

## **Supporting the digital transformation journey through monitoring systems in healthcare. A comparative analysis of European empirical approaches.**

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E-government is a form of organization where public services are delivered as business processes and where communication and information technologies play a central role (Dunleavy et al., 2006). It can be defined as an opportunity to reinvent how these services are delivered, building a new partnership with citizens through digitalization (Silcock, 2001). Brown (2005) identified four main components of the e-government: citizen-centered service, information as a public resource, new skills and working relationships, and accountability and management models. All these factors can indeed be improved through the novel concept of Digital Transformation (DT). DT refers to “a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies” (Vial, 2019). The pandemic has led the public sector to speed up DT to ensure citizens the services through non-physical means (Dal Mas et al., 2023; Kraus et al., 2021; Leone et al., 2021; Marques & Ferreira, 2020). With this new state of the art, there is a strong emphasis on the need for thorough assessments to determine the true progress and influence of digitalization, which needs to be measured from the standpoint of efficiency and effectiveness, as required by public sector regulations (Arnaboldi et al., 2015). This article explores the developments and shortcomings in evaluating digitalization across European healthcare systems by examining how DT measures are incorporated into Health System Performance Assessments (HSPAs) across member states of the European Union (EU). Objectives and Research questions: Our research endeavors to answer the following key questions: (i) What are the metrics utilized to measure and evaluate the digitalization of health systems across Europe? (ii) How do European countries integrate digital health metrics into their HSPAs? and (iii) Which are the implications for the ongoing digitalization of healthcare? To address these questions, we conducted a comprehensive multiple empirical case study by performing a literature review to gather all available materials pertaining to the availability and integration of measures or indicators concerning the digitalization of healthcare across EU countries. Subsequently, we conducted a content analysis to categorize these indicators into a simplified and adapted version of the Input-Process-Output-Outcomes (IPOO) framework. (M. G. Brown & Svenson, 1988). This framework provides a methodical way to evaluate the various stages of healthcare DT journey. Methodology: Using a multiple empirical case study methodology, the paper assesses the existence of performance measurement systems and investigates how various EU countries deployed quantifiable standards for evaluating digital health. Using Google Scholar, a literature review with an emphasis on English-language publications published after 2010 was employed (Figure 1). This timeline emphasizes the importance of ICTs in EU objectives and corresponds with the release of the Digital Agenda for Europe. Starting from an initial

sample of 5150 documents, the screening process was integrated with information from official websites. In the end, 39 documents with a national HSPA emphasis were found and examined. Next, the IPOO Framework is used to map Key Performance Indicators (KPIs) development in European healthcare systems in a methodical manner. Findings: Results show that 17 European countries have comprehensive HSPA while 11 developed KPIs for digital health (Table 1). The identification and categorization of 99 KPIs into theme clusters provide detailed insights into digitalization strategies and priorities (Table 3). Key findings indicate that while most countries have developed KPIs related to digital health infrastructure, data literacy, and accessibility of digital technologies, there are variations in monitoring activities related to the adoption of electronic health records, pharmaceutical prescriptions, and eHealth services. In terms of output, countries have focused on monitoring the percentage of video consultations and information digitalization of primary care services. However, some metrics lack standardized methodologies and robust data collection methods, hindering comprehensive computation and monitoring efforts. In the outcome stage, countries are evaluating the capacity of digital services to reach the targeted audience and the satisfaction of healthcare professionals and patients. Discussion and implications: This study shed light on both the advancements and gaps in measuring DT within European healthcare systems. The analysis reveals a strong commitment among several European countries to evaluate digitalization through the development of specific KPIs, emphasizing the importance of measuring and tracking digital health initiatives. Despite this progress, challenges such as resource allocation and data availability persist, hindering comprehensive monitoring and evaluation across all nations. The study's implications for scholars include gaining insights into how countries prioritize, measure, and allocate resources for digital health initiatives. By systematically comparing KPIs, scholars can map the direction of DT journeys across countries and contribute to the literature on DT in healthcare. Practitioners can benefit by benchmarking KPIs against those of other countries and refining their performance monitoring systems. Additionally, insights into user experiences with digital health platforms offer valuable guidance for optimizing DT initiatives. Limitations of the study include its focus solely on European Union countries and reliance on Google Scholar as the primary database. Future research could expand the scope to include other geographical areas, delve deeper into single countries' experiences, and explore interconnected effects and strategic decisions facilitating digital transformation. In conclusion, the study emphasizes the importance of concretizing measures for DT in healthcare to provide actionable insights for measurement and management. Despite varying strategies among EU member states, all countries must eventually adopt metrics to measure DT in healthcare to align with EU policies and regulations.