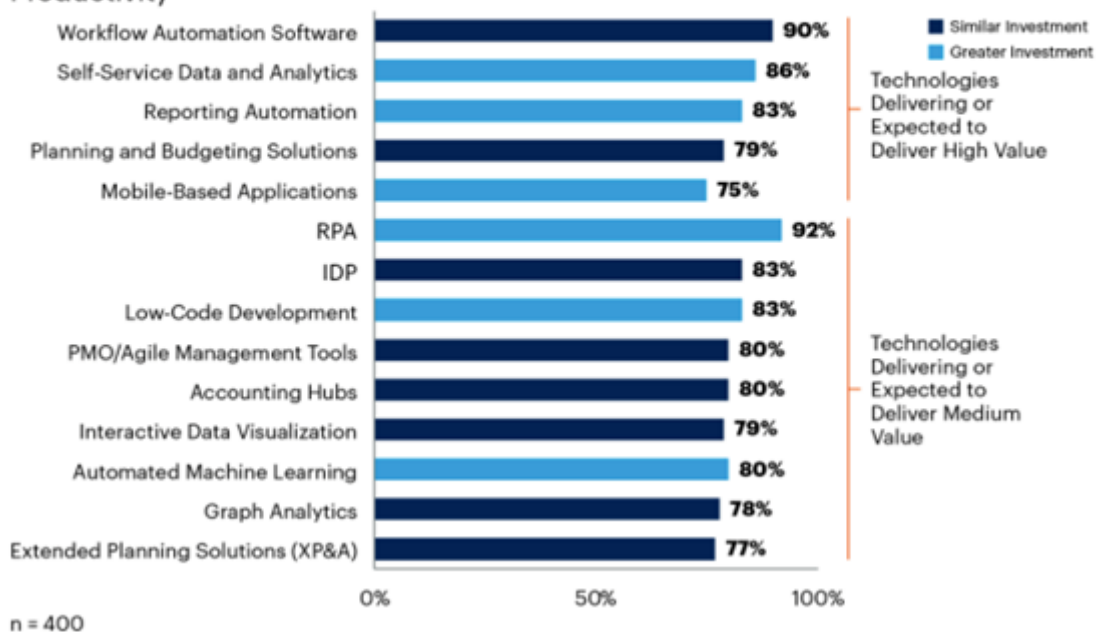
Figure 1.5. Gartner Process mining magic quadrant

It is also important to highlight the expected application of Process Mining in the financial industry. According to a survey by Gartner, Inc.¹⁷, 80% of finance leaders agree that the industry must significantly accelerate the adoption of digital technologies, such as robotic process automation (RPA) and artificial intelligence, to effectively support the business by 2025. When implementing RPA, CFOs see an investment in process mining as key to successful returns from the technology (Figure 1.6).

¹⁷ "Gartner Survey Shows CFOs Turning to Process Mining to Drive Better Returns from RPA." Gartner, 2022. www.gartner.com/en/newsroom/press-releases/2022-04-27-gartner-survey-shows-cfos-turning-to-process-mining-to-drive-better-returns-from-rpa

Percentage of Respondents Associating Technology With Specific Primary Value Factors

Increases Cost Efficiency, Improves Speed and Agility, or Enhances Employee Productivity



Source:Gartner, Inc

Figure 1.6. Technology investments in the financial industry

As part of the study, industry leaders were interviewed about 16 different technologies in the automation and process optimization category. Only three technologies within it are expected to see an increase in investment from current levels over the next two years: reporting automation, RPA and process mining. Of these three technologies, only reporting automation is rated as currently providing "high value" to finance departments. Process mining is designed to detect, monitor, and improve real processes by analyzing event logs in information systems. Finance leaders can review exactly what happened during the execution of their process, identifying root causes of inefficiencies and variances in real time. This provides an opportunity to streamline and adjust processes that can be perceived as resistant to automation, and introduce more opportunities to use automation (RPA) to achieve additional efficiencies and optimization in cost.

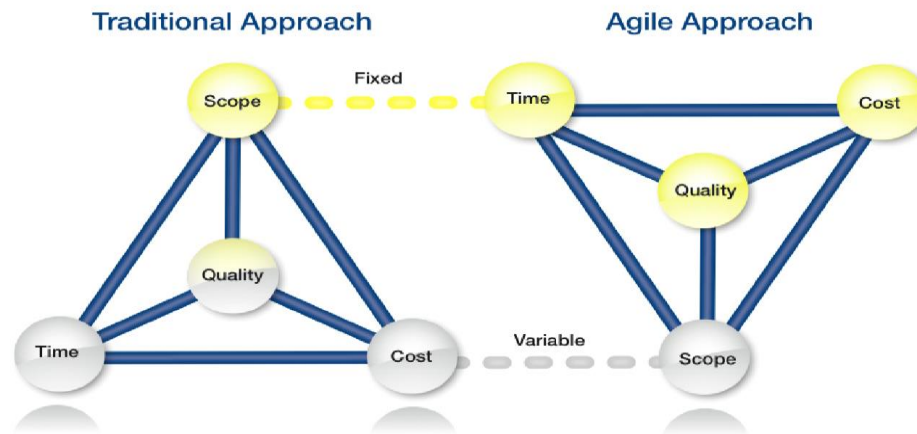
From the review of the current state of the digitalization processes and the identified bottlenecks in each of the described areas, we believe that a reasonable conclusion can be drawn about the need to review and create an interdisciplinary model that provides a framework for change management with corresponding anchor points on key processes of the product/service lifecycle to address the described issues and opportunities for development. Combining such a

framework with an advanced field such as Process mining would provide an automated approach for early identification, management and prevention of possible deviations. The factors described, such as requirements for speed of development, timely and controlled change management, resource management, combined with a robust conceptual framework for process management and development in a dynamic and decentralized environment, definitely provide new directions for business development and return on investments made. Given the huge volume of operational business data generated, the ability to control, monitor and audit in real time using digital technologies and advanced models related to data science is also crucial.

Response time to deviation from core business processes is critical. Failures in this area can lead not only to direct losses for the business, but also to strong image problems, a collapse in reputation, and in specific cases to a loss of consumer confidence, which in today's reality can mean the termination of the existence of the business entity. Current paradigms built on productivity and based on human resources must be adapted to today's realities. The expert capacity of companies should be supported with adapted models and tools for their use. Business is continuous, global and without geographical limits. It is beyond the capacity of staff to cover such a scale without appropriate support and directorates. Timely addressing of the described specificities and successful implementation of adapted innovation management models in a digital environment will be a major competitive advantage for those who successfully implement it.

2. PROJECT MANAGEMENT POLICIES AND MODELS

Practice shows that in a period of rapid development of the software and IT industry, the old methodologies are not applicable in some cases. The rapid evolution of technology and working methods implies a dynamic project management environment. Heavy project management methodologies do not allow for effective and economical management of the constant changes in project requirements and scope caused by the continuous flow of innovations and rapidly changing customer environment. These reasons are causing the emergence of a new field in project management called Agile Software Development (Figure 2.1).



Source: Iterata AG

Figure 2.1. Traditional approach vs. DSDM approach
(DSDM Agile-<https://www.agilebusiness.org/>)

Agile methodology belongs to the "adaptive" part of project management methodologies. Adaptive methods rely on rapid adaptation to changing reality. When the needs of a project change, the adaptive team also changes, and so do the new realities. Such a team would not be able to describe exactly what will happen in the future. The farther in the future a given point in time is, the less accurately an adaptive method will be able to predict upcoming events at that point. The adaptive team would not be able to describe the exact planned actions for the next week, only the planned features for the next month. When asked about a software release planned for 6 months out, an adaptive team would only be able to state the features built into the release or the expected value versus cost.

The Agile/Scrum approach is best suited for relatively uncertain environments. In this environment it is extremely difficult, if not impossible, to accurately define the requirements and design of the solution in detail before the project begins. This specificity is addressed by the inclusion of the business analysis in an earlier phase. In spite of the lack of detail, the key business development directions and strategies are defined, communicated and validated. Respectively, the same applies to the possible risks.

Flexibility and adaptability are essential to further define and develop the requirements and design of the solution as the project is underway. Integration with business analytics allows proper and timely reflection of changing requirements using a systematic approach.

The focus on added value is leading.

The positives of an integrated approach relate to creativity and innovation, time to market, lower costs, improved quality, customer satisfaction and organisational synergy.

Creativity and Innovation: In the highly competitive environment we live in, no one wants to buy mediocre products that are not market-oriented. People expect a higher level and personalisation and that requires creativity and innovation. The Agile/Scrum approach emphasizes creativity and innovation to increase the business value of the solution.

- **Time to market:** Agile/Scrum typically results in faster time to market due to shorter time to market. The incremental development effort will also allow for early delivery of at least a portion of the requirements without the entire solution being 100% complete. This will allow quick feedback from the market and optimize the error rate.

- **Lower costs:** Agile/Scrum can reduce the cost of a project in several ways:
 - Significantly reduced overheads as a result of reducing unprofitable documentation and control requirements.

- Higher productivity of the project team.

- **Improved quality -** Agile/Scrum project quality is an integral part of the development process, not a sequential activity. Developers know that quality is a "team responsibility".

- **Customer Satisfaction:** Agile/Scrum should lead to higher customer satisfaction and more effective solutions, as the customer is heavily involved in providing feedback and input throughout the development process.

- **Organizational Synergy:** Agile/Scrum can improve organizational synergy by breaking down organizational barriers and developing a spirit of trust and partnership around organizational goals.

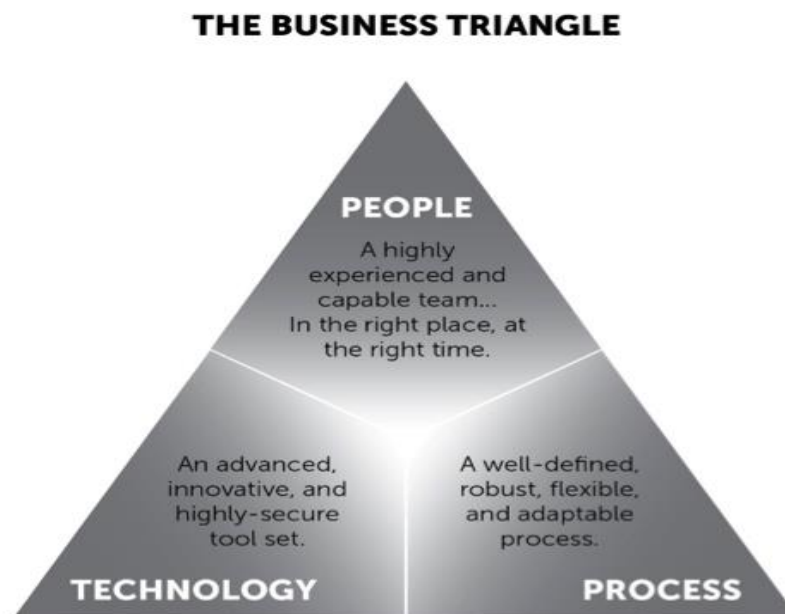
Like any approach, Agile/Scrum is not without its drawbacks of an objective and subjective nature, which can be overcome through continuous learning, improvement of expertise and organizational transformation:

- *Ongoing training and expertise.* Agile/Scrum requires continuous training and skills for successful implementation, which many project teams do not fully understand or are unwilling to put the effort into. They try to do Agile/Scrum mechanically without fully understanding the principles behind the approach, which is usually not very effective.

- *Organizational Transformation.* To be successful, the Agile/Scrum approach may also require some level of organizational transformation. This involves business users working with the development team in a spirit of trust and partnership, and may also require breaking down some organizational barriers.

- *Scalability.* There is a possibility to experience serious difficulties in scaling Agile/Scrum to large complex projects. There are some models for doing this (Scrum-of-Scrums, LeSS and SAFe, etc.), but none of them represent a ready-made, easy-to-implement solution.

The limitations described should be addressed correctly. The paradigm of a successful social and business model still remains people, processes and automation (Figure 2.2).

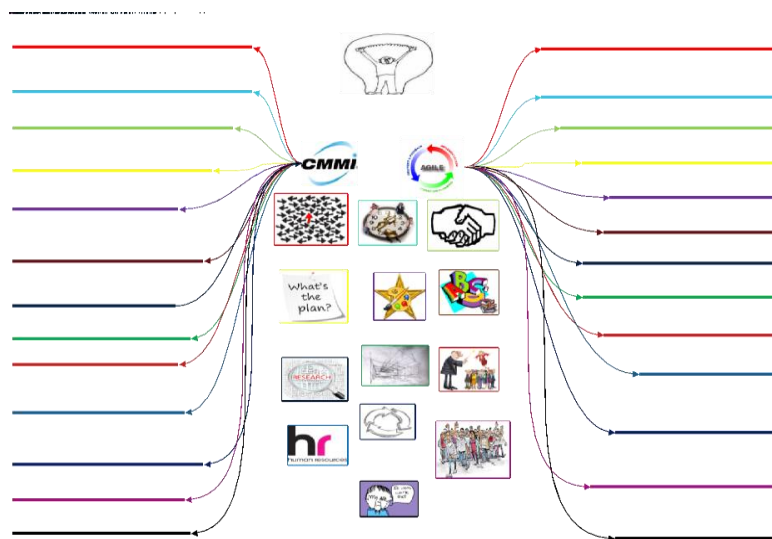


Source: Applied organizational change in industry, structural, technological and humanistic approaches. Handbook of organizations

Figure 2.2 People, Processes, Technology (PPT) framework

Here we move on to the next component of the synergistic model for managing digital initiatives, namely quality assurance and process control as a superstructure of business analytics combined with deployment and implementation in an Agile environment.

The synergy between Agile and CMMI can be visualized as follows:



Source: Redalyc

Figure 2.3. CMMI/Agile synergy model

Quality assurance and process control systems

What are the issues we are addressing by incorporating these systems into a synergistic model? The signs are many and varied, but could be grouped as follows:

Missed commitments:

- spiralling costs;
- delay in delivery to the market;
- last minute efforts.

Inadequate management:

- too many surprises.

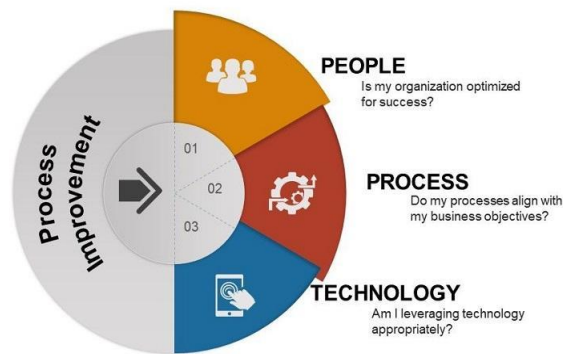
Quality issues:

- complaints from customers;
- too much rework;
- functions that do not work properly.

Bad Morals:

- left people;
- Inadequate monitoring of project results.

The actual standard matrix that leads to results is presented in Figure 2.4.



Source:Slide Team

Figure 2.4. People, processes, technology - process optimization model

Processes really complement the focus on technology, as technology alone does not guarantee effective use without a proper process framework. It is also important to emphasize that process complements the focus on people. Workforce experience and training is not always a sufficient guarantee of effectiveness without an appropriate process. Good process gives value to the phrase 'work smart not harder'. Realistically, people are not to blame for performance under poorly defined processes.

Review of available data in the space and high-level analysis show the following correlation: system quality is highly dependent on the quality of the process used for acquisition, development, and maintenance. This is an established prerequisite in manufacturing. The hypothesis is also supported by visible quality developments worldwide in manufacturing and the service sector (e.g. ISO standards).

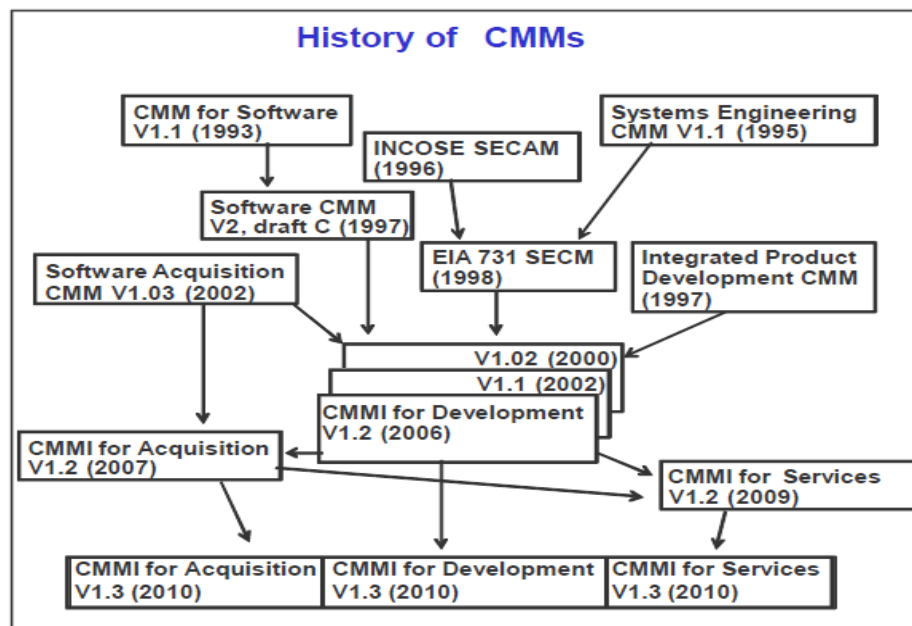
Interviews conducted in various business organizations¹⁸ also show some common misconceptions about the processes, such as:

- I don't need processes, I have good people, technology and a good manager.
- Processes stop creativity. There is too much bureaucracy and discipline. Not needed when testing prototypes. Have use only in large projects. Stop rapid access and are not flexible in emerging markets. They are quite expensive to implement.

¹⁸ Delusions of Success: How Optimism Undermines Executives' Decisions. *Harvard Business Review*, July 2003, hbr.org/2003/07/delusions-of-success-how-optimism-undermines-executives-decisions

To counter these claims, we will consider one of the best-known sets of carefully selected best practices based on experiences from different disciplines and their applications.

CMMI (Capability Maturity Model Integration) is a proven industry framework for improving product quality and efficiency for hardware and software development. It is sponsored by the U.S. Department of Defense (DoD) in collaboration with Carnegie Mellon University and the Software Engineering Institute (SEI). Many companies are included in the CMMI definition, such as Motorola and Ericsson. CMMI was created as a model for improving business performance. It is a process metamodel—a structured set of best practices that are essential elements of effective processes (Figure 2.5).



Source.: CMU/SEI

Figure 2.5. CMMI history

There are several fundamental challenges related to business process management. Two general problems underlie the fact that in many companies process management and improvement are running in the background. At the current time, however, there is a relatively new discipline called Process Mining (PM) that addresses the generic problems and makes it possible to fix bottlenecks that have remained problematic for a long period of time.

One issue involves the creation of processes in As Is "current state" - a description of how a business process is executed today. In business process reengineering, organizations are primarily interested in an improved To Be process, so they often have little interest in examining the "As Is" or how the process is currently being executed. But understanding the current process is critical to knowing if it is worth investing in improvements, where performance

issues exist, and how much variation there is in the process across the organization. As a result, some companies tend to either skip analyzing the current process altogether or do a superficial analysis of the current state.

Companies that take an incremental improvement approach, on the other hand, tend to spend too much time analyzing the As Is condition. In addition, their ongoing process analysis is often based on interviews and flying notes and memos, which managers sometimes consider too subjective and treat the information with justified skepticism.

The other common problem with process management is the lack of linkages between business processes and the organization's corporate information systems. Some enterprise systems (SAP, for example) are process-oriented in the sense that they support processes such as order-to-cash or delivery-to-pay, but there is rarely an easy way to understand how a process is executed from the information system. Some different technologies (such as Microsoft's Visio or Software AG's Aris) support aspects of process design. But if information on how the process performs on a daily basis is desired, it usually requires a difficult set of manual steps to collect and synthesize data. Many process improvement approaches - Lean and Six Sigma, for example - have not emphasized information technology as a means of supporting and managing processes.

Process mining can solve both problems. Its software is able to help organizations easily aggregate data from enterprise transaction systems and provides a detailed, real-world data-based picture of how key processes are performing. It creates event logs when work is done: order received, product delivered, payment made. The logs show how the work actually gets done, including who did it, how long it takes, and how it deviates from the company's chosen average.

Process analytics creates key performance indicators for the process, allowing the company to focus on priority improvement steps. AI algorithms can detect the root causes of variation - for example, pointing out that every time a new customer needs a credit check, the process slows down significantly. Choosing where to apply Process mining is important. Organizations will get the best value from applying it to digitized processes (i.e., supported by an IT system) and where there is still some unstructured work (i.e., reviews and approvals) happening outside of the IT system.

Process mining is used effectively to analyze the current state of business process performance, identify areas for improvement, and evaluate the results of process improvements. This fact makes it a prerequisite for implementing highly autonomous automation systems. With such an approach, it is easy to first identify areas where bots could be integrated and then

provide the means to calculate the beneficial impact of their deployment. Consideration should also be given to the fact that Process mining is at a stage in its development that provides a visually appealing and data-driven view of process performance. Such a view is essential for senior management who can easily see where the problems and opportunities lie for the organisation.

At a conceptual level, Process Mining is also an important potential tool in the paradigm called Industry 4.0. Details on the position of the Bulgarian state are reflected in the Concept for Digital Transformation of Bulgarian Industry.¹⁹

3. A MODEL FOR MANAGING DIGITAL INITIATIVES THROUGH PROCESS MINING (PROCESS MINING)

Process information extraction techniques can extract knowledge from event logs, which are common in modern information systems. These techniques provide new means to detect, monitor and improve processes in different application domains.

Practical application with examples from different industries

Process mining is becoming increasingly applicable due to changes in the business environment. The advancement of the service economy is increasing the need to improve business processes, and digitalization is creating a variety of data that can be analyzed with the right techniques.

Process mining mainly contributes to reducing costs and improving customer satisfaction, but is also very effective in reducing the time and cost of the analysis itself compared to conventional business analysis methods.

¹⁹ Concept for digital transformation of Bulgarian industry (Industry 4.0). Ministry of Economy and Industry, 2017. https://www.mi.government.bg/files/useruploads/files/ip/kontseptsia_industria_4.0.pdf

There are two environmental changes that should be mentioned as major trends in society as a whole: the service economy and the digital economy.

Service economy (servitisation)

What has supported economic development so far is mass production and mass sales of various products, mainly from mass industry. By efficiently producing a large number of excellent products, unit costs are reduced and products are sold in large quantities mainly through wholesale and retail channels.

It is particularly important for manufacturers to develop, produce and deliver high quality products, and the process of delivering them to consumers is a key commitment of the distribution chain. Purchased products are freely used and consumed by individual households and consumers without restrictions after purchase. Producers do not focus on the details related to the consumption of production, the life cycle and the cycle and disposal. The only focus is the warranty support for the calculated period.

With the emergence of different service industries and the intensification of competition in the manufacturing industry, more and more companies are providing value-added services related to their products (insurance, installations, additional support, training content, etc.). The overall approach to the customer is changing into providing a complete solution that goes far beyond the physical product. The trend in recent years has been to provide value in use on an ongoing basis rather than selling the product. In recent years there has been an increase in the form of renting products for a monthly or annual fee. This is a so-called "subscription type" business and is effectively a sales method providing a service rather than a product, which is on the rise. The shift from products to services is seen in all industries. We are in a "service economy".

There are four service characteristics: intangibility, inseparability, variability, and perishability²⁰ :

- as the nature of the service is intangible, hence the production and delivery of services is more complex than the product;
- inseparability is an essential characteristic that distinguishes the service from the product according to simultaneous production and consumption;
- due to the variability of the service, it is difficult to control as it relies heavily on the provider, in addition to when, where and how it is provided;

²⁰ Kotler, Philip, Kevin Lane Keller. Marketing Management 15th Ed., Harlow, 2016.

– perishability is one of the main characteristics of the service - it cannot be stored for later use or sale (without inventory).

Concurrency and variability are relevant to the service. The service is provided in real time and each time its value and quality will vary. It is therefore essential that the service provider manages the process appropriately and tries to keep the quality of the service as homogeneous as possible.

Digital economy - digitalisation

The beginning of digitalization was probably the lifting of the ban on commercial use of the Internet in 1995, and since then various services using the Internet have appeared one after another. Advances in hardware development and the massive penetration of smart devices into everyday life have given a further boost to Internet-based businesses and services. In this digital economy, the biggest challenge for companies is to properly manage the process of delivering value to the end user. Although online services often involve the movement and consumption of some physical product, they are essentially services with the four characteristics described by Philip Kotler and Kevin Keller²¹. A key aspect remains quality control, especially given the variability of the service.

The key factors that help companies navigate the macroeconomic environment are customer experience and operational excellence.

The core of operational excellence lies in the right processes.

Both the external and internal environment of companies is changing due to digitalization. It is important to draw a correlation with two factors and they are: process visibility and digital footprints.

The advent of ERP in the 1990s marked the beginning of digitization or systemization of various business operations in the enterprise. At the same time, there was the so-called Internet revolution, which resulted in the development of a large volume of business systems and applications based on Internet technologies.

The emergence of concepts like SaaS (software as a service) are affecting corporate life at all levels, enabling businesses of all sizes to escape heavy upfront investments. The style of working is changing from manual and human-supervised monitoring to system-based. Standard process control and management models provide direct visibility and a simple but limited model for growth and development.

²¹ Ibidem

Today, more and more business operations are being digitized and systematized, making it possible to record the entire operating state of a system as data. By recording and analysing the operational history of individual users of applications such as ERP and CRM, as well as office software such as Excel and PowerPoint, it is possible to gain complete and unambiguous visibility over all business processes.

This is where the role of Process Mining comes in. It automatically replicates business processes based on event log files extracted from business systems, etc., and is currently the only model for continuous business process improvement. Additionally, the concept is emerging as an indispensable analysis method for current and future corporate and organizational management models and an option to address the rapid environmental changes brought about by digitalization.

If we approach from a management perspective, the main goal for the business is to improve profits and sales. Process mining has a direct impact on cost reduction. Through the extraction and visualization of the company's processes, inefficient processes can be easily identified with loss of time and resources. We can scan the business for low urgency tasks and for tasks with recurring errors. By eliminating such tasks, it is possible to dramatically reduce the cost of performing business activities.

Next, customer satisfaction can be expected to improve. For example, in the case of the ordering process from order receipt to delivery, by identifying and improving problem areas delivery times can be dramatically shortened. For customers, satisfaction will increase if they receive their orders faster than before.

Further optimizing business processes will not only shorten delivery times, but also reduce errors, such as receiving items other than those ordered. Speeding up the process and improving the quality of service will also impact customer satisfaction, which in turn will lead to an increase in order quantity and improve repeat business.

As a result, employee satisfaction can also be expected to improve. If bottlenecks that cause unnecessary work and strain are eliminated through process extraction, working hours spent on performing routine business processes will be reduced. As a result, unnecessary overtime is eliminated and overall working hours can be reduced. Employees will be able to perform their jobs more efficiently without having to spend time on tasks that seem unnecessary, and morale within the company will improve. As a consequence of the optimisation and the increase in the volume of business, additional social packages can be applied to the staff, which directly reflects on the motivation of the workforce. In a digital economy, this is one of the key factors in achieving results.

In addition, by directly linking the process extraction tool to the business process and feeding event log data into the tool in real time, it is possible to monitor not only completed cases, but also ongoing cases. In the case of real-time monitoring, it is possible to detect bottlenecks and deviations in processes that are currently running and take corrective measures immediately. Some tools can even predict problems before they occur and suggest corrective measures. These functions are called "operational support" and are a hot topic in the development of Process Mining at the moment.

In addition to the benefits discussed, Process mining as part of the family of business analysis methods has some advantages over traditional analog methods. Conventional methods use analogue approaches, such as individual interviews with people involved in the business process to be analysed, and workshops where teams come together to discuss the process, plus manual action research and lead times. This is subjective data that can be at odds with reality, and is primarily based on human memory.

In the case of long and complex processes, many people are involved and the time and cost of interviews and workshops can be enormous. The cost of real time in which business tasks are not performed is also tangible. Process mining, on the other hand, is a quantitative analysis based on event log data extracted from business systems. Since the entire operational history of the system is analyzed in its entirety, end-to-end processes **should** be reproduced in detail, objectively and without gaps. Although it is necessary to obtain the cooperation of the IT department to extract the data to be analyzed, the process analysis itself does not burden front-line personnel heavily, and even if the time and effort of data preprocessing are included in the calculation, time and cost can be significantly reduced compared to conventional methods.

Process innovation and its future development

Process mining is a young discipline that uses real data from organizations' operating systems to analyze and improve business processes. In the following years, several major development trends stand out.

First, the *use of data from different sources should be expanded*. A particular weakness of the application model used is the lack of direct connectivity to requirements and project management systems. In addition, and depending on the type of business model, process modelling can use information sources from the physical world, the Internet of Things (IoT),

data from social networks, websites and other digital sources. This additional variety of data will allow for a broader and more detailed analysis of processes.

The next trend is *integration with artificial intelligence and machine learning*. Process modelling will increasingly benefit from advances in artificial intelligence and machine learning. The developed application model shows that solutions are still based on expert human resources. It is expected that the direction of predictive analytics, rapid process optimization and decision automation will develop dramatically. Currently, techniques such as automatic process detection are fully developed and no activity in this direction is expected.

The third trend that is common to all digital business tools is the *development of more sophisticated and intuitive visualisation and analytics tools*. These tools allow users to visualize and analyze processes in an easier and more convenient way, e.g. ad hoc analytics, custom process diagrams, flexible table modeling, graphs, etc.

The totality of the development trends described will lead to increased efficiency, optimization and innovation in the business processes of multiple organizations. Process modeling will continue to play an increasingly significant role in improving operations and decision making in organizations. Its massive use will also lead to the last level of evolutionary development, namely process modelling as a service (Process mining as a Service).

With the ongoing development of cloud technologies and the availability of large-scale data (Big Data), it is logical to offer process modelling as a service (Process mining as a Service). The process of moving many types of resources and services to the Internet is a fact. Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), Database as a Service (DBaaS) and Data Analytics as a Service (DAaaS) are now standard. Respectively, as part of Data Science, Process Mining as a Service (Process Mining) will move to the cloud and allow organisations to benefit from the expertise and tools of process modelling without being required to develop and maintain them in-house.

CONCLUSION

The daily work and business of any company is knowledge generation and management. When managerial decisions are made, when new products and technologies are developed, when customer problems are solved, organisations generate knowledge. Or as management guru Peter Drucker says, "knowledge is the ability to act" and that "technology is the application of knowledge to work"²² .

The most important processes in companies - management, value creation and development - are based on the generation of new knowledge. So in the context of the information society, it is a strategic necessity to be able to properly understand and manage knowledge generation processes.

The correct formula for thinking about productivity and growth is:

$$\textit{Productivity} = \textit{Knowledge} \times \textit{Resources}.$$

From the two productivity factors, two development strategies can be formulated - by increasing resources (extensive development) and by increasing knowledge (intensive development), with the real solutions always on a plane somewhere between the two extremes.

In the current socio-economic situation, it can be reasonably assumed that knowledge-based solutions actually require less cost and are much more efficient, which in turn increases the effectiveness in achieving a given outcome. In parallel, these solutions have a higher level of flexibility and are more sustainable than extensive solutions. The right knowledge generation process involves constantly looking at and questioning existing processes and outcomes, and continuously seeking ways to improve them, which is achieved by gathering new information and new perspectives on problems.

The applications of an innovative coherent model for business management in a digital environment can be defined in several main directions. The impact of such a model/tool at a managerial level will help:

– to properly understand and actively manage the processes of growth and investment in business entities;

²² Drucker, Peter. Today Knowledge Has Power. It Controls Access to Opportunity and Advancement. *BrainyQuote.com*, BrainyMedia Inc, 2023. https://www.brainyquote.com/quotes/peter_drucker_154449.

- to integrate the core business of the company with the process management model, which is one of the basic and necessary conditions for the generation of added value, and to understand what such integration actually requires to be successful and effective;

- to manage (plan, organise, control and evaluate) the process of generating and implementing innovation, which is the core process of value creation in any organisation;

- to reason about an organisation's ability to develop in the future and to be able to assess that ability, which is in effect an assessment of the present value and performance of the firm;

- to proactively increase an organisation's capacity to generate efficiency and effectiveness and to evolve in the future, which is now a competitive advantage to cope with rapid changes in the environment.

In parallel, the model would impact at an organisational level and:

- Build the right organisational structures and systems that will keep the business ecosystem functioning and make value generation and development cost effective;

- to adjust the style of managers and the general operating model of management for value generation and continuous development.

Proper integration of such a model would require a structured concept. In the corporate world, every initiative must have a defined value. Business value is the measurable effect that certain decisions have on the business and business processes.

The main effects expected from this type of solutions are:

- reducing costs and increasing revenues;
- optimising working capital;
- customer satisfaction;
- compliance and sustainability;
- workforce productivity.

The ability by integrating Process Mining (PM) concepts for companies to uncover and correct inefficiencies to enable them to operate at levels they never thought possible is a strong competitive advantage. Opportunities to correct inefficiencies or otherwise improve a process are called Value opportunities. Addressing and closing such opportunities should be done through an adapted innovative methodology.

The main directions of the proposed methodology are:

- Identification of potential value for the business from the implementation of an improved/innovative model (industry benchmark, completion of questionnaires, completion of a list of bottlenecks and opportunities for development, assessment of feasibility).

- Define initiative frameworks - prioritize improvement initiatives, research root causes, create and present business cases, create a pilot project, create a knowledge hub, create a roadmap for improvement, validate and secure resource and management level).

- Implementation of initiatives - according to a pre-established action plan with clear financial metrics. Defining strategies for improvement. Create action plans with tasks and timelines. Implement action plans for selected improvement initiatives.

- Change management - change management and stakeholder ongoing development. Creating and sharing success stories e.g. video testimonials, blogs and announcements. Monitoring KPIs and process performance metrics and reporting to management. Evaluating success of action plans and course correcting as needed.

During the study, the following problem points were also identified for the development of the proposed model and its implementation in widespread use:

- Digital transformation is almost always met with some anxiety and pushback within the organization. A solid change management plan can smooth this realignment process through clear and consistent communication that keeps all stakeholders in the loop.

- IT system modifications - such a model is highly dependent on digital footprints and the quality of information provided in the underlying IT systems.

- Changes related to employee behaviour - the model cannot correct for non-compliance with procedures by the workforce. Many of these types of problems often cannot be solved by updating the system or re-engineering the process. If employee behavior is wrong, employee-focused improvement actions such as training or incentive methods should be considered.

There are two key metrics to track when it comes to successfully measuring the impact of model implementation: value realized and return on investment, or ROI. *Realised value* is about measuring the relevant set of key performance indicators (KPIs) to see if the target values are being achieved. These KPIs can be both financial metrics (such as working capital, for example) and operational metrics (such as order completion time, manual activities, etc.). It really depends on the type of business where the model will be implemented.

The second metric, *return on investment (ROI)*, is closely related to the realized value metric, but focuses on profitability and compares the monetary gain from the investment to the cost. These investment gains can be factors such as cost savings and revenue growth. The ROI calculation essentially quantifies the realised value indicator in financial terms, translating it into a bottom line impact.

From the research conducted, it can be reasonably concluded that the implementation of Process Mining (PM) in corporate structures is yet to evolve. Undoubtedly, with the increasing volume of data generated by businesses and the speed of life in general, operating in a digital environment without such a tool is almost impossible. The development phase of the concept only covers basic business processes, but with the upgrade of addons can easily cover all business processes.

There is hardly a process that has not been digitized by now. This, of course, comes with some serious trade-offs. Companies and entities in emerging markets with a low level of maturity do not have access to this type of digitization, and are consequently limited in their use of such a model. Information security is also a very serious case for the future development of the concept. Full assurance in terms of cyber security is existential for the uptake of a model in a business environment (especially in conservative financial institutions). Last but not least, the case of personal data should be noted. The model allows monitoring of the social graph within the company, which should be regulated against existing regulations and ethical standards.

Currently, there are no significant barriers to Process Mining and its participatory models and as noted by Gartner®, the trend is positive with significant potential for growth. Or as John Kennedy said, "Change is the law of life. And those who look only to the past or the present are sure to miss the future."

CONTRIBUTIONS

The proposed work gives a scientifically and practically justified proposal for the renewal of the objects, processes and technologies used in the economy, production and management of digital products. A new innovation model for digital product lifecycle management will provide a different approach to the case studies created by the need for flexible capacity, sales and resource planning in response to a rapidly changing economic environment. The direct expression of an innovation model for a new approach to business processing lies in increasing the productivity and profitability of the business.

Expected scientific and applied contributions are as follows:

- A detailed breakdown of the BA, CMMI and Agile methodologies was performed.

- Outlined a clear framework are the synergies between the considered models and Process mining practices
- The main problems and their causes in the companies' digitalization life cycle are analyzed.
- Significant interdependencies between organizational factors and the quality of the produced digital product/service are derived and prerequisites for their resolution are systematized
- A new applied model for interpretation of basic methodologies is proposed
- The model is the basis for the subsequent development of a process innovation based on the integration of data science and a complex approach to business process management in a real-time digital database environment.

The pilot user of the product is the ICT industry in Bulgaria. The technology industry is in the top 5 economic sectors by revenue in Bulgaria for the last 10 years, according to the latest CBN - Pannoff, Stoytcheff & Co. The development of the Technology business in Bulgaria is evidenced by the fact that over the last 15 years the revenues of the 100 largest ICT companies have grown by 6.8% from 4.9% to 11.7% - i.e. the growth rate of the Technology business is nearly 2.5 times faster than other industries in the country.

It is important to note that the product has no limit in its use. ICT was chosen due to early adopters mindset.

For the implementation process to be effective, the model must be integrated into the operational life and corporate culture of the organization, i.e. it must be reflected in all processes, methodologies, policies, procedures, documents, tools that are applied in management.

The implementation process is divided into the following steps:

- Creating a strategy for the implementation of the model
- Implementation of the model in the management approach
- Implementation of the model in business processes
- Implementation of the model in the company culture
- Communication

Validation will be based on a comparative analysis of the company's effectiveness and efficiency.

Effectiveness answers the question of whether the "right things" are being done, which relates to the company's strategic goals. Efficiency answers the question whether things are being done in the "right" way, i.e. what is the result achieved relative to the inputs.

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LIST OF SCIENTIFIC PUBLICATIONS ON THE THESIS

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