Interdepartmental Graduate Program in Business Administration

Thesis

"Innovative anthropocentric methodologies for project & infrastructure management in the Healthcare sector"

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Abstract

This thesis explores the innovative anthropocentric methodologies for project & infrastructure management in the healthcare sector.

The use of methodologies such as Waterfall, Agile & Scrum in the healthcare ecosystem on the one side appears to be expanding, either in terms of increase in use or in terms of developing of new, hybrid methodologies, setting a more fertile ground for responding to the sector's current and future emerging challenges.

On the other side, the patient's ecosystem doesn't seem to be as integrated into the design & development phase of projects & infrastructure as possible, even if innovative co-creation techniques such as Design Thinking, Service Design, etc. share basic principles with the aforementioned methodologies.

The responses from interviews with 4 healthcare ecosystem and 3 patient organizations' representatives, as well as analysis of online activity, are examined and presented.

Results indicate that integrating innovative project management methodologies and combining them with co-creation techniques, can lead to valuable results, while their combination seems to offer the appropriate "toolbox", in order to efficiently respond to the big questions to be faced, in the healthcare's future.

Keywords: Project management methodologies; agile methods; scrum; waterfall methodology; co-creation methodologies; design thinking; service design; user-centered design; health; healthcare; point-of-care system; healthcare innovation management;

Contents

Table of Figures

Introduction

In recent years, the Health sector has shown rapid growth, resulting in an increase in the life expectancy of the population and the positive development of many indicators of social well-being. An outstanding role in this development has been played by the rapid development of technology, as well as the wide adoption of its offered solutions. The intersection between health and technology has already led to enormous new opportunities, from the dissemination of knowledge around diseases and remote psychological support for patients; to the development of pharmacovigilance tools and telemedicine.

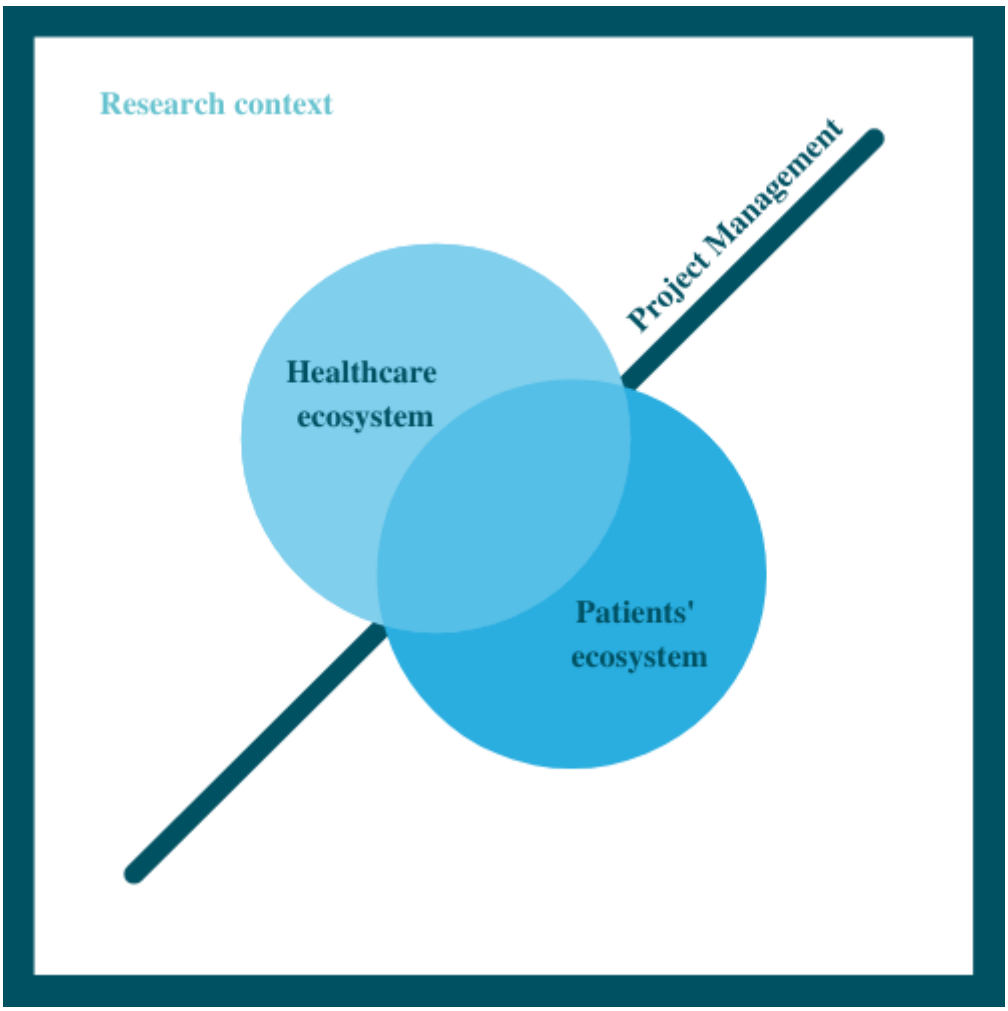
Forecasts for the coming years follow this rapid rate of development and creation of new solutions, a fact which raises significant expectations regarding the further growth of the Healthcare sector. In order to achieve these expectations, each health provider should be able to manage extremely important challenges, both in terms of the identification of needs and as well as in terms of response time to develop appropriate, corresponding solutions.

When it comes to "identifying needs" and developing products to meet them, there are significant developments in the methodologies used to achieve meaningful results. From "mass production" and the doctrine of "one fits all" -which were established in the era of the boom in production- we are heading fast to an era where services and products are developed in such a way so as to create added value, responding to the personal needs of each end user.

Through the very development of technology and easier access to a greater share of "product suppliers", end users have become more demanding and selective. Thus, new co-creation approaches have emerged, bringing the end user and other stakeholders at the heart of the design of the delivered outcomes. Referring to products, it is important to remember the definition from the "father" of modern marketing, Philip Kotler: *"Product is anything that can be offered to a market to satisfy a want or need, including physical goods, services, experiences, events, persons, places, properties, organizations, information, and ideas"*. (Kotler & Keller, 2009).

Regarding the response time to the challenges, in recent years various innovative approaches have emerged, which are adopted in many industries, at the level of management (Agile, Waterfall, etc.). Unfortunately, these innovative methodologies do not seem to be adopted to the same degree, in the field of Health.

This thesis will explore the importance and contribution of project management methodologies in the Health sector and their "human-centeredness" in terms of growth and contribution to society. In order to do so, this thesis examines the issue of "Innovative anthropocentric methodologies for project & infrastructure management in the Healthcare sector", like a two-sided coin.



Picture 1: Visualization of the research context

So, in order to examine how anthropocentric project management methodologies/techniques work -both in Healthcare ecosystem and patients' ecosystem levels- and whether there is added value in investing resources in their upgrade within the Healthcare context, the current thesis analyzes the following 3 pillars:

1) Healthcare's state of the art, emerging issues and future trends
2) Project management, recent evolutions and its significance in Healthcare
3) Co-creation methodologies that capture user needs & preferences

All the above analysis of the current practice & future trends, ends up setting the scene for the actual examination of whether there is use of innovative management techniques in Healthcare, whether that affects the future of Health development and to what extent.

The research findings from the 1st stage analysis, where next cross-referenced with the common practice, in order to identify if the theoretical approaches are actually applied to the "daily-routine" of the healthcare ecosystem. High-profile representatives of both healthcare ecosystem and patients' ecosystem across Europe where interviewed, answering to 15 questions each, reflecting the aforementioned 3 pillars.

Finally, the results of the thesis highlight the importance of the contribution of project management in the design, development and provision of health products/services/infrastructures. In addition, the results document the need for new, innovative, hybrid methodologies that will satisfy the specific conditions and needs of the sector. In this manner, more ideal conditions are created for the sector's further evolution in combination with the satisfaction of the immediate development of solutions by the medical community resulting in their contribution to society.

Literature review

Overview of health sector

The health sector has seen rapid development over the past 50 years, driven by major advances in medical technology, changes in healthcare delivery, shifts in healthcare financing and a more user-centered approach.

In terms of medical technology, the last 50 years have witnessed the introduction of sophisticated imaging tools such as CT and MRI scanners, which have revolutionized diagnostic imaging and allowed for earlier and more accurate detection of diseases. Genetic engineering techniques, such as PCR, have led to significant advances in genetic research, and the completion of the Human Genome Project in 2003 has enabled a better understanding of the genetic basis of disease and the development of personalized medicine.

In terms of healthcare delivery, the use of new technologies has allowed for more efficient and accessible healthcare. This has been coupled with a shift towards managed care and the use of digital health technologies that have helped to streamline healthcare delivery. The COVID-19 pandemic has further accelerated the adoption of digital health, telemedicine, and the importance of government intervention in healthcare, showing that the healthcare sector is in a constant state of evolution, and it's important to keep up with the latest developments to ensure that patients have access to the best possible care.

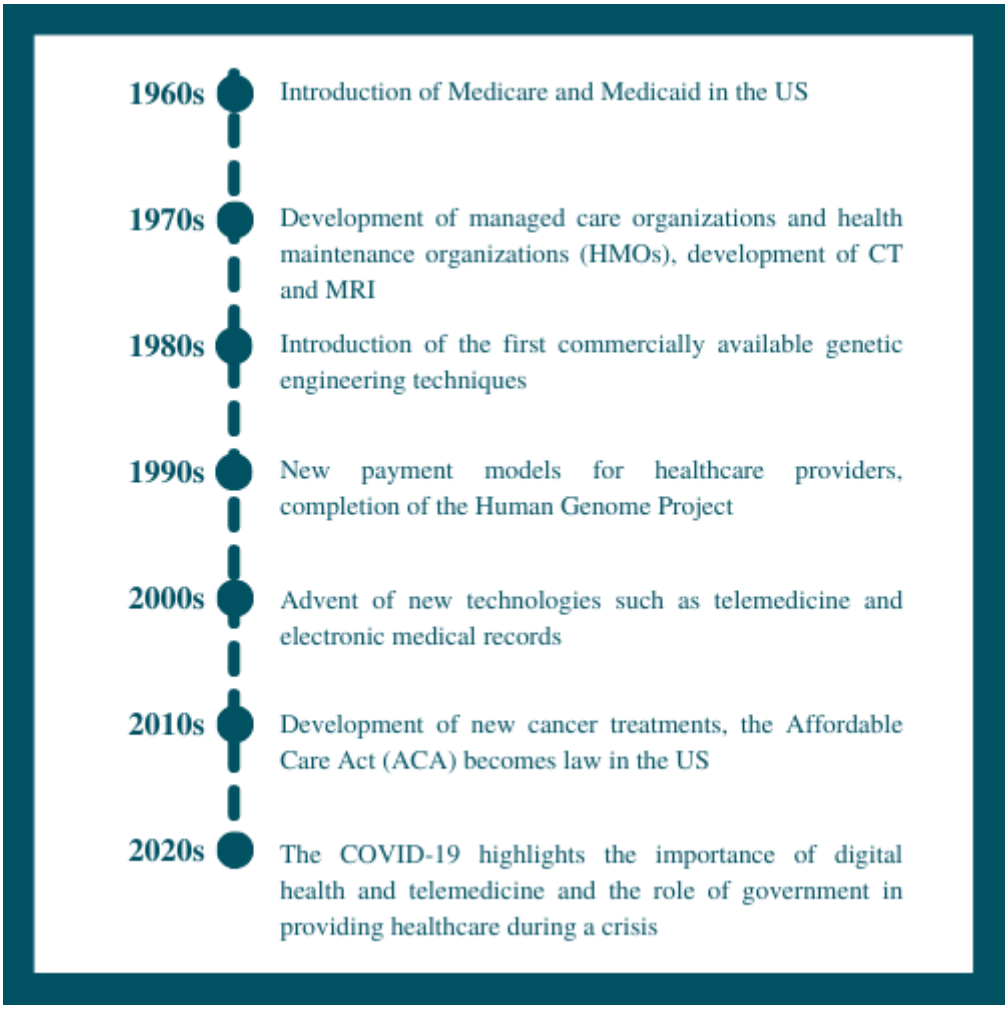
In terms of healthcare financing, there has been a shift towards new payment models, such as the Medicare Prospective Payment System (PPS) that aims to control healthcare costs and improve the coordination of care. Government policies such as the introduction of Medicare and Medicaid in the United States and the Affordable Care Act (ACA) have also played a significant role in expanding access to healthcare.

Lastly, during the same timeframe we have seen a shift towards a more user-centered approach, where healthcare providers and systems are becoming more patient-centered, empowering patients to take a more active role in their own health and care. This approach focuses on the person as a whole and not just their illness. The COVID-19 pandemic has also contributed in highlighting the role of patients in care.

Here is a brief overview of some of the major developments of the last decades:

- **1960s**: The introduction of Medicare and Medicaid in the United States expands access to healthcare for older adults and low-income individuals.

- **1970s**: The development of managed care organizations and health maintenance organizations (HMOs) aims to control healthcare costs and improve the coordination of care. The development of CT (computed tomography) and MRI (magnetic resonance imaging) scanners revolutionize diagnostic imaging and allow for earlier and more accurate detection of diseases such as cancer.
- **1980s**: The introduction of the first commercially available genetic engineering techniques, such as PCR (polymerase chain reaction), leads to significant advances in genetic research and the development of new treatments for genetic disorders.
- **1990s**: The Balanced Budget Act of 1997 leads to the development of new payment models for healthcare providers, such as the Medicare Prospective Payment System (PPS). The completion of the Human Genome Project in 2003 leads to a greater understanding of the genetic basis of disease and the development of personalized medicine.
- **2000s**: The advent of new technologies such as telemedicine and electronic medical records allows for more efficient and accessible healthcare.
- **2010s**: Breakthroughs in cancer research lead to the development of new cancer treatments, such as immunotherapy, which harness the body's immune system to fight cancer. The Affordable Care Act (ACA) becomes a law in the United States in 2010, expanding access to healthcare for millions of Americans.
- **2020s**: The COVID-19 pandemic highlights the importance of digital health and telemedicine and the role of government in providing healthcare during a crisis.



Picture 2: Timeline of highlights in Health developments over the last 50 years

Healthcare growth trend

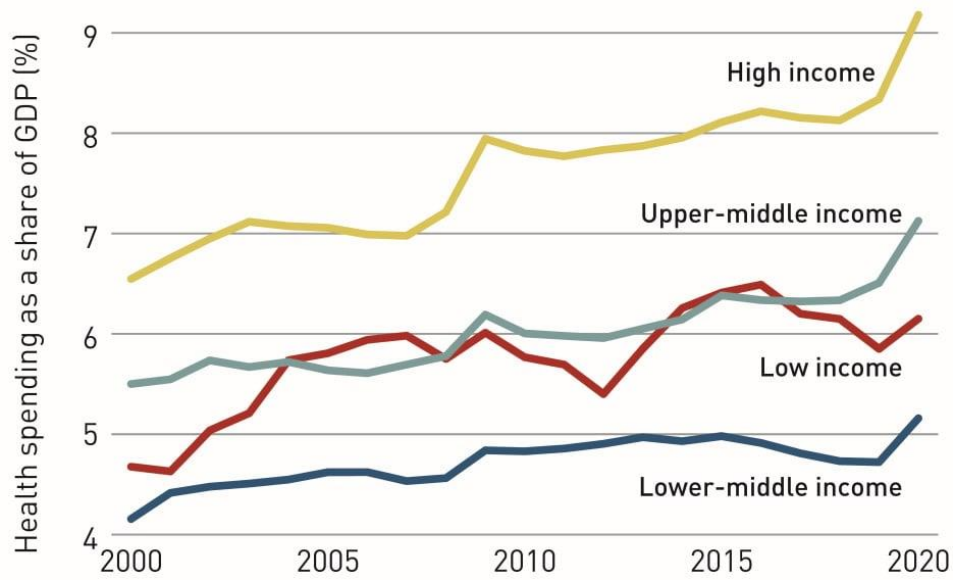
The healthcare sector has experienced significant growth in recent years, driven by a number of factors. According to the "2022 Global Health Expenditure Report" by the World Health Organization (WHO), the global health spending 2020 "*rose to US $9 trillion in 2020, or about 10.8% of global GDP, a new high*", a boom which resulted due to the COVID-19 outbreak, however having its roots driven by an aging population, increasing chronic disease rates, and technological advancements. Undoubtedly, the pandemic accelerated technological advancement in healthcare, but in order to gain a macroscopic view on these factors, one needs to focus in long-term causes.

One major factor driving healthcare sector growth is an aging population. As people live longer, the demand for healthcare services increases, as does the need for long-term care and support. Additionally, with an aging population, there is an increase in chronic

diseases such as diabetes, heart disease, and cancer, which can alone drive demand for healthcare services.

Another important factor driving healthcare growth is technological advancement. The development of new medical technologies, such as telemedicine, telehealth, and electronic health records (EPRs) has made it easier for patients to access healthcare services and for healthcare providers to deliver care more efficiently.

Moreover, a rise in healthcare expenditure by the government and private sector is also a major factor. For example, the US government spent $3.65 trillion on healthcare in 2019, an increase of 4.6% from the previous year, according to a report by the Centers for Medicare & Medicaid Services (CMS). Private sector spending on healthcare also increased, driven by rising healthcare costs and an increase in the number of people with health insurance coverage.



Picture 3: Health spending as a share of GDP (%). Source: WHO

Healthcare emerging issues

The health sector is facing a number of emerging issues which are likely to shape its future growth. These include an aging population, growing rates of chronic disease, and a shortage of healthcare workers.

One of the main challenges facing the health sector is the **growing rates of chronic disease**. Chronic diseases, such as diabetes, heart disease, and cancer, are becoming more prevalent and are a major cause of death and disability worldwide. These diseases are often caused by lifestyle factors, such as poor diet, lack of physical activity, and smoking, and require a coordinated, multidisciplinary approach to management. Effective management of chronic diseases is crucial for improving patient outcomes and reducing healthcare costs.

Mental health is becoming an increasingly important issue as rates of depression, anxiety, and stress continue to rise. This is particularly true in the context of the COVID-19 pandemic, which has caused widespread disruptions and uncertainty. Mental health services are often underfunded and understaffed, and there is a need for more effective, accessible, and affordable mental health care. Addressing mental health is crucial for improving overall health and reducing healthcare costs.

Digital health technologies, such as telemedicine, mHealth, and electronic health records, are rapidly evolving and have the potential to transform the way healthcare is delivered. However, there are concerns about privacy, security, and data sharing, and there is a need for regulations and guidelines to ensure that digital health technologies are used in an ethical and effective way.

Another important issue is an **aging population**. As people live longer, there is an increased demand for healthcare services, particularly for conditions such as dementia, or arthritis. This is putting a strain on healthcare systems and will require new approaches to care and support. As people live longer, the demand for healthcare services increases, as does the need for long-term care and support

Climate change is having a significant impact on health, particularly in low-income countries. Climate-sensitive diseases such as malaria, dengue, and heat stroke are increasing, and extreme weather events are causing damage to health infrastructure. There is a need for more research and investment in climate-resilient health systems, as well as for more action on climate change mitigation.

Data privacy and security in healthcare is definitely an emerging issue. With the widespread use of electronic health records (EPRs) and other digital health technologies, there is an increasing amount of sensitive personal information being stored and shared electronically. This includes information such as medical history, test results, and prescription information. This data is of great value to healthcare providers, but it is also highly sensitive and vulnerable to breaches, hacking, and misuse.

Finally, the health sector is facing a **shortage of healthcare workers**. With a growing population and an aging workforce, there is a growing demand for healthcare professionals, particularly in areas such as nursing, primary care, and mental health. This is a concern, as a shortage of healthcare workers can lead to increased waiting times, reduced access to care, and increased costs (e.g. longer hospitalizations). A shortage of healthcare workers, particularly in rural and underserved areas, is becoming a major concern for healthcare systems worldwide.

The future of Health

It has always been humans' desire to forecast the future. Especially, when it comes to life-related topics, like health itself. Having seen a lot of improvements, affecting life-expectancy greatly, people wonder what the future holds for us. There is a great amount of discussions and quite a few theories, narrowed down to the following quite commonly accepted scenarios:

- **Increased use of technology**: The use of technology, such as telemedicine, artificial intelligence, and big data analytics, is expected to continue to grow in the healthcare industry over the next few years. This could help to improve access to healthcare, reduce costs, and improve patient outcomes.
- **Greater emphasis on value-based care**: The healthcare industry is expected to continue to shift towards a focus on value-based care, which is a model of care that aims to improve patient outcomes and reduce costs by focusing on preventive care, population health management, and evidence-based medicine.
- **Greater focus on patient-centered care**: The healthcare industry is expected to continue to shift towards a focus on patient-centered care, which is a model of care that aims to improve patient outcomes by putting the patient at the center of the care delivery process.
- **Greater focus on mental health**: Mental health is expected to become an increasingly important issue in the healthcare industry over the next few years. According to the WHO World Mental Health report published in 2022, depression and anxiety rose 25% in the first year of the pandemic, bringing the total number of people living with a mental disorder to nearly 1 billion. With mental health issues on the rise, mental health is expected to gain an increased focus. An improvement in the access to mental health services will help reduce the stigma associated with mental illness.
- **Greater focus on healthcare data**: As healthcare becomes increasingly digitized, the protection of patient data is becoming a major concern. Therefore, there is expected to be an increased focus on healthcare data privacy and security in the upcoming years.

Project management

According to the Project Management Body of Knowledge (Project Management Institute, PMBOK, 2021, p.36), "*Project management is the application of knowledge, skills, tools, and techniques to project activities to meet project requirements*". It is the process of planning, organizing, motivating, and controlling resources, procedures and protocols to achieve specific goals in scientific or daily problems. It involves the use of various tools, techniques, and methodologies to ensure that a project is completed on time, within budget, and to the satisfaction of all stakeholders. Project management is a discipline that involves the application of knowledge, skills, tools, and techniques to plan and execute projects effectively and efficiently. It is used in various industries, including healthcare, construction, engineering, information technology, and manufacturing. The goal of project management is to achieve specific objectives by using resources efficiently and effectively while also considering the constraints of time, budget, and resources.

Project management typically refers to the internal processes and activities of an organization or business that are used to plan, execute, and finalise projects. These activities include identifying project goals and objectives, developing project plans and schedules, assigning tasks and resources, monitoring and controlling progress, and reporting on project performance.

However, project management also involves external stakeholders such as customers, vendors, and other partners that are affected by the project. Project management, thus, not only ensures that the project is completed on time, within budget, and to the satisfaction of all stakeholders but also that it meets the needs of the customers, users, and other external stakeholders who will be thereafter using the product or service.

Therefore, project management encompasses both internal and external aspects of a project and it's important that project managers effectively communicate and collaborate with all stakeholders to ensure the successful completion of a project.

According to PMI (PMBOK, 2021, p.100), project management includes the management of the project stakeholders, which includes *"an individual, group, or organization that may affect, be affected by, or perceive itself to be affected by a decision, activity, or outcome of a project, program, or portfolio."*.

Evolution of project management

Project management has evolved significantly over the years, with new methodologies and approaches being developed to improve efficiency and effectiveness.

One of the earliest forms of project management was the "waterfall" method, which involved a linear and sequential approach to completing a project. This method was widely used in the construction and manufacturing industries; however, it was criticized for its inflexibility and lack of ability to handle changes in project requirements.

In the 1980s, the "Agile" methodology was introduced as an alternative to the waterfall method. Agile emphasized flexibility and collaboration, and it was well-suited to software development projects. Agile has since become one of the most popular project management methodologies, with Scrum being one of the most widely used Agile frameworks. Agile methodology is based on the Agile manifesto, which lays out four core values: individuals and interactions, working software, customer collaboration, and response to change. Agile methodologies like Scrum, Kanban, and Lean Software Development focus on incremental delivery, self-organizing teams, and constant adaptation to changing customer needs. It is particularly well-suited to healthcare projects that involve a high degree of uncertainty or change

Scrum is a specific methodology that falls under the Agile umbrella, it is mainly used to manage and control products development and it is focused on delivering small chunks of functionality in short Sprints, generally two to four weeks According to Ken Schwaber & Jeff Sutherland, ("The Scrum Guide The Definitive Guide to Scrum: The Rules of the Game", November 2020, pg. 7) Sprints are *"fixed length events of one month or less to create consistency. A new Sprint starts immediately after the conclusion of the previous Sprint. All the work necessary to achieve the Product Goal, including Sprint Planning, Daily Scrums, Sprint Review, and Sprint Retrospective, happen within Sprints"*. Waterfall, on the other hand, is a linear, sequential approach that emphasizes detailed planning, clear deliverables, and strict control. It is also well-suited to healthcare projects that have well-defined objectives and a clear end-point.

In recent years, there has been a shift towards more holistic and integrated approaches to project management. One example is the "Integrated Project Delivery" (IPD) method, which brings together all stakeholders, including owners, architects, engineers, and contractors, to work together towards a common goal. Another example is the "Building Information Modeling" (BIM) approach, which uses 3D modeling and digital tools to

streamline the design, construction, and operation of buildings. IPD is a collaborative project delivery method where all project stakeholders share a common goal, risks, and rewards. It is used to design, construct, and operate buildings and other projects. BIM is a digital representation of the physical and functional characteristics of a building. It is used to design, construct, and operate a building.

Another trend in project management is the increased use of automation and digital tools. Project management software such as Asana, Trello, and Jira have become popular for managing tasks, tracking progress, and collaborating with team members. Artificial intelligence (AI) and machine learning (ML) are also being used to improve project planning and forecasting, and to identify potential risks. AI-based project management tools can help with scheduling, resource allocation, and risk management.

In addition, there is an increasing focus on sustainability and "green" project management. This involves incorporating environmentally-friendly practices and materials into the design and construction of buildings and other projects. Green project management is the process of applying environmentally sustainable principles to the planning, design, construction, and operation of buildings, infrastructure, and other projects.

Another trend is the adoption of hybrid project management methodologies which combines the best of both traditional and agile methods. Hybrid project management methodologies such as Scrumban, SAFe, and Leankanban have emerged as an alternative to traditional and agile methodologies. For example, some organizations are using the "scaled agile" (SAFe) approach that uses Agile methodologies to manage individual teams or projects, while still maintaining a high-level plan and governance structure that is more consistent with Waterfall.

In conclusion, the evolution of project management has been marked by a growing emphasis on flexibility, adaptability, and customer satisfaction. The healthcare industry has been particularly active in the development of new project management methodologies, that are specifically tailored to the unique needs of healthcare projects. However, it is important for healthcare organizations to evaluate the specific needs of their projects and choose the project management methodology that is best suited to those needs.

Overall, the evolution of project management has been characterized by a move away from rigid and hierarchical approaches, towards more flexible and collaborative methods that emphasize integration and the use of technology.

Summarizing, the current trends in project management comprise of the integration of different methodologies, the use of digital tools and technologies, the focus on sustainability and the emergence of hybrid methodologies.

Other than project management's evolution & methodologies categorization based on specific elements and approaches that distinguishes one from another, there is also a "sectoral filter". Different sectors have adopted different methodologies depending on the nature of their projects. Some sectors that have demonstrated a greater evolution towards more innovative (or hybrid) methodologies include:

1. **Software Development**: Software development has been using Agile methodologies for many years, but in recent years, it has been increasingly adopting more innovative methodologies such as Scrum and Kanban. These methodologies are well-suited to the fast-paced and rapidly changing nature of software development projects.
2. **Construction**: The construction sector has also seen a shift towards more innovative project management methodologies, such as Building Information Modeling (BIM) and Integrated Project Delivery (IPD). These approaches aim to improve collaboration and information sharing among project stakeholders, resulting in more efficient and cost-effective construction projects.
3. **Manufacturing**: The manufacturing sector has been actively adopting new project management methodologies such as Lean Manufacturing and Six Sigma to improve efficiency and reduce waste. These methodologies are used to optimize the production process and increase the quality of the end product.
4. **Service industries**: Service industries such as consulting, advertising, and marketing have also begun to adopt more innovative project management methodologies, such as Lean Six Sigma and Design Thinking. These methodologies help service organizations to improve the quality and efficiency of their services and to better meet the needs of their customers.

Project management in healthcare

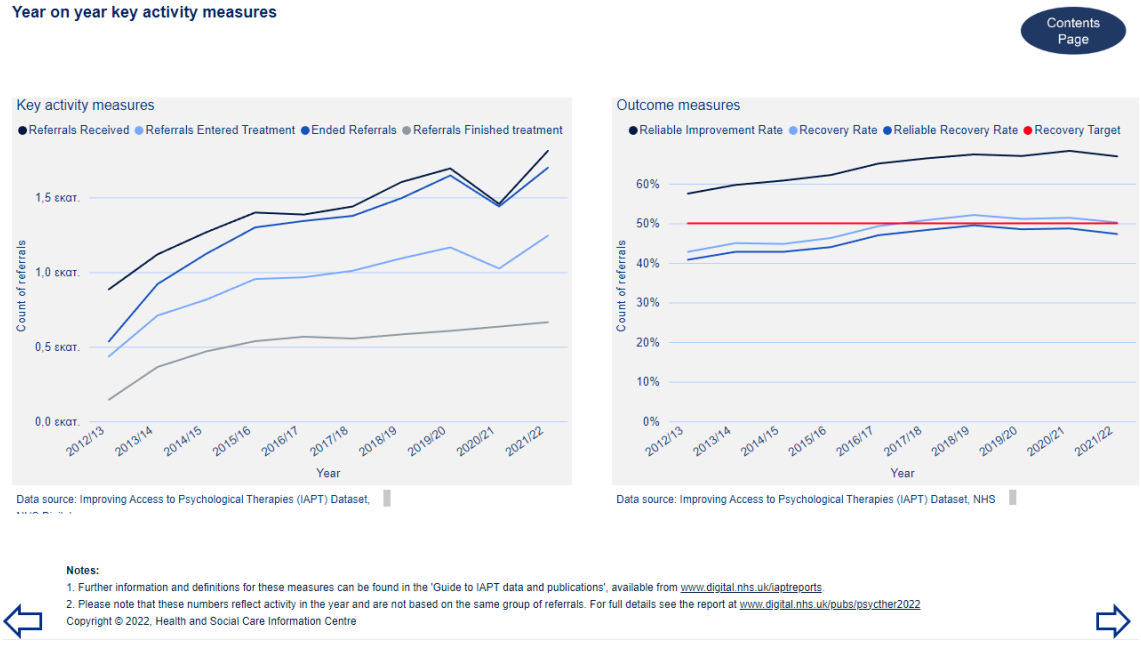
Project management plays a crucial role in addressing the emerging issues in the healthcare industry. Project management methodologies and techniques can be used to plan, execute, and control projects that aim to improve healthcare delivery, reduce costs, and improve patient outcomes. Some specific cases-studies -where project management significantly contributed to address emerging issues in healthcare- are provided below.

Chronic disease management: CareMore Health System was founded by Dr. Sheldon Zinberg and John Edelston in 1992 in an effort to reorganize the healthcare delivery system to proactively integrate and improve the quality of care and have greater penetration in the growing membership of health maintenance organizations (HMOs) (CareMore, Wikipedia). CareMore implemented a care management program for seniors with chronic conditions.

Picture 4: How CareMore works, Source: CareMore: Improving Outcomes and Controlling Health Care Spending for High-Needs Patients, The Commonwealth Fund

The project management methodology used was the Agile Methodology, it helped to identify and prioritize the most important issues, and then to rapidly develop and test solutions. It developed a new health-care-delivery system, incorporating the founder's vision of a health-care organization where all stakeholders (doctors, nurses, therapists, etc.), continually sharing information about their clients and providing whatever services were needed to keep those clients in the best possible physical and mental health (2011, Slywotzky, Tom Main and Adrian) .According to the "CareMore: Improving Outcomes and Controlling Health Care Spending for High-Needs Patients" case study (2017, The Commonwealth Fund) *"In 2015, CareMore members had 20% fewer hospital admissions, 23% fewer bed days, and a 4% shorter length-of-stay than beneficiaries covered under fee-for-service Medicare. A comparative analysis of Medicare Advantage plan pricing for beneficiaries in average health indicates CareMore is more efficient in providing standard Medicare benefits than market competitors on average*".

Mental Health: The "Improving Access to Psychological Therapies (IAPT)", -also known as "talking therapies"- is an NHS program in the United Kingdom, aiming to increase access to evidence-based psychological therapies for people with common mental health problems, such as anxiety and depression.



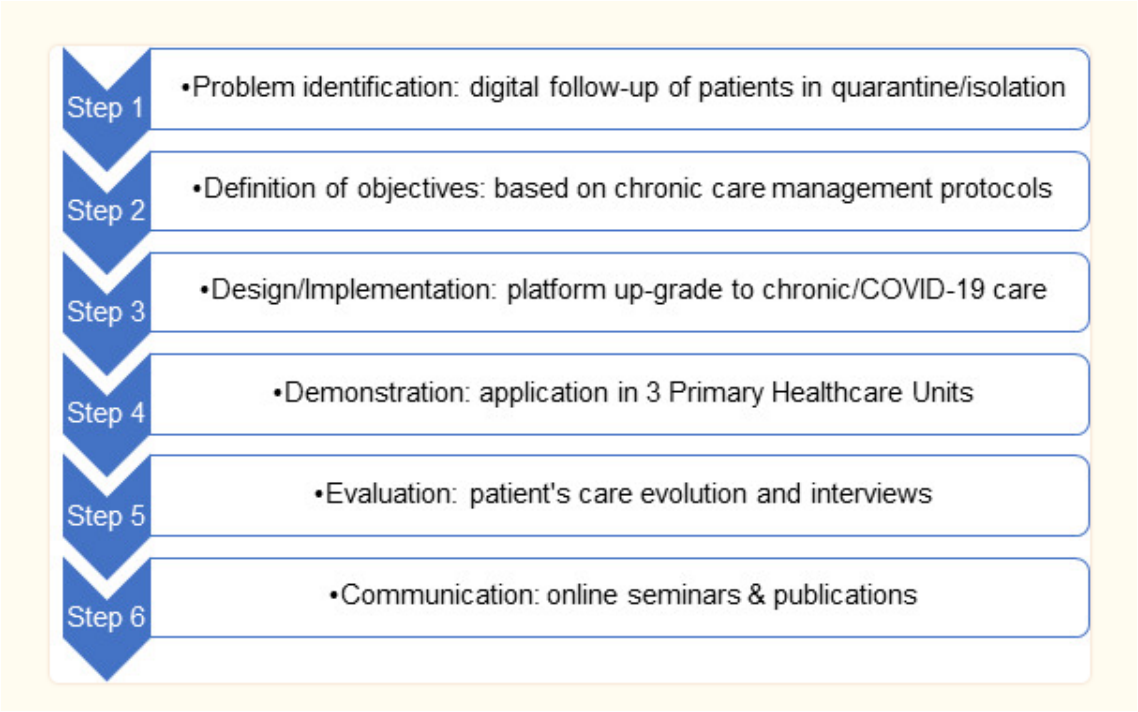
Picture 5: Key activity measures & Outcome measures, Source: IAPT Annual Interactive Dashboard 2021-2022

The project management methodology used was PRINCE2 - de facto standard in use in the public sector in the UK – (2020, "Improving Inpatient Mental Health Services for Lambeth", Pre-Consultation Business Case, v/9), which helped to ensure that the program was delivered on time and within budget. The program resulted in a significant increase

in the number of people receiving evidence-based psychological therapies and a reduction in the number of people on sick leave or disability benefits due to mental health problems. (2022, Psychological Therapies, Annual report on the use of IAPT services, 2021-22)

Digital Health: An increasing number of individuals are living with long term health conditions which they manage by themselves most of the time (Varnfield et al., 2014). The "ePharmaCare platform" project, implemented in Portugal and funded by the Fundação para a Ciência e Tecnologia (Ministry of Science of Technology, Portugal) under the Research4COVID-19 program, aimed to design a web-based digital platform to support primary health care services during the COVID-19 pandemic by facilitating web-based consultations between primary health care teams and their patients, to guarantee appropriate care, promote adherence to treatment, provide counseling and psychological support (Lapão et al., 2021).

The digital platform was developed using the pace established by Scrum and in a close collaboration with the Primary Health Care professionals who would be using the platform,



Picture 6: ePharmaCare platform design science research process. Source: Lapão et al., 2021

Project management techniques and methodologies

There are several project management techniques and methodologies used in healthcare systems, with healthcare providers selecting the proper ones that match the specific needs & characteristics of the projects & infrastructures to be developed:

1. **Waterfall**: Waterfall is a traditional project management methodology that is widely used in the healthcare industry. It is a linear, sequential approach that is well-suited to projects with well-defined requirements, fixed budgets, and fixed timelines. The following phases are required: data collection, analysis, design, development, and testing. If successful, these phases will be followed by implementation and maintenance (Nordmark et al., 2022).
2. **Agile Project Management**: Agile project management is a flexible and iterative approach that emphasizes continuous improvement and rapid delivery of small, incremental changes. Agile project management is often used in healthcare systems to manage complex and rapidly changing projects, such as implementing electronic health records (EPRs) or clinical decision support systems. (Goodison et al., 2019). Its methodologies are well-suited to the fast-paced and rapidly changing nature of healthcare projects. They emphasize flexibility, collaboration, and continuous improvement, which can help healthcare organizations respond quickly to changing requirements and improve patient care
3. **Six Sigma**: Six Sigma is a methodology that focuses on improving the quality of processes and products by identifying and eliminating defects. Six Sigma is often used in healthcare systems to improve patient care and safety, as well as to reduce costs, and improve operational efficiency. (Niñerola et al., 2020)
4. **Lean Project Management**: Lean project management is a methodology designed to improve efficiency and reduce waste. Lean project management is often used in healthcare systems to streamline operations and improve patient flow, such as in hospital emergency departments or inpatient care units. (Chan et. al., 2014)
5. **PRINCE2:** PRINCE2 (PRojects IN Controlled Environments) is a widely used project management methodology that is particularly well-suited to large, complex projects. It's a structured approach to project management that emphasizes clear roles and responsibilities, good governance and control, and the ability to manage risks. PRINCE2 is widely adopted in the UK public sector, and healthcare system is one of the domains of its application. (Tatnall et al., 2013).

6. **Scrum**: Scrum is an Agile methodology that is commonly used in software development and IT projects, but it can be applied to healthcare projects as well. Scrum focuses on delivering small chunks of working software and emphasizes on team collaboration, flexibility and rapid iteration. (Lapão LV, et al., 2021)
7. **PMBOK:** PMBOK (Project Management Body of Knowledge) is a widely recognized guide for the project management profession, and it's considered as the standard guide for project management. It provides a general framework for managing projects, and it's useful to understand the general concepts and processes of project management. (PMBOK, 2021)

Healthcare organizations should evaluate the specific needs of their projects & infrastructures to be developed and choose the project management methodology –or a combination - that is best suited to those needs.

Hybrid project management

Hybrid project management is an approach to project management that combines elements of different project management methodologies in order to create a customized approach that meets the specific needs and goals of an organization or project. Hybrid project management can be used in a wide range of industries, including healthcare, and may be particularly effective in situations where traditional project management approaches may not be suitable.

In the healthcare industry, hybrid project management can be used to address the complex and rapidly-evolving nature of many healthcare projects, which may require a high degree of flexibility and adaptability. Hybrid project management can allow healthcare organizations to customize their approach to project management in order to better meet the needs of their specific projects and stakeholders.

There are many different elements that can be included in a hybrid project management approach, depending on the specific needs and goals of the organization or project. Some common elements that may be included in a hybrid project management approach in the healthcare industry include:

- Agile methodologies, which focus on rapid iteration and flexibility in the face of uncertainty
- Lean principles, which aim to eliminate waste and streamline processes
- Six Sigma, which emphasizes data-driven decision-making and continuous improvement
- Traditional project management approaches, such as the Waterfall method, which focus on structured planning and sequential execution

Co-creation methodologies

Co-creation methodologies refer to the process of involving end-users in the design, development, and delivery of products, services, and experiences. This approach aims to tap into the knowledge, skills, and creativity of customers, employees, and other stakeholders to create more valuable and relevant solutions. Co-creation methodologies can provide several benefits and value for organizations, such as:

- **Increased innovation**: By involving end-users in the design and development process, organizations can gain access to a wider range of ideas and perspectives, which can lead to more innovative and relevant solutions.
- **Greater customer engagement and loyalty**: Co-creation can help organizations build stronger relationships with customers by involving them in the design process and making them feel more connected to the solutions they are using.
- **Improved product and service design**: By incorporating end-user feedback and insights into the design process, organizations can create products and services that better meet customers' needs and preferences.
- **Increased efficiency and cost savings**: Co-creation can help organizations identify and address problems and challenges more quickly and effectively, leading to cost savings and improved efficiency.
- **Greater flexibility and adaptability**: Co-creation can help organizations stay attuned to serving customer needs and market trends, allowing them to be more flexible and adaptable to changing conditions.

Even through these advantages seem to be more than self-evident and adequate to convince any service/product provider to use co-creation methodologies, it is quite common for organizations (enterprises, SMEs, research institutions, public government, etc.) to feel that they are either fully aware of particular needs & wants from the end-user's perspective, or that they ought to rush to provide solutions, under the pressure of the competition, positive public opinion, etc. Another common mistake is thinking of co-creation as a synonym of collecting data from the stakeholders. Co-creation is not just about eliciting inputs, but also about providing solutions. It is a collaborative process that enables the emergence of new ideas, new possibilities and new forms of value. Lastly, even though co-creation has been a quite "trendy" term in the last few years in the business world, there is a tendency of confounding it with IT products, like websites, apps, etc. This is as narrow a view as considering design to be all about a chair, a car or a dress.

Understanding user needs & requirements

The process of capturing user requirements is utilized to comprehend the needs and expectations of users with regards to a service that is in the process of being designed. This is achieved by observing users as they interact with similar services and by conducting interviews to understand how they plan and accomplish their goals. This information is then used to create a list of necessary content, features, and functionalities that the new service must possess in order to meet the needs of its users. There are several tools for capturing user needs and preferences, for example:

1. **User interviews**: User interviews constitute a qualitative research method that involves conducting in-depth, one-on-one interviews with users to understand their needs, preferences, and pain points. This method allows organizations to get a better understanding of the user's perspective, and it can also be used to validate or refute assumptions about user needs.
2. **Surveys**: Surveys are a quantitative research method that involves collecting data from a large number of users through questionnaires. Surveys can be used to gather information on user demographics, needs, preferences, and satisfaction. They are a useful tool for understanding the needs of a large number of users in a short period of time.
3. **Focus groups**: Focus groups are a qualitative research method that involves bringing a group of users together to discuss a particular topic. The method allows organizations to gain insights into the collective needs, preferences and pain points of a group of users.
4. **User personas**: User personas are fictional representations of the target users of a product or service. They are used to help organizations understand the needs, preferences, and behaviors of their target users. User personas can be based on research conducted through methods such as user interviews, surveys, and focus groups.
5. **Usability testing**: Usability testing is a methodology that allows organizations to evaluate the user experience of a product or service by testing it with real users. This method helps organizations identify usability problems and understand the needs and preferences of users.
6. **Contextual inquiry**: Contextual inquiry is a qualitative research method that involves observing and interviewing users in their natural environments, such as their homes or workplaces. This method helps organizations understand the

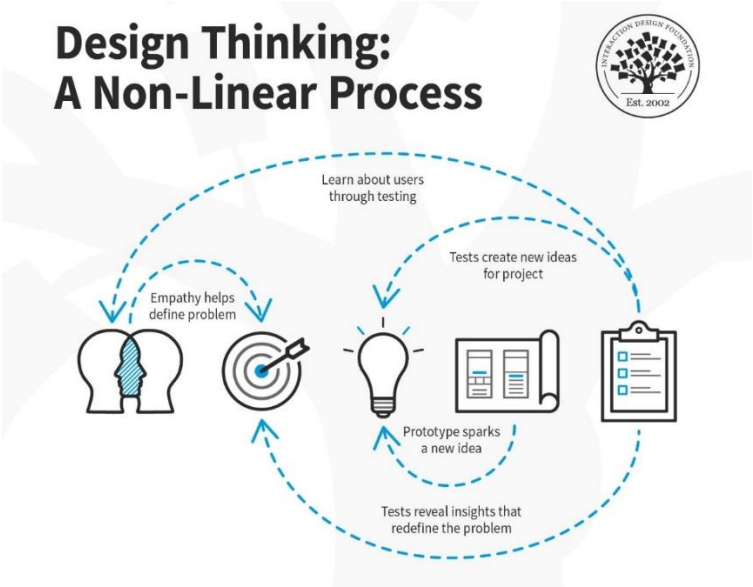
context in which users interact with a product or service and identify potential pain points.

These tools can be part of specific methodologies or toolkits such as user-centered design, market research, contextual design, human-computer interaction, design thinking, to name a few. These methodologies and toolkits can help organizations gain a deeper understanding of their users' needs, preferences, and pain points, which is crucial for creating products and services that meet those needs. When managing a project, it's crucial to consider the objectives, available resources, and limitations of the organization when selecting a methodology or toolkit. It's not always necessary to use a specific methodology or toolkit, but it is important to have a clear comprehension of the needs and preferences of the users for a successful outcome.

Design methodologies

Design methodology refers to the process and methods used by designers to solve problems and create new products, services, or systems. It is a structured approach to design that helps designers understand the needs and wants of users, identify problems, and create solutions that meet those needs. Design methodology's cornerstone is that it includes the respective interested parties (end-user, stakeholders, etc.) at the very heart of the co-development process. Some of the most popular design methodologies include design thinking, user-centered design (UCD) and contextual design.

Design thinking is a human-centered approach to design that emphasizes empathy, experimentation, and iterative problem-solving. It is a flexible, non-linear process that can be applied to a wide range of problems, from product design to service design, and from organizational design to urban design. It is often considered as a creative and process that helps to generate new ideas and test them with users. (Lewrick, Link & Leifer, 2018)

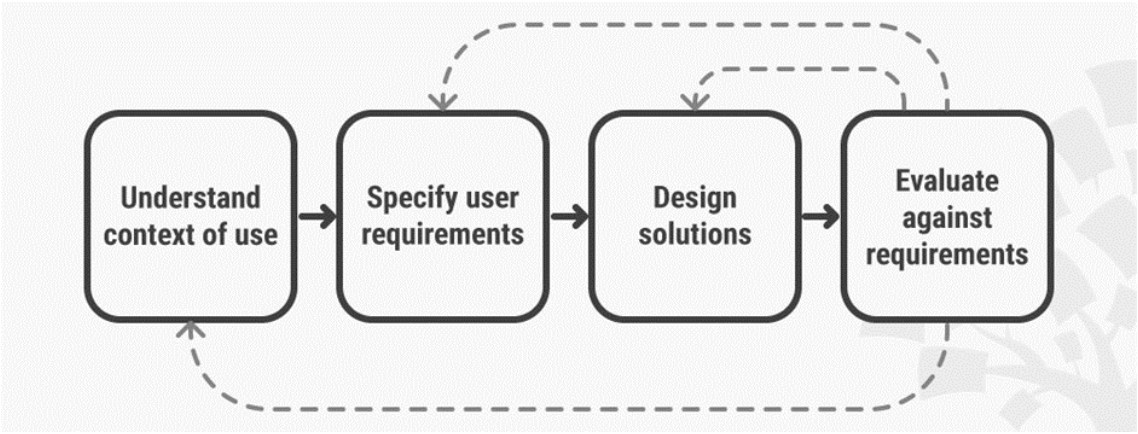


Picture 7: Design Thinking process, Source: Interaction Design Foundation (IDF)

Design thinking typically includes the following stages:

1. **Empathize**: Understand the needs, wants, and pain points of users through research methods such as user interviews, surveys, and observations.
2. **Define**: Identify the problem or opportunity, and create a clear statement of the problem or opportunity.
3. **Ideate**: Generate a wide range of ideas for solutions through brainstorming, sketching, and other ideation techniques.
4. **Prototype**: Create a physical or digital representation of the solution, such as a sketch, a wireframe, or a working model.
5. **Test**: Validate the solution with users and gather feedback to inform further iterations.

Another popular design methodology is **user-centered design (UCD)**, which is a design process in which the needs, wants, and limitations of end users are given extensive attention at each stage of the design process. UCD typically includes stages such as research, conceptualization, design and evaluation.

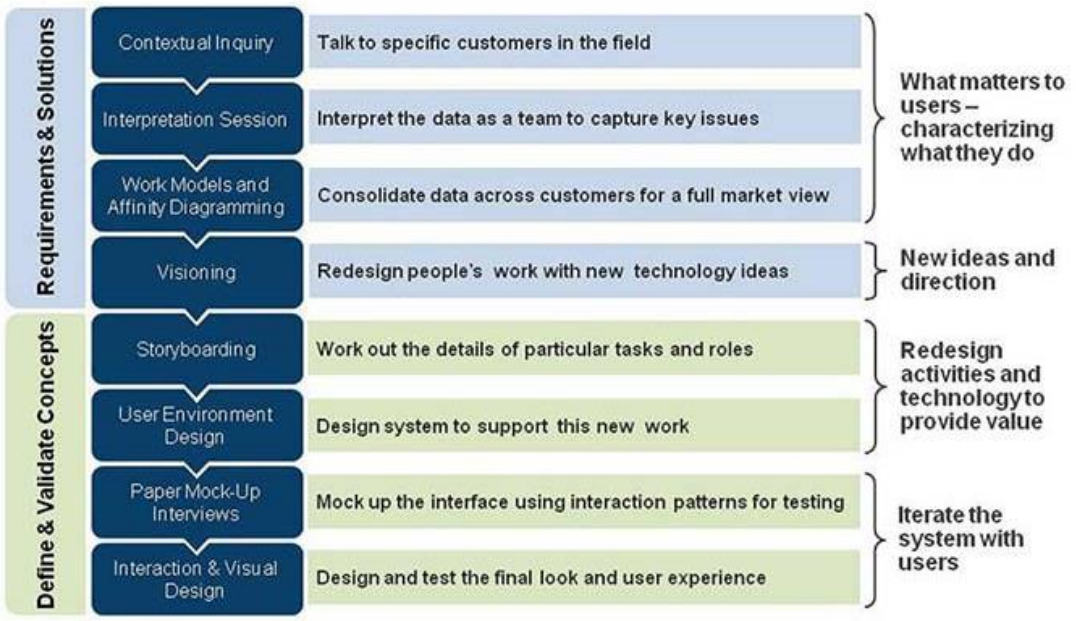


Picture 8: User-Centered Design process, Source: Interaction Design Foundation (IDF)

It is often used in the development of products and services and is considered as a more structured and rigorous process that focuses on understanding and addressing the needs of the end-users in a more efficient way. What sets user-centered design (UCD) apart from other design methodologies is that it does not only focus on the needs and preferences of users, but it specifically focuses on usability and user experience. UCD typically involves a user-centered approach to design, which means that users are actively involved in the design process and their input and feedback are incorporated into the final design. UCD is often used to design digital products and services, such as websites, apps, and software. (Cooper, Reimann, and Cronin, 2007)

There are some similarities between design sub-methodologies, however, there are also some key differences between them.

Contextual design is another methodology that is widely used in the design of products and services. It is an approach that combines ethnographic research methods and design techniques to create products and systems that are tailored to the users' needs and work practices. It's a user-centered design process that uses a combination of field observation, interviews and co-design workshops to understand the context and users' needs and constraints. (Beyer and Holtzblat, 1998)



Picture 9: Conceptual design process, Source: Interaction Design Foundation (IDF)

Lean Design is more focused on reducing waste and optimizing resources. Lean Design is a methodology that borrows concepts from the Lean Manufacturing philosophy and applies them to the design process. It aims to reduce waste and optimize resources, by creating a culture of continuous improvement, collaboration, and customer satisfaction. (Gothelf and Seiden, 2008)

Participatory design is a design approach that involves users in the design process in a more collaborative and democratic way. Participatory design typically involves co-design activities, such as workshops and focus groups, where users and designers work together to identify needs, generate ideas, and create prototypes. The goal of participatory design is to create products, services, and environments that are more responsive to the needs and preferences of users. (Rosenzweig, 2015)

Service design is a design approach that focuses on designing services that are user-friendly and meet the needs of both users and providers. Service design typically involves a user-centered approach to design, which means that users are actively involved in the design process and their input and feedback are incorporated into the final design. Service design is often used to design healthcare services, such as patient care pathways, appointment scheduling processes, and care coordination models. (Stickdorn, Schneider, et al., 2011)

In summary, all design sub-methodologies aim to understand the needs and wants of users, identify problems, and create solutions that meet those needs, despite their minor differences. As most cases found in the current thesis refer to the very same principles

and techniques used even when implementing diverse design methodologies, we have decided to use the umbrella term “Design Thinking” from this point forward.

Design thinking in healthcare

As already highlighted, design thinking is a problem-solving approach that involves empathy for the user, prototyping and testing, and iteration. It is increasingly being used in the healthcare industry to improve patient experiences, increase efficiency, and reduce costs. While theoretical approaches to the subject come from every corner of the globe, the majority of case studies found in the literature are from the USA.

Picture 10: Design thinking & Human Centered Design Examples in Healthcare, Source: innovationtraing.org

There are successful examples of the use of design thinking in the healthcare industry. Here are a few examples of what has been done so far per category (e.g. patient experience etc):

1. **Redesign of hospital environments**: Many hospitals have used design thinking to redesign their physical spaces in order to improve the patient experience. This can involve creating more welcoming and comfortable waiting areas, designing exam rooms so that they are more efficient and functional, and incorporating technology such as self-service kiosks to streamline processes. A study of redesign of hospital environments using design thinking is the redesign implementation of the emergency department at the Cleveland Clinic

   Cleveland Clinic

   Cleveland Clinic, is considered to be one of the tops in US (no.4 in “2022-2023 Best Hospitals Honor Roll”). To be able to get that distinction -consecutively over

years-, Cleveland Clinic had to implement first a non-traditional approach in its organizational structure, reversing focus from work-oriented, to patient-friendly, being the first major academic medical center to create an "Office of Patient Experience".

Cleveland Clinic former President and CEO (2004-2017), Dr. Delos Marshall Cosgrove wrote in an article for the Cleveland Clinic Magazine:

> *"Here at Cleveland Clinic, we always positioned quality in terms of outcome. But I have come to understand that there is more to quality healthcare than great outcomes. There is the entire experience that patients have, from the moment they call for an appointment to the moment they arrive at the hospital—fearful and concerned—to the moment they get in their cars and drive away.*
>
> *The patient experience encompasses many aspects of care, from the physical environment to the emotional…It is about communication and the expression of care and concern at times when they are most needed….It is our duty to remember that empathy lies at the very heart of the healthcare profession."*

The redesign focused on improving the patient experience by improving the Clinic's operations, services & facilities, in a way that it meets patient expectations. Interventions were multi-layered, covering a wide range:

- **Amenities upgrade** (e.g. adding pull-out beds for family members)
- **Personnel training** on Clinic's values and the importance of patient's experience,
- **"What to Expect During Your Hospital Stay" patients' program**, which enabled patients to understand all touchpoints, through leaflets and introductory videos.

As a result of the redesign, patient satisfaction rates improved, especially in terms of patient - healthcare professionals' communication, which was translated to a higher possibility of recommending the Clinic to friends and family. (Raman & Tucker, 2013).

2. **Development of digital health tools**: Design thinking has also been used to develop a wide range of digital health tools, including electronic medical record systems, patient portals, and telemedicine platforms. These tools can help to

improve communication between patients and healthcare providers, as well as streamline processes and reduce the risk of errors. One example of the development of a digital health tool using design thinking is the creation of the MyChart patient portal (powered by Epic), an Electronic Patient Portal in Alberta, Canada. MyChart is an online platform that allows patients to access their medical records, communicate with their healthcare providers, and schedule appointments.

The platform was developed using design thinking principles, including a focus on the needs and preferences of the user, prototyping and testing, and iteration. As a result, MyChart has been widely adopted by patients and healthcare providers and has been credited with improving communication and coordination between patients and their healthcare teams (Avdagovska et al., 2020)

3. **Creation of new models of care delivery**: Design thinking has been used to develop new models of care delivery, such as telemedicine and virtual care, which allow patients to access care remotely using technology. These approaches can be more convenient and cost-effective for both patients and healthcare providers. A case of creation of such a new model is the development of the Teladoc telemedicine platform. Teladoc allows patients to access care remotely, by connecting them with healthcare providers, allowing both sides to conduct appointments remotely, via videoconference. (Kolovou, 2021)

The platform was developed using design thinking principles, including a focus on the needs of the user, prototyping and testing, and iteration. As a result, Teladoc has been widely adopted by patients and healthcare providers, and has been credited with improving access to care, particularly in rural or underserved areas.

4. **Improvement of patient experiences:** Design thinking has also been used to identify and address pain points in the patient experience, such as long waiting times and long processes. This can involve redesigning processes and creating

new technologies, processes, or even lead to the creation of Innovation departments, focusing on making the user-experience more seamless and efficient for patients. A significant case of the use of design thinking to improve the patient experience through the creation of an innovation department is the Mayo Clinic, which is considered one of the world's greatest hospitals and has been ranked as no.1 in the US for the current year. (source: 2022-2023 Best Hospitals Honor Roll). The institution has a three-part focus: patient care, research, and education. It also has a track record of innovation, by initiating projects that enhance the delivery and experience of healthcare, through regularly evaluating and enhancing medical practices. This is being done through its Center for Innovation (CFI).

In the early 2000s, a physician at Mayo Clinic, Nicholas LaRusso, began exploring the idea of testing new methods of doctor-patient interaction in the same way that new drugs are tested in clinical trials. LaRusso believed that improving the way healthcare is delivered could make new technology and treatments more effective. He reached out to design firms like IDEO for help, and together with his colleague Dr. Michael Brennan, they set up an outpatient lab called “SPARC” where physicians and designers could test new ideas for patient-provider interactions. Over time, the lab grew into an enterprise-wide “Center for Innovation”, which studied various aspects of healthcare provision and implemented service redesigns to improve patient outcomes and the healthcare experience, numbering multiple projects -such as the “Re-imagining Integration in the Outpatient Setting” initiative, eConsult & the diabetes education card projects”-. (Canales and Drenttel, 2010)

These are just a few examples of the many ways in which design thinking has been used in the healthcare industry to improve patient experiences, increase efficiency, and reduce costs. Overall, the use of design thinking in healthcare has the potential to significantly improve patient outcomes and experiences, as well as increase the efficiency and effectiveness of the healthcare system.

Stakeholders involved in a healthcare design thinking application

It is important to keep in mind that when designing and implementing a new product (/service/process/infrastructure), all stakeholders taking part in the delivery process should be involved (Stola,2018), and -consequently- should be comfortable with it, able to use it, and see added value in the change. One should also always be mindful of the fact that a new product does not always compete with another, but always antagonizes people's habits and routine, even if no solutions were previously offered.

In a healthcare setting, there are many different stakeholders or interested groups that may be involved in the application of design thinking methodology, depending on the case.

1. **Patients**: Patients are often the primary users of healthcare services, and their needs and preferences should be a key consideration in any design thinking process.
2. **Caregiver**s: Caregivers, such as family members or friends, may also be involved in the care of patients and may have insights and perspectives that are important to consider in the design process.
3. **Healthcare providers**: Healthcare providers, such as doctors, nurses, and other clinical staff, are typically involved in the delivery of healthcare services and may have valuable input on how to improve processes and outcomes.
4. **Hospital administration**: Hospital administration, including executives and managers, may be involved in the design thinking process in order to align the project with the overall goals and mission of the organization.
5. **Regulators**: Regulators, such as government agencies or accrediting organizations, may be involved in the design thinking process in order to ensure that the project meets relevant standards and regulations.
6. **Funding agencies**: Funding agencies, such as philanthropic organizations, insurance companies or public authorities, may be involved in the design thinking process in order to ensure that the project is financially viable and meets their specific requirements.

Adoption of cross-discipline innovative methodologies in healthcare

Culture of change

Healthcare is generally considered to be a slow-moving industry in terms of adopting new technologies or methods. However, in recent years there has been an increased focus on using innovative project management methodologies and co-creation techniques in healthcare. In general, there are many factors that can influence the adoption and effectiveness of these methodologies, such as the complexity of the industry, the nature of the work being done, as well as the goals & objectives of the organization.

For example, innovative project management methodologies and co-creation techniques may be more widely adopted, produce impact faster and showcase greater effectiveness in some industries or sectors, such as technology or software development, where there is a high degree of uncertainty and the need for rapid iteration and flexibility. In other industries or sectors, such as manufacturing or construction, where processes are more predictable and there is a greater emphasis on efficiency and standardization, these methodologies may be less widely adopted or may need to be adapted first, in order to be effective.

Especially in healthcare, due to the constant pressure on professionals being involved in decision-making about health-related results, methodological advances are often overlooked. This might be due to the fact that professionals consider those changes a distraction from their main medical focus. Another plausible reason for rejecting any change, both at organizational or individual level, is the lack of knowledge & skills, in order to handle newly developed schemes and tools.

Nevertheless, there are cases where the added value of the interoperability of cross-discipline innovative methodologies (management and co-creation) has been identified, and such “holistic” approach used in the development of systems/products/services. Such an interesting case is presented at by Maximilian Zorzetti, Ingrid Signoretti, Larissa Salerno, Sabrina Marczak, Ricardo Bastos in their work “Improving Agile Software Development using User-Centered Design and Lean Startup”.

Skills in the healthcare setting

A few decades ago, healthcare providers worked independently and managed their own administrative affairs. However, issues as managing patient expectations and complexity of medical billing & compensation, have complicated healthcare management to such an extent, making it impossible to navigate through healthcare system while practicing medicine. At the same time, medical education does not always provide adequate preparation for the practical aspects of healthcare, while constant improvement is necessary. Throughout the past few years, there is an evolving discussion regarding the skills that healthcare providers (managers & doctors) have -or should have, in the future- (Hall, 2011).

According to Bayot & Varacallo (p.1, 2022) "*Management skills in the healthcare setting are composed of sets of competencies essential for healthcare professionals who effectively and efficiently manage a variety of medical, nursing, or public health resources to attain goals that ideally align with improving the overall health of the population and healthcare system*".

The discussion focuses more on soft skills -such as critical thinking, communication, adaptability, & efficient problem-solving among others-, and this is easily understood, considering the current growth of the Health industry, the new management methodologies as well as the new human-centered trends that we examined earlier. Hence, there are some skills that healthcare managers (and doctors) should develop in order to be able to identify patient journey pain-points and design/implement advancements in the field of healthcare. Myers & Pronovost (2017), suggest that fundamentals of management should be incorporated into the required medical school curriculum, including training and exposure to topics related to the following categories:

- Individual and Interpersonal Dynamics
- Team and Unit Dynamics
- Organizational Dynamics

Sample Management and Organization Curriculum Topics for Medical Education

Management domains	Sample topics
Individual and Interpersonal Dynamics	• Judgment and decision making • Motivation and job attitudes • Interpersonal relationships and communication • Negotiation and conflict management
Team and Unit Dynamics	• Leading and coordinating teams • Team norms and processes • Managing knowledge and information • Networks in organizations
Organizational Dynamics	• Organizational structure and design • Organizational culture • Change management • Interorganizational relationships

Picture 11: Sample management and Organization Curriculum topics for Medical Education, Source: Making Management Skills a Core Component of Medical Education, Myers &. Pronovost, 2017

In a broader context, the soft skills that will be necessary in healthcare, in the future, clusters around the following pillars:

1. **Problem-solving**: The ability to identify and solve problems is essential for healthcare managers and doctors who want to improve processes and outcomes in the healthcare industry. This involves using tools and techniques such as root cause analysis, value stream mapping, and prototyping to identify and address issues.
2. **Communication and collaboration**: Strong communication and collaboration skills are essential for healthcare managers and doctors who want to work effectively with a range of stakeholders, including patients, caregivers, healthcare providers, and hospital administration staff. This involves using tools and techniques such as active listening, effective feedback, and teamwork to facilitate effective communication and collaboration.
3. **Creativity and innovation**: Healthcare managers and doctors will need to be creative and innovative in their thinking. To achieve this, the ability to use techniques such as design thinking, rapid prototyping, and ideation to generate new ideas and approaches to healthcare challenges, will be considered a must-have skill.
4. **Adaptability**: The healthcare industry is constantly evolving, and healthcare managers and doctors who want to stay at the forefront of these changes will need to able to adapt to new situations and challenges. This requires being open to new

ideas and approaches, being willing to learn and grow, and being flexible in the face of change.

Overall, it appears that there is a growing need for healthcare managers and doctors to get more and in-depth training in several different areas. However, it is important to note that the specific needs and challenges of each organization and individual vary. Unfortunately, there is no one-size-fits-all need or solution for the improvement of these skills.

Methodology

This thesis adopts a qualitative research approach, with a focus on exploring the importance and contribution of innovative, anthropocentric project and infrastructure management methodologies in the health sector. The research was organized into 4 main themes: (i) health, (ii) project management, (iii) co-creation methodologies & (iv) adoption of innovative methodologies in healthcare. In order to achieve the research goals, two main research tools were used: a literature review and interviews with stakeholders.

Literature Review

The literature review involved a comprehensive search of academic journals, books, and other relevant sources to gather information on the topic of project and infrastructure management methodologies in the health sector. The focus was on understanding the current state of the field, identifying the most common methodologies used, and exploring their adaptation in the context of the health sector. The review also sought to identify gaps in the existing literature and to provide an overview of the opportunities and challenges that exist in the adoption and implementation of innovative, anthropocentric management methodologies in the health sector. Case studies have been also showcased in order to highlight the application of different methodologies in different sub-domains.

Interviews

In order to complement the findings of the literature review and to gain a deeper understanding of the experiences of healthcare professionals on the one side, and patients on the other, a series of semi-structured interviews were conducted. The healthcare professionals – interviewees, were selected based on their experience, expertise & type of organization they represented, in order to have the best spread of key organizations possible. The patient representatives – interviewees, were selected, based on their experience, representing (members/presidents of the Board) the largest patient organizations in Greece, whilst also participating in European & international networks & forums. The aim of the interviews was to gain insights regarding the future of health, the incorporation of new technologies, the adaption of innovative management & co-creation methodologies, and the future skills required, to fully exploit the health sector's

potential. All interviews focused on the practical applications and limitations of all the above, as well as exploring the experiences and perspectives of the interviewees.

Data Analysis

The data collected through the literature review, fed in the development of the Discussion guide used for the interviews. Subsequently, the feedback received from interviewees was analyzed using thematic analysis, which involved identifying and categorizing common themes that emerged from the data. This allowed for the identification of key patterns and trends in the experiences and perspectives of those working in the health sector compared and contrasted with patient representatives. These two sources provided the basis for the development of key recommendations for future research and practice.

Overall, the combination of the literature review and interviews provided a comprehensive and in-depth understanding of the importance and contribution of innovative, anthropocentric project and infrastructure management methodologies in the health sector.

Results

In our research, we covered the use of innovative project management methodologies in the healthcare industry. We discussed the challenges and opportunities facing the healthcare industry, and how innovative project management & co-creation methodologies can be used collaboratively, in order to address these challenges and opportunities. We also discussed specific examples of the use of these methodologies in the healthcare industry.

In summary, the healthcare industry is facing a number of challenges and opportunities, including the need to improve the quality and efficiency of care, the adoption of new technologies, and the need to address changing demographics and healthcare needs. Innovative project management & co-creation methodologies can be particularly effective in addressing these challenges and opportunities, as they allow organizations to tailor their approach to the specific needs and goals of their projects and to involve stakeholders in the development process.

Interview analysis

The interviewees' responses are classified **per group, based on their role.** This way, two groups are formed, the healthcare ecosystem representatives, and the patient representatives. The focus on this type of classification is on the perceptions of each group as a total, towards some core questions, following the 4-main-research-pillars setup.

Future of health | *"What are the most pressing health challenges facing society in the coming years?"*

Healthcare ecosystem representatives	Patients representatives
1. **Chronic diseases & multimorbidity**. Chronic diseases are increasingly diagnosed as the population is aging. Consequences are that increased medical attention & polypharmacy are required.	1. **Chronic diseases & multimorbidity** Modern ways of living have led to close contact between people and animals, leading to an increase in the disease burden of communicable diseases (deforestation). Also, on an individual level, the new lifestyle has

2. Response of healthcare systems to the growing needs of patients The response of healthcare systems seems to be inadequate. There is a limited connection between primary and tertiary care. E-health could solve some of these problems, but there is limited uptake of new digital applications. Moreover, the secondary use of health data, & the use of AI tools can present challenges like patient data security issues.	led to an increase in non-communicable diseases. **2. Response of healthcare systems to the growing needs of patients** Patients should be actively engaged in the decision-making and design phase of solutions, providing soft, other than hard data in the process. Inclusion in the process can also reverse the current risks of the degradation of the services and the widening of inequalities.
3. Sustainability of health systems Healthcare costs are skyrocketing all over the world. This fact combined with the shortage and unequal distribution of healthcare professionals leads to inadequate services and fears for the sustainability of healthcare systems. This is particularly relevant when comparing high and low-income countries, where increasing inequity is apparent.	**3. Sustainability of health systems** There is a constant increase in costs and an inability to properly allocate resources. Moreover, the systems do not identify and respond to existing inadequacies.
4. Transition to personalized medicine Medical advances combined with technological tools and analysis processes enable the medical treatment tailored to an individual, based on their unique genetic information. This could transform healthcare by providing a more proactive, patient-centric	**4. Transition to personalized medicine.** Transitioning to personalized medicine seems inevitable and could revolutionize healthcare. However, it requires collaboration and coordination between various stakeholders, including healthcare providers, patients, government, industry, and researchers, to revisit the current processes.

approach to treatment, leading to improved outcomes and reduced costs.	

Project management methodologies | *"In what ways do you think the COVID-19 pandemic has accelerated the adoption of innovative project management techniques in the health industry, and what lasting effects do you think this will have?"*

Healthcare ecosystem representatives	Patients representatives
1. Project management methodologies Other than the technological innovation occurred (i.e. development of effective vaccines), project management methods in place failed to address global shortages in necessary consumables, poor coordination with the authorities, etc. Other than lack of coordination in logistics, project management as known changed, as organizations had to deal with remote working and new ways of collaborating and delivering their products/services/etc. **2. Cultural change** The health crisis made us become more adaptive and flexible, enabling rapid innovation. What we have seen through COVID-19 is that we need to become better at dealing with turbulence and uncertainty. **3. Collaboration networks in response to the pandemic**	**1. Project management methodologies** It has become clear that rigid bureaucratic processes, especially in the regulatory field, are not written in stone. COVID-19 has brought technological applications and new approaches, leading to new project management (experimental) methods. Patient participation was sought in new national campaigns (e.g. National Vaccination Campaign for COVID-19 - Operation "Freedom".), where patient representative organizations were included as equal members at design committees. **2. Cultural change** Pandemic has been a real catalyst for developing a culture of rapid adaptation to changes. New forms of communication and collaboration were developed while digital literacy became an investment area for optimal and quick adjustment to new conditions.

Broader collaborative networks in the form of coordination mechanisms are being developed, as a consequence of the COVID-19 crisis, showcasing a new way of managing problems and combining forces against them. **4. Lasting effects** Tools and culture are here to stay, either because we can't predict when we are going to face such a crisis again, or because people got to understand there are more efficient ways to work and solve problems. The crisis also leads to increased "openness" to more "out-of-the-box" thinking, creating a fertile ground for management innovation, that will certainly be needed to face future challenges in healthcare.	**3. Collaboration networks in response to the pandemic** COVID-19 created a huge pool of patients (or patients by proxy), spreading the notion of how it feels being at the heart of a problem, and not being included in the solution design. During the first phase of the pandemic, it became clear that collaborating with patients is vital, and this has strengthened the presence and role of patient organizations **4. Lasting effects** Patients were "exposed" to new tools and ways of communication with the healthcare system. They solved problems in an easier way and there is no way back, now that the crisis highlighted that -even under these circumstances- we are able to provide them with tools to make their life better.

Co-creation methodologies | *"How do you envision patient involvement and engagement being incorporated into the project management process for new projects/infrastructure development?"*

Healthcare ecosystem representatives	Patients representatives
1. Patient participation Patients should be encouraged to participate in patient societies and through them, to get involved to the project management processes for the development of new projects / services / products / infrastructures. Increased availability of technology, allied to the need to re-consider healthcare delivery practices, has the potential to drive a move towards more personalized, efficient, and cost-effective health and social care models. **2. Value of patient participation** Patient involvement and engagement are key to the attainment of equitable and effective healthcare delivery. It is increasingly recognized that preventive, pre-emptive and predictive healthcare decisions should be made in a pervasive, participatory and personalized manner. Project management in healthcare should strive towards endorsing the concept of bottom-up planning and involvement of patients in project design rather than merely in project evaluation.	**1. Patient participation** Patients should be included from the very stage of planning, in order to bring parameters that are important to patients and that organizations need to be well aware of. **2. Value of patient participation** The healthcare ecosystem should always keep in mind that patients are a diverse group of people with different expertise, bringing information, ideas and constraints in a design phase of a solution. As a consequence, patient representative organizations are not treated as equally-important partners, as it is usual to be included in dissemination activities of projects only, while being overlooked during the actual development of the interventions.

Skills required for cultural change | *"What skills and abilities do you think will be most important for project managers to have, so to efficiently oversee the adoption of novel discoveries in the future?"*

Healthcare ecosystem representatives	Patients representatives
1. Project manager skills Project managers should be equipped with -at least- basic knowledge of healthcare-related complications (legal, ethical, etc.). Project managers should also have a good level of understanding of data science. This can range from interpreting patient satisfaction data collected from patients being discharged, to data analytics gather from ePROs / patient health records. In order to perform the above tasks and introduce innovation in products / services / infrastructures in healthcare, the specific soft skills required are: • adaptability • foresight • good interpersonal skills • willingness to adopt change • leadership • efficient problem-solving skills	**1. Cultural change** Patients are starting to be the initiators and managers of projects. In order to be able to serve that role, respective skills should be developed. **2. Project manager skills** Patient organizations must adapt to the new conditions and acquire skills that will allow them to participate equally in all processes. Patient representatives should be educated and gain valid knowledge about all current issues and trends in health care, at a national and European level. In addition, they must invest in improving the functionality of their organizations, which should have the ability to support their members and communicate with their healthcare partners

Discussion

Interoperability between design methodology and innovative management techniques refers to the ability of different design methodologies and management techniques to work together seamlessly, in order to achieve a common goal. This can be particularly important in healthcare, where different stakeholders have different needs and goals, and where there is a need to balance the needs of patients, healthcare providers, and other stakeholders.

An example of how design methodology and innovative management techniques can be used together is by combining the principles of design thinking with lean management. Design thinking helps organizations to understand the needs and preferences of patients and other stakeholders, while lean management helps organizations to improve efficiency and reduce waste. By combining these two approaches, healthcare organizations can create solutions that improve patient care and reduce costs. Another example is the combination of design thinking methodology with Agile. Agile project management is a flexible and adaptive approach that emphasizes collaboration and customer satisfaction, while design thinking focuses on understanding the needs, wants and limitations of end users. Both design thinking and Agile can be used to develop and improve processes and systems in the healthcare industry. In this case, a design thinking team can use user-centered design techniques, such as empathy mapping and prototyping, to understand the needs of patients and healthcare providers and develop ideas for improving the patient experience. An Agile team, such as a Scrum team, can then take those ideas and break them down into smaller units of work, or "sprints," and use collaboration and communication tools, such as daily stand-up meetings, to improve communication and coordination among team members.

In general, it's important to remember that no single methodology or technique can solve all problems, and that different methodologies and techniques can be used together to achieve a common goal. By combining different methodologies and techniques, organizations can gain a more comprehensive understanding of the needs and preferences of patients and other stakeholders, and create solutions that are tailored to those needs.

Conclusions

Synopsis of thesis' results

The healthcare sector is constantly evolving, with new technologies and treatments being developed, and new challenges arising. As a result, healthcare organizations must be able to adapt and change quickly to meet the needs of their patients and other stakeholders. **Project management** plays a crucial role in this process, as it helps healthcare organizations plan, execute, and control projects in a way that meets their objectives and improves patient care.

One of the key challenges in healthcare project management is to balance the needs of patients, healthcare providers, and other stakeholders. Innovative anthropocentric methodologies for project and infrastructure management in the healthcare sector aim to achieve this balance by putting the needs of patients at the center of the project management process. This approach is based on the idea that by **understanding the needs and preferences of patients, healthcare organizations can create solutions that improve the quality of care and the patient experience**.

Another important aspect of innovative anthropocentric methodologies is the use of digital technologies and data analytics. The healthcare sector is increasingly relying on digital solutions to improve patient care, reduce costs and enhance the efficiency of healthcare systems. Project management methodologies that incorporate digital technologies and data analytics can help healthcare organizations to identify patterns and trends in patient care, optimize resource utilization and improve the quality of care.

Innovative anthropocentric methodologies for project management in the healthcare sector can bring many benefits to healthcare organizations. They can improve patient safety and quality of care, reduce project costs and improve project performance, and enhance the efficiency of healthcare systems. However, it is important to note that the **adoption of these methodologies requires a change in organizational culture and mindset, and a willingness to embrace new ways of working**.

One of the prerequisites for the successful implementation of innovative anthropocentric methodologies is the active involvement and engagement of stakeholders, particularly patients and healthcare providers. By involving patients and healthcare providers in the project management process, healthcare organizations can gain a deeper understanding of their needs and preferences, and create solutions that are tailored to their specific needs.

Another important factor is the availability of data and information. Innovative anthropocentric methodologies rely heavily on data and information to inform decision making and identify patterns and trends in patient care. Therefore, **healthcare organizations need to ensure that they have the necessary systems and processes in place to collect, store, and analyze data**.

In addition, it's essential to have a qualified and **experienced project management team that can lead to the implementation of these methodologies**, as well as being able to identify and manage the risks associated with these projects.

In summary, innovative anthropocentric methodologies for project and infrastructure management in the healthcare sector aim to put the needs of patients in the center of the project management process. These methodologies, such as Lean and Six Sigma, can help healthcare organizations improve patient safety and quality of care, reduce project costs and improve project performance, and enhance the efficiency of healthcare systems. However, their successful implementation requires a change in organizational culture and mindset, the active involvement and engagement of stakeholders, and the availability of data and information, as well as a qualified and experienced project management team.

Limitations

The research presented in this paper aims to provide insight into innovative anthropocentric methodologies for project & infrastructure management in the Healthcare sector. However, it is important to acknowledge that there are limitations that should be considered when interpreting the findings.

One limitation of this research is the interviews' sample size. The interviews' sample size used in this study is 7 people, 3 patient organization representatives and 4 healthcare ecosystem representatives. Even though there was a significant effort to include different type of organizations' representatives (patient organizations, research centers, academic institutions, public authorities, European-wide networks), in order to assure both a 360^{o} outlook and a common ground in terms of knowledge and terminology used, it was difficult to attain a higher number of interviewees. Moreover, a greater variety and number of interviews, could better validate the results of the primary literature research. Even though the majority of interviewees (both healthcare professionals & patients representatives) are participating in European and international networks & committees, still, the sample was geographically specifically located in Greece (90%), which limits the universality of the findings.

Another limitation is the breadth of the subject in focus. As this research examined 4 different aspects -without counting their intersections-, the returning results during the literature review were thousands, leading to a time-consuming -and sometimes unrewarding- process, which led at the end to limited time for the finalization of the thesis. The breadth of the subject also influenced the interviews' questions accordingly.

It is important to note that these limitations do not invalidate the findings of the study, but rather provide a context for interpreting the results. Further research is needed to expand on the findings presented in this thesis and to address the limitations identified.

Recommendations

Based on the results of the study, the following recommendations are proposed for the Healthcare sector in order to improve the adoption and effectiveness of innovative anthropocentric methodologies for project and infrastructure management:

- **Encourage the adoption of human-centered methodologies**: Based on the findings of this research, it is recommended that organizations in the Healthcare sector prioritize the adoption of human-centered methodologies in their project and infrastructure management practices. This can be achieved by providing training and education on these methodologies, as well as by incorporating them into organizational policies and procedures.
- **Foster collaboration and co-creation**: The Healthcare sector is composed of many stakeholders, including patients, healthcare providers, and other organizations. To ensure that the development and implementation of innovative methodologies are effective, it is recommended that organizations in the sector foster collaboration and co-creation between these stakeholders. This can be achieved through regular consultation and engagement with all relevant parties.
- **Promote the use of hybrid methodologies**: The results of the study highlight the importance of using hybrid methodologies in the healthcare sector, in the way that they best serve the unique requirements and constraints of each organization. It is therefore recommended that organizations in the Healthcare sector promote the use of hybrid methodologies, and encourage their employees to adopt these approaches.
- **Continuously monitor and evaluate methodologies**: To ensure that the adoption of innovative anthropocentric methodologies is effective, it is recommended that organizations in the Healthcare sector continuously monitor and evaluate their

use. This can be achieved through regular audits and reviews, as well as through the collection of feedback from relevant stakeholders.

- **Invest in research and development**: To ensure that the Healthcare sector continues to benefit from innovative anthropocentric methodologies, it is recommended that organizations in the sector invest in research and development in this area. This can be achieved through the funding of research projects and the establishment of innovation labs or centers.

Areas for further research

The results of this study provide a comprehensive overview of the current state of project and infrastructure management methodologies in the Healthcare sector, as well as their human-centeredness. However, there is still much room for further research to build on the findings of this study.

One area of future research could involve turning the literature-based approach of this study into more hands-on, practical applications. This could involve case studies, pilot projects, or other initiatives that aim to test and demonstrate the effectiveness of the hybrid management methodologies identified in this study. Such initiatives could provide valuable insights into the challenges and benefits of implementing these methodologies in real-world Healthcare settings.

Another area of future research could focus on the development of new, innovative anthropocentric methodologies for project and infrastructure management in the Healthcare sector. This could involve exploring new approaches to human-centered design, as well as exploring new ways of integrating the end user into the development process.

Finally, future research could focus on the broader implications of project and infrastructure management methodologies for the Healthcare sector. This could involve exploring the impact of these methodologies on patient outcomes, as well as the broader impact on society and the healthcare system as a whole.

In conclusion, the results of this study provide a foundation for further research in the field of project and infrastructure management methodologies in the Healthcare sector. By exploring new, innovative anthropocentric methodologies and turning literature-based approaches into practical applications, future research has the potential to make a

significant contribution to the development of the Healthcare sector and improve the lives of patients and healthcare providers.

Appendix I: Discussion guide for Interviews

Discussion guide for Healthcare ecosystem representatives

1. In your opinion, what are the most pressing health challenges facing society in the coming years, and how do you envision innovative project management techniques being used to address them?

2. How do you see the use of technology, such as artificial intelligence and machine learning, impacting the healthcare industry in the future?

3. In what ways do you think the COVID-19 pandemic has accelerated the adoption of innovative project management techniques in the health industry, and what lasting effects do you think this will have?

4. How do you see the role of project management evolving in the healthcare industry in the future?

5. Can you give an example of a successful project you have managed in the healthcare industry, and what innovative techniques you used to ensure its success? (if any)

6. How do you think the increasing trend towards value-based care will impact the healthcare industry, and how can project managers help to facilitate this transition?

7. How do you envision the use of data and analytics changing in the healthcare industry in the coming years, and how can project managers leverage these tools to drive better outcomes?

8. Can you discuss any emerging technologies or trends in the healthcare industry that you think will have a particularly significant impact in the coming years, and how can project managers help to ensure their successful adoption?

9. How do you envision patient involvement and engagement being incorporated into the project management process for new projects/infrastructure development?

10. How do you see the use of design thinking and other user-centered approaches changing the way healthcare is delivered in the future, and how can project managers help to facilitate this shift?

11. What skills and abilities do you think will be most important for healthcare's sector project managers to have so to efficiently oversee the adoption of novel discoveries in the future?

12. Have you used in the past any project management techniques, that led to the successful delivery of new projects or infrastructure on time and within budget?

13. Can you discuss a project where you had to overcome significant challenges or obstacles, and how you used innovative project management techniques to do so?

14. How do you see the use of technology, such as project management software and virtual collaboration tools, changing the way projects are managed in the future?

15. Have you ever used co-creation techniques, for the development of a new project/service/infrastructure, already in its conception phase? If yes, please describe the case and the techniques

Discussion guide for patient organizations' representatives

1. In your opinion, what are the most pressing health challenges facing society in the coming years, and how do you envision patient organizations being involved in addressing them?

2. How do you see the use of technology, such as artificial intelligence and machine learning, impacting the healthcare industry in the future, and how can patient organizations ensure that the needs and interests of patients are considered in this context?

3. In what ways do you think the COVID-19 pandemic has accelerated the adoption of innovative project management techniques in the health industry, and what lasting effects do you think this will have on the involvement of patient organizations in the planning and execution of healthcare projects?

4. How do you see the role of patient organizations evolving in the healthcare industry in the future, and what skills and abilities do you think will be most important for patient representatives to have in this context?

5. Can you give an example of a successful project or initiative in which your organization has been involved, and what innovative techniques you used to ensure its success and maximize the involvement of patients? (if any)

6. How do you think the increasing trend towards value-based care will impact the healthcare industry, and how can patient organizations help to facilitate this transition in a way that prioritizes the needs and interests of patients?

7. How do you envision the use of data and analytics changing in the healthcare industry in the coming years, and how can patient organizations leverage these tools to drive better outcomes for patients and advocate for their needs and interests?

8. Can you discuss any emerging trends or best practices in patient engagement and involvement in the project management process for new projects/infrastructure development that you think will be particularly important in the coming years?

9. How do you envision patient involvement and engagement being incorporated into the project management process for new projects/infrastructure development?

10. In what ways do you think the adoption of patient-centered design principles can enhance the planning and execution of new projects/infrastructure development?

11. How do you see the use of design thinking and other user-centered approaches changing the way healthcare is delivered in the future, and how can patient organizations help to facilitate this shift in a way that puts patients at the center?

12. Can you discuss any specific examples of how patient feedback has influenced the design or implementation of new projects/infrastructure in the past?

13. How do you think the use of patient-reported outcome measures (PROMs) and other patient-generated data can improve the planning and execution of new projects/infrastructure development?

14. Can you discuss any challenges or obstacles that you have encountered in the past when trying to incorporate patient perspectives into the project management process for new projects/infrastructure development, and how you addressed them?

15. How do you see the role of patient organizations evolving in the project management process for new projects/infrastructure development in the future, and what skills and abilities do you think will be most important for patient representatives to have in this context?

References

Alexander M. (2022, December 5). *Project management: Tips, tools, best practices*. CIO. https://www.cio.com/article/228109/project-management-tips-strategies-best-practices.html

Alexander, M. (2001). Six Sigma: The Breakthrough Management Strategy Revolutionizing the World's Top Corporation. *Technometrics*, *43*(3), 370. https://doi.org/10.1198/tech.2001.s622

American Society for Quality. (n.d.).*What is Lean Six Sigma?*. ASQ. https://asq.org/quality-resources/six-sigma

Amichai-Hamburger, Y., McKenna, K. Y., & Tal, S. A. (2008). E-empowerment: Empowerment by the Internet. *Computers in Human Behavior*, *24*(5), 1776-1789. https://doi.org/10.1016/j.chb.2008.02.002

Archer, S. & Kaufman, C. (2013). Accelerating outcomes with a hybrid approach within a waterfall environment. *PMI® Global Congress 2013—North America, New Orleans, LA.* Project Management Institute. https://www.pmi.org/learning/library/outcomes-hybrid-approach-waterfall-environment-5839

Avdagovska, M., Stafinski, T., Ballermann, M., Menon, D., Olson, K., & Paul, P. (2020). Tracing the decisions that shaped the development of MyChart, an electronic patient portal in Alberta, Canada: historical research study. *Journal of medical Internet research*, *22*(5), e17505. https://doi.org/10.2196/17505

Baker, A. (2001). *Crossing the quality chasm: a new health system for the 21st century* (Vol. 323, No. 7322, p. 1192). British Medical Journal Publishing Group. https://doi.org/10.17226/10027

Bayot, M. L., & Varacallo, M. (2022). Management Skills. In *StatPearls [Internet]*. StatPearls Publishing.

BIMTech. (n.d.). *What is BIM and how it came to be*. BIMTech. https://bimtech.eu/bim/

Block, L. E. (1997). Evolution, growth, and status of managed care in the United States. *Public health reviews*, *25*(3-4), 193-244.

Brown, T. (2008, June). *Design Thinking: Thinking like a designer can transform the way you develop products, services, processes—and even strategy*.

Readings.design. https://readings.design/PDF/Tim%20Brown,%20Design%20Thinking.pdf

Brown, T., & Martin R. L. (2015). *Design for Action: How to use design thinking to make great things actually happen*. HBR. https://hbr.org/2015/09/design-for-action

Butkovic, M. (2022, July 11). *6 experts weigh in on the present and the future of mental health*. Forbes. https://www.forbes.com/sites/marijabutkovic/2022/07/11/6-experts-weigh-in-on-the-present-and-the-future-of-mental-health/?sh=70c454c52efc

Canales, R., & Drenttel, W. (2010). Design at Mayo. In *SAGE Business Cases*. Yale School of Management. Available at: https://vol10.cases.som.yale.edu/design-mayo/

Capone, A. (2022, January 11). *The future of healthcare technology*. Forbes. https://www.forbes.com/sites/forbestechcouncil/2022/01/11/the-future-of-healthcare-technology/?sh=63ce8f484750

Catalyst, N. E. J. M. (2017). What is patient-centered care?. *NEJM Catalyst*, *3*(1).

Centers for Medicare & Medicaid Services. (2019). *National health expenditure projections 2019-2028*. CMS. https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/NationalHealthAccountsProjected

Chan, H. Y., Lo, S. M., Lee, L. L. Y., Lo, W. Y. L., Yu, W. C., Wu, Y. F., ... & Chan, J. T. S. (2014). Lean techniques for the improvement of patients' flow in emergency department. *World journal of emergency medicine*, *5*(1), 24. https://doi.org/10.5847/wjem.j.issn.1920-8642.2014.01.004

Chen, L., Evans, T., Anand, S., Boufford, J. I., Brown, H., Chowdhury, M., ... & Wibulpolprasert, S. (2004). Human resources for health: overcoming the crisis. *The lancet*, *364*(9449), 1984-1990. https://doi.org/10.1017/ipm.2020.72

Chen, T. Y. (2018). Medical leadership: An important and required competency for medical students. *Tzu-chi medical journal*, *30*(2), 66. https://doi.org/10.4103/tcmj.tcmj_26_18

Cleeren, K., Lamey, L., Meyer, J. H., & De Ruyter, K. (2016). How business cycles affect the healthcare sector: A cross-country investigation. *Health economics*, *25*(7), 787-800. https://doi.org/10.1002/hec.3187

Constand, M. K., MacDermid, J. C., Bello-Haas, D., & Law, M. (2014). Scoping review of patient-centered care approaches in healthcare. *BMC health services research*, *14*(1), 1-9. https://doi.org/10.1186/1472-6963-14-271

Cooper, A., Reimann, R., & Cronin, D. (2007). *About face 3: the essentials of interaction design*. John Wiley & Sons.

D.School Stanford. (n.d.). *Design Questions Library*. D.school.stanford. https://dschool.stanford.edu/resources/design-questions-library

Dobin, V. M., & Lazar, B. (2020). Project management and quality in healthcare: A systematic literature review. *Project Management World Journal*, *9*(9), 1-15.

Eby, K. (2016, September 23). *Everything you need to know about agile project management*. Smartsheet. https://www.smartsheet.com/everything-you-need-to-know-about-agile-project-management

European Observatory on Health Systems and Policies. (2021). COVID-19 Health System Governance. *Journal of the European Observatory on Health Systems and Policies* 27(1).

Ferreira, F. K., Song, E. H., Gomes, H., Garcia, E. B., & Ferreira, L. M. (2015). New mindset in scientific method in the health field: Design Thinking. *Clinics*, *70*, 770-772. https://doi.org/10.6061/clinics/2015(12)01

Folkman, A. K., Tveit, B., & Sverdrup, S. (2019). Leadership in interprofessional collaboration in health care. *Journal of multidisciplinary healthcare*, 97-107. https://doi.org/10.2147/JMDH.S189199

Gavin, B., Lyne, J., & McNicholas, F. (2020). Mental health and the COVID-19 pandemic. *Irish journal of psychological medicine*, *37*(3), 156-158. https://doi.org/10.1017/ipm.2020.72

Giasson, L. (2019). The best of both models: key components of a successful hybrid project management office model in a health care organization. *The health care manager*, *38*(3), 247-252. https://doi.org/10.1097/HCM.0000000000000272

Gomes, J., & Romão, M. (2016). Investments in information systems and technology in the healthcare: Project management mediation. *Journal of Information Systems*

Engineering & Management, *1*(1), 15-24. https://doi.org/10.20897/lectito.201606

Goodison, R., Borycki, E. M., & Kushniruk, A. W. (2019). Use of Agile Project Methodology in Health Care IT Implementations: A Scoping Review. *ITCH*, 140-145.

Gordon, A. J. & Hornstein, H. (2014). The symbiosis of project management and change management during healthcare integrated planning: a case study of Ontario's healthcare system. *PMI Research and Education Conference*. https://www.pmi.org/learning/library/project-change-management-healthcare-planning-1923

Gordon, A., & Pollack, J. (2018). Managing healthcare integration: Adapting project management to the needs of organizational change. *Project Management Journal*, *49*(5), 5-21. https://doi.org/10.1177/8756972818785321

Greater New York Hospital Association (2018, February 21). *Value-based payment fundamentals: a guide to New York state medicaid value-based payment*. Gnyha. https://www.gnyha.org/wp-content/uploads/2018/02/VBP_Guide_digital.pdf

Green Project Management. (DATE or n.d.). *What is Sustainable Project Management?*. Greenprojectmanagement. https://www.greenprojectmanagement.org/about/what-is-sustainable-project-management

Greenway Health. (n.d.). *The future of healthcare technology*. Greenwayhealth. https://www.greenwayhealth.com/knowledge-center/greenway-blog/future-healthcare-technology

Grossmann, C., Powers, B., & McGinnis, J. M. (2011). *Digital infrastructure for the learning health system: the foundation for continuous improvement in health and health care*. National Academies Press.

Hakim A. (2019). Hybrid project management has role in health care today. *Physician Leadership Journal*, *6*(2), 38-39.

Hall, D. (2011). Debate: Innovative teaching to enhance critical thinking and communication skills in healthcare professionals. *Internet Journal of Allied Health Sciences and Practice*, *9*(3), 7. https://doi.org/10.46743/1540-580X/2011.1361

Hamil, S. (2021, September 9). *What is Building Information Modelling (BIM)?*. Thenbs. https://www.thenbs.com/knowledge/what-is-building-information-modelling-bim

Hartley, K. (2016). Untangling approaches to management and leadership across systems of medical education. *BMC health services research*, *16*, 33-43. https://doi.org/10.1186/s12913-016-1391-9

Highsmith, J. (2001). *History: the agile manifesto*. Agilemanifesto. https://agilemanifesto.org/history.html

Hoffman, C. (2009, March). *National health insurance: a brief history of reform efforts in the US*. Henry J. Kaiser Family Foundation. KFF. https://www.kff.org/wp-content/uploads/2013/01/7871.pdf

Holtzblatt, K., & Beyer, H. (1997). *Contextual design: defining customer-centered systems*. Elsevier. ISBN: 9780080503042

Hood, L., & Rowen, L. (2013). The human genome project: big science transforms biology and medicine. *Genome medicine*, *5*, 1-8. https://doi.org/10.1186/gm483

Hostetter, M., Klein, S., & McCarthy, D. (2017, March 28). *Caremore: improving outcomes and controlling health care spending for high-needs patients*. *Commonwealthfund*. https://www.commonwealthfund.org/publications/case-study/2017/mar/caremore-improving-outcomes-and-controlling-health-care-spending

IDEO U. (n.d.) *Design Thinking*. Ideou. https://www.ideou.com/pages/design-thinking

Institute of Medicine (US) - Committee on the Robert Wood Johnson Foundation Initiative on the Future of Nursing. (2011). *The future of nursing: Leading change, advancing health*. National Academies Press. https://doi.org/10.17226/12956

Interaction Design Foundation (n.d.). Interaction-design. https://www.interaction-design.org/

Gothelf, J. (2013). *Lean UX: Applying lean principles to improve user experience*. O'Reilly Media, Inc.

Kim, S. H., Myers, C. G., & Allen, L. (2017). Health care providers can use design thinking to improve patient experiences. *Harvard Business Review*, *95*(5), 222-229.

Knebel, E., & Greiner, A. C. (Eds.). (2003). The Core Competencies Needed for Health Care Professionals. In *Health professions education: A bridge to quality*. National Academies Press.

Kolko, J. (2015). *Design thinking comes of age: the approach, once used primarily in product design, is now infusing corporate culture*. Enterprisersproject. https://enterprisersproject.com/sites/default/files/design_thinking_comes_of_age.pdf

Kolovou, O. M. (2021). *TellADoc: Business Plan for a Telemedicine Application* [Master's thesis, International Hellenic University]. Repository.ihu.edu. https://repository.ihu.edu.gr/xmlui/bitstream/handle/11544/29739/Dissertation_thesis_businessPlan_kolovou_olga_maria_04012021.pdf?sequence=1

Kolson-Hurley, A. (2009, September 8). *Small steps toward integrated project deliver*. Architectmagazine. https://www.architectmagazine.com/practice/small-steps-toward-integrated-project-delivery_o

Kotler P. & Keller K. L. (2009). Marketing management (13th ed.). Pearson Prentice Hall.

Ladas, C. (2009). *Scrumban-essays on kanban systems for lean software development*. Agilealliance. https://www.agilealliance.org/scrumban/

Lapão, L. V., Peyroteo, M., Maia, M., Seixas, J., Gregório, J., Mira da Silva, M., ... & Correia, J. C. (2021). Implementation of digital monitoring services during the COVID-19 pandemic for patients with chronic diseases: design science approach. *Journal of Medical Internet Research*, *23*(8), e24181. https://doi.org/10.2196/24181

Leask, C. F., Sandlund, M., Skelton, D. A., Altenburg, T. M., Cardon, G., Chinapaw, M. J., ... & Chastin, S. F. (2019). Framework, principles and recommendations for utilising participatory methodologies in the co-creation and evaluation of public health interventions. *Research involvement and engagement*, *5*(1), 1-16. https://doi.org/10.1186/s40900-018-0136-9

Lewrick, M., Link, P., & Leifer, L. (2018). *The design thinking playbook: Mindful digital transformation of teams, products, services, businesses and ecosystems*. John Wiley & Sons.

Liedtka, J. (2018). Why design thinking works. *Harvard Business Review*, *96*(5), 72-79.

Lin, M. C., Hughes, B. L., Katica, M. K., Dining-Zuber, C., & Plsek, P. E. (2011). Service design and change of systems: Human-centered approaches to implementing and spreading service design. *International Journal of Design*, *5*(2).

Living Well Network Alliance & NHS Lambeth Clinical Commisioning Group. (2020, March 29). *Improving inpatient mental health services for Lambeth*. Lambethtogether. https://lambethtogether.net/wp-content/uploads/2020/03/Lambeth-Hopital-Reconfiguration-PCBC-Version-9-ReleaseB.pdf

McGrath, J. Košťálová, J. (2020). Project Management Trends and New Challenges 2020+. *Hradec Economic Days*. Dk.upce. https://dk.upce.cz/bitstream/handle/10195/77122/Project_Management_Trends_and_New_Challenges_2020%2b.pdf?sequence=1&isAllowed=y

McKinsey & Company. (2018). *The business value of design*. Mckinsey. https://www.mckinsey.com/capabilities/mckinsey-design/our-insights/the-business-value-of-design

McKinsey & Company. (n.d.). *The Future of Healthcare* [Audio podcast]. Mckinsey. https://www.mckinsey.com/industries/healthcare/our-insights/the-future-of-healthcare

Myers, C. G., & Pronovost, P. J. (2017). Making management skills a core component of medical education. *Academic Medicine*, *92*(5), 582-584. https://doi.org/10.1097/ACM.0000000000001627

National Association of State Facilities Administrators, Construction Owners Association of America, The Association of Higher Education Facilities Officers, Associated General Contractors of America, & American Institute of Architects. (2010). *Integrated project delivery for public and private owners*. AGC.

https://www.agc.org/sites/default/files/Files/Programs%20%26%20Industry%20Relations/IPD%20for%20Public%20and%20Private%20Owners_1.pdf

National Cancer Institute. (2019, September 24). *Immunotherapy to treat cancer*. Cancer. https://www.cancer.gov/about-cancer/treatment/types/immunotherapy

National Health System Digital (2022, September 29). *Psychological therapies, annual report on the use of IAPT services, 2021-22*. Digital.nhs. https://digital.nhs.uk/data-and-information/publications/statistical/psychological-therapies-annual-reports-on-the-use-of-iapt-services/annual-report-2021-22#

National Health System Digital. (2022, December 5). *Psychological therapies, annual report on the use of IAPT services, 2021-22*. IAPT Annual Interactive Dashboard. http://bit.ly/IAPTannual_2122

Niñerola, A., Sánchez-Rebull, M. V., & Hernández-Lara, A. B. (2020). Quality improvement in healthcare: Six Sigma systematic review. *Health Policy*, *124*(4), 438-445. https://doi.org/10.1016/j.healthpol.2020.01.002

Nordmark, S., Lindberg, I., & Zingmark, K. (2022). "It's all about time and timing": nursing staffs' experiences with an agile development process, from its initial requirements to the deployment of its outcome of ICT solutions to support discharge planning. *BMC Medical Informatics and Decision Making*, *22*(1), 186. https://doi.org/10.1186/s12911-022-01932-4

Organisation for Economic Co-operation and Development. (2021, November 9). Health at a Glance 2021: OECD Indicators. OECD Publishing. https://doi.org/10.1787/19991312

Organisation for Economic Co-operation and Development. (2022, December 5). Health at a Glance 2022: State of Health in the EU Cycle. OECD Publishing. https://doi.org/10.1787/507433b0-en

Payne, J. M., France, K. E., Henley, N., D'Antoine, H. A., Bartu, A. E., Elliott, E. J., & Bower, C. (2011). Researchers' experience with project management in health and medical research: Results from a post-project review. *BMC Public Health*, *11*, 1-11. https://doi.org/10.1186/1471-2458-11-424

Pool, E. T., Poole, K., Upjohn, D. P., & Hernandez, J. S. (2019). 'Agile' helping Mayo improve its projects. *Physician Leadership Journal*, *6*(2), 34-38.

Project Management Institute. (2021). *A guide to the project management body of knowledge (PMBOK® Guide)*. Project Management Institute, Inc

Project Management Institute. (2021). *What is Project Management*. PMI. https://www.pmi.org/about/learn-about-pmi/what-is-project-management

Radiologyinfo. (n.d.). *Computed Tomography*. Radiologyinfo. https://www.radiologyinfo.org/en/ctscan

Radiologyinfo. (n.d.). *Magnetic Resonance Imaging (MRI)*. Radiologyinfo. https://www.radiologyinfo.org/en/mri

Raman, A., & Tucker, A. (2011). The Cleveland Clinic: improving the patient experience. *Harvard Business Review*. Nexus. https://nexus.us/wp-content/uploads/2021/05/Cleveland-Clinic-HBS-2013.pdf

Ramaswamy, V., & Ozcan, K. (2013). Strategy and co-creation thinking. *Strategy & Leadership, 41*(6), 5-10. https://doi.org/10.1108/SL-07-2013-0053

Roberts, J. P., Fisher, T. R., Trowbridge, M. J., & Bent, C. (2016, March). A design thinking framework for healthcare management and innovation. In *Healthcare* (Vol. 4, No. 1, pp. 11-14). Elsevier. https://doi.org/10.1016/j.hjdsi.2015.12.002

Rosenzweig, E. (2015). UX Thinking, Successful User Experience: Strategies and Roadmaps (pp. 41-67). In *Successful user experience: Strategies and roadmaps*. Morgan Kaufmann. https://doi.org/10.1016/B978-0-12-800985-7.00003-X

Saha, V., Goyal, P., & Jebarajakirthy, C. (2022). Value co-creation: a review of literature and future research agenda. *Journal of Business & Industrial Marketing, 37*(3), 612-628. https://doi.org/10.1108/JBIM-01-2020-0017

Santos, C., Santos, V., Tavares, A., & Varajão, J. (2014). Project Management success in health–the need of additional research in public health projects. *Procedia Technology, 16*, 1080-1085. https://doi.org/10.1016/j.protcy.2014.10.122

Scaled Agile. (n.d.). *SAFe 5 for Lean Enterprise*. Scaledagileframework. https://www.scaledagileframework.com/

Schmidt H. (2016). Chronic Disease Prevention and Health Promotion. In: D. H. Barrett, L. W. Ortmann, A. Dawson, C. Saenz, A. Reis (Ed.). *Public Health Ethics: Cases Spanning the Globe*. SpirngerOpen.

https://www.ncbi.nlm.nih.gov/books/NBK435779/, https://www.doi.org/10.1007/978-3-319-23847-0_5

Schwaber, K., & Sutherland, J. (2020, November). *The scrum guide - the definitive guide to scrum: the rules of the game*. Scrumguides. https://scrumguides.org/docs/scrumguide/v2020/2020-Scrum-Guide-US.pdf

Scott, A. (2018, Febuary 20). *An introduction to Lean Kanban software development*. Inviqa. https://inviqa.com/blog/introduction-lean-kanban-software-development

Scrum. (n.d.). *What is Scrum?*. Scrum. https://www.scrum.org/resources/what-is-scrum

SinSky, C. A., & SinSky, T. A. (2015). Lessons from CareMore: A stepping stone to stronger primary care of frail elderly patients. *Am J Manag Care*, *3*(2), 2-3.

Slipicevic, O., & Masic, I. (2012). Management knowledge and skills required in the health care system of the Federation bosnia and herzegovina. *Materia socio-medica*, *24*(2), 106. https://doi.org/10.5455/msm.2012.24.106-111

Slywotzky, A., & Main, T. (2011). The quiet health-care revolution. *Atlantic*, *308*(4), 92-98.

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of business research*, *104*, 333-339. https://doi.org/10.1016/j.jbusres.2019.07.039

Stickdorn, M., & Schneider, J. (2011). *This is service design thinking: Basics-tools-cases*. John Wiley & Sons, Incorporated.

Stickdorn, M., Hormess, M. E., Lawrence, A., & Schneider, J. (2018). *This is service design doing - applying service design thinking in the real world: a practitioners' handbook*. O'Reilly Media, Inc.

Stola, K. (2018). User experience and design thinking as a global trend in healthcare. *Journal of Medical Science*, *87*(1), 28-33. https://doi.org/10.20883/jms.2018.281

Sutton, L., Berdan, L. G., Bolte, J., Califf, R. M., Ginsburg, G. S., Li, J. S., ... & Boulware, L. E. (2019). Facilitating translational team science: the project leader model. *Journal of Clinical and Translational Science*, *3*(4), 140-146. https://doi.org/10.1017/cts.2019.398

Tatnall, A., Davey, B., & Dakich, E. (2013). *Major eGovernment Projects in Health, Education and Transport in Victoria*. In Bled eConference (p. 30).

https://domino.fov.um.si/proceedings.nsf/0/902dedfb5137c145c1257b8a002ecea8/$FILE/05_Tatnall.pdf

The Lean Construction Institute. (n.d.). *Lean Construction*. https://www.leanconstruction.org/

The office of the National Coordinator for Health Information Technology. (2015, April). *Guide to Privacy and Security of Electronic Health Information*. Healthit. https://www.healthit.gov/sites/default/files/pdf/privacy/privacy-and-security-guide.pdf

Thesing, T., Feldmann, C., & Burchardt, M. (2021). Agile versus waterfall project management: decision model for selecting the appropriate approach to a project. *Procedia Computer Science*, *181*, 746-756. https://doi.org/10.1016/j.procs.2021.01.227.

U.S. Department of Health and Human Services. (2022, March 17). *The Affordable Care Act*. HHS. https://www.hhs.gov/healthcare/about-the-aca/index.html

U.S. News. (2022, July 26). *America's best hospitals: the 2022-2023 honor roll and overview*. Health.usnews. https://health.usnews.com/health-care/best-hospitals/articles/best-hospitals-honor-roll-and-overview

Varnfield, M., Karunanithi, M., Ding, H., Bird, D., & Oldenburg, B. (2014). Telehealth for chronic disease management: Do we need to RE-AIM?. In *Global Telehealth 2014* (pp. 93-100). IOS Press. https://doi.org/10.3233/978-1-61499-456-5-93

Wikipedia. (2022, November 17). *Improving access to psychological therapies*. Wikipedia. https://en.wikipedia.org/wiki/Improving_Access_to_Psychological_Therapies

Wikipedia. (2022, September 15). *Building information modeling*. Wikipedia. https://en.wikipedia.org/wiki/Building_information_modeling

Wikipedia. (2022, September 7). *CareMore.* Wikipedia. https://en.wikipedia.org/wiki/CareMore

World Health Organisation. (1978, September 6-12). Declaration of Alma-Ata. WHO. https://www.who.int/teams/social-determinants-of-health/declaration-of-alma-ata

World Health Organization (2019, June 6). *Recommendations on digital interventions for health system strengthening*. WHO. https://www.who.int/publications/i/item/9789241550505

World Health Organization. (n.d.). Digital health. WHO https://www.who.int/health-topics/digital-health#tab=tab_1

World Health Organization (n.d.). *Mental health & COVID-19*. WHO. https://www.who.int/teams/mental-health-and-substance-use/mental-health-and-covid-19

World Health Organization. (2008). *The world health report 2008: primary health care: now more than ever*. World Health Organization. https://apps.who.int/iris/handle/10665/43949

World Health Organization. (2011, October). *Global Health and Aging*. Nia.nih. https://www.nia.nih.gov/sites/default/files/2017-06/global_health_aging.pdf

World Health Organization. (2017). *Integrated care for older people: guidelines on community-level interventions to manage declines in intrinsic capacity*. Apps.Who. https://apps.who.int/iris/handle/10665/258981

World Health Organization. (2018). *Health workforce: fact sheet on Sustainable Development Goals (SDGs): health targets – mental health*. Apps.Who. https://apps.who.int/iris/handle/10665/340830

World Health Organization. (2019). *Global action plan for the prevention and control of noncommunicable diseases 2013-2020*. WHO. https://www.who.int/publications/i/item/9789241506236

World Health Organization. (2020 July, 7). *Global strategy on human resources for health: Workforce 2030*. WHO. https://www.who.int/publications/i/item/9789241511131

World Health Organization. (2021). *Global strategy on digital health 2020-2025*. Apps.who. https://apps.who.int/iris/bitstream/handle/10665/344249/9789240020924-eng.pdf

World Health Organization. (2021). *Social determinants of health*. WHO. https://www.who.int/health-topics/social-determinants-of-health#tab=tab_1

World Health Organization. (2021, November 8). *2021 WHO health and climate change global survey report*. WHO. https://www.who.int/publications/i/item/9789240038509

World Health Organization. (2022). *Global Health Expenditure Report: Rising to the Pandemic's Challenges*. Apps.Who. https://apps.who.int/iris/bitstream/handle/10665/365133/9789240064911-eng.pdf

World Health Organization. (2022, June 16). *World mental health report: Transforming mental health for all*. WHO. https://www.who.int/publications/i/item/9789240049338

Zorzetti, M., Signoretti, I., Salerno, L., Marczak, S., & Bastos, R. (2022). Improving agile software development using user-centered design and lean startup. *Information and Software Technology*, *141*, 106718. https://doi.org/10.1016/j.infsof.2021.106718