

# Applications and Capabilities of Digital Twin in Swiss Healthcare: System Dynamic Approach

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European healthcare systems grapple with challenges due to aging populations, health professional shortages, disease burdens, and escalating healthcare expenditures. Digital Twin technology offers a transformative potential to enhance patient care and reduce costs. This article, among one of the first studies in Switzerland, examines the current state of Digital Twin technology and presents a model for assessing its capabilities.

## Introduction and Objectives

Digital Twin is a form of a model with a bi-directional flow of data between a digital object and a physical object, where both are fully connected and integrated. The following work first reviews the existing ecosystem of Digital Twin, then it presents its own Human Digital Twin framework. Finally, based on models of system dynamics, compares healthcare capabilities with and without an integrated digital twin and assesses the current digital maturity of the Swiss healthcare system.

## Research Design

The research objectives will be achieved through a literature review and system dynamics modeling. The scope of the literature review discusses digital health services, with a special emphasis on the Human Digital Twin with its application in Swiss healthcare. Due to the lack of a common Human Digital Twin framework, the second section presents the conceptual framework of the Human Digital Twin. The last creates System Dynamics models to assess the current maturity of the Digital Twin in Switzerland. Due to the complex structure of healthcare, the modelling includes qualitative and quantitative approaches, with a 20-year perspective.

## Results

The literature review presents the state of the art of Digital Twin and discusses constraints hindering further development, such as the absence of a

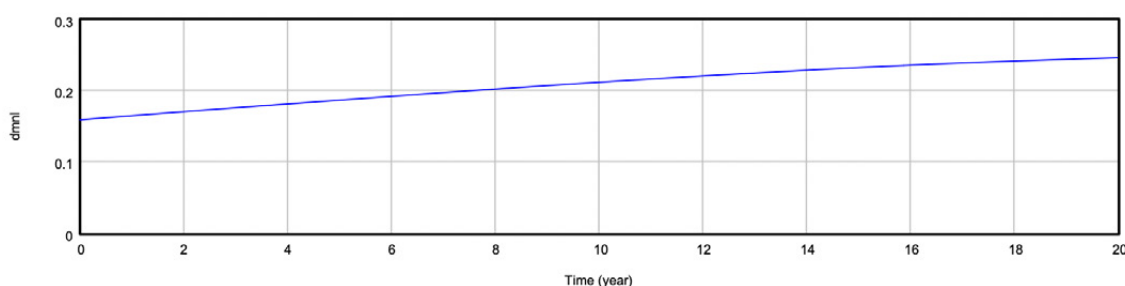
common definition and framework for Digital Twin technology, data privacy issues, as well as a low level of digital maturity. The results of the second part present the current Digital Twin maturity and how it is changing over a given time frame. The technological capabilities of methods with Digital Twin in a given time frame at its highest point are 6 times higher in comparison to methods without Digital Twin. On the social side, the difference grows slower, reaching over 0.9 times higher during a given time. Finally, the article considers the acceptance rate among the Swiss public. The results show that the acceptance rate starts to increase in the sixth year, reaching a maximum value in the ninth year.



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## Implications and Recommendations

The model presented is purely conceptual and more empirical evidence is needed to validate it. This is because the Digital Twin is still mostly in the conceptual phase and therefore not enough data has been provided, making it difficult to review this technology in full detail. The shape of Digital Twin technology should be considered on different layers of application complexity. Among others, this refers to the question of how and where data-collecting sensors should be located and interconnected with each other. Moreover, social variables such as fear of missing out or automation bias should be further investigated. The research contributed to future works by providing the framework to evaluate and compare Digital Twin technology maturity.



Impact of Digital Twin's current capabilities on acceptance rate