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Design Science Research as a Methodology in Health Information Systems: An Overview

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Abstract

Background: Research in the information system (IS) field employs diverse methodologies and paradigms shaped by assumptions about reality, knowledge, and nature of research problems. The interdisciplinary and sociotechnical nature of IS has led to ongoing debate regarding its identity and appropriate research paradigms, which can be challenging for researchers in emerging domains such as health informatics (HI). This paper provides an interpretive and accessible overview of Design Science Research (DSR) as a prescriptive research paradigm in health informatics.

Methods: A narrative review of seminal IS and DSR literature, together with recent studies applying DSR in healthcare, was conducted. Thematic analysis was used to examine targeted problems, types of artefacts, design processes, interactions with the knowledge base, and evaluation approaches.

Findings: The findings show that DSR supports the development of diverse artefacts in healthcare, including system instantiations, methods, and models, and enable the integration of theory and practice through iterative design and evaluation. DSR emphasizes rigor through continuous interaction with knowledge bases while maintaining flexibility in its processes and forms of contribution.

Conclusion: The study highlights the relevance of DSR for addressing complex healthcare challenges and provides insights to guide researchers and practitioners in applying DSR within resource-constrained developing healthcare contexts – such as the Libyan.

Keywords: Design Science Research (DSR); Health Information Systems; Health Informatics; Digital Health; Information System Research; Low-and Middle-Income Countries

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1. Introduction

Information systems (IS) has evolved as an academic discipline that explores the innovative use of IS in organizations. Significant scholarly effort has been devoted to consolidating its core foundations and identifying its boundaries and research paradigms [1]. As a multidisciplinary applied social science [2], the field addresses complex socio-technical systems [3] that must be designed, developed, and implemented to support strategic, managerial, and operational objectives in organizations. Information system development (ISD), a core subarea of IS, can be understood as an organizational change process aimed at producing computer-based systems [4]. Given the importance of managing both technical and organizational change, ISD is typically regarded as a context-sensitive and iterative process.

Research in IS has been conducted by scholars from diverse disciplinary backgrounds who are interested in investigating the phenomena that arise from the design and use of information systems in organizational settings. IS research examining the social, organizational, and technical aspects of ISs, although research outcomes may sometimes be overshadowed by the rapid pace of change in ICT. Emerging technologies often lead to new or redesigned work processes and consequently generate new research questions [1]. As a field, IS draws on several related disciplines, including computer science, computer systems engineering, and social sciences [1]. The diversity of the field frequently stimulated debate regarding issues of relevance, identity, rigor and theory development [4]. The lack of clear and well-established foundational theories has been suggested as one possible explanation for these ongoing debates [1, 4], which has motivated calls for stronger conceptual development and more active theory building within the field [4].

Research in IS employs a variety of theories and frameworks drawn from reference disciplines to study the social phenomena that arise from the interaction between ISs and their organizational context [4, 5]. This behavioral perspective assumes that underlying patterns and explanations of these IS phenomena can be discovered and theorized [6]. Contextual phenomena requiring attention and management include stakeholder politics, requirements definition, development team dynamics, change management, and technology appropriation [4]. The outcomes of such research enhance our understanding of IS, their behavior, and factors that enable or hinder their effective implementation. At the same time, these insights contribute to the development of an integrative body of IS knowledge that embraces sociotechnical perspective and inform both research and practice [4]. While these insights are valuable, scholars have also emphasized the need for research that focuses on developing and evaluating practical solutions to organizational problems. In this regard, two broad research paradigms can be distinguished within IS: descriptive and explanatory research, which seeks to explain phenomena, and prescriptive

research, which focuses on designing and evaluating solutions [3, 6].

Descriptive and explanatory research in IS focuses on the social phenomena and seeks to explain the behavioral and organizational aspects that influence successful IS implementation [6]. Such research commonly draws on behavioral science theories including the theory of planned behavior, the theory of reasoned action, and technology adoption models such as the technology acceptance model (TAM), and the Diffusion of Innovations (DOI) theory. Often this type of research treats the IS itself as a "black box", assuming the technological artefact as given while focusing primarily on its use and effects within organizational context. As a result, it may overlook the interdependence between the system design and its social and organizational environment [7]. This limitation has motivated the development of design-oriented research approaches in IS, which focus explicitly on the creation and evaluation of innovative artefacts.

DSR, as a prescriptive research paradigm, focuses on the design, development, and evaluation of information systems with the aim of solving organizational problems and generating utility. The outcomes of such research include artefacts and theories concerning their design and validity. DSR recognize a wide range of artefacts as legitimate research outputs, including complete systems, design deliverables, and practical design principles. This perspective provides the flexibility required to study complex systems such as HIS. Consequently, the artefacts developed through DSR are typically contextualized, evidence-based, practical, and rigorously evaluated. Through this process, DSR contributes to the accumulation of knowledge by developing and refining a body of disciplinary knowledge that is produced by researchers and applied by practitioners [4].

Health Information Systems (HIS) share the fundamental characteristics of IS while also being developed to support complex healthcare processes. Healthcare processes possess distinctive characteristics, including multidisciplinary collaboration, political influence [8], high level of uncertainty, limited resources, and the involvement of highly independent professionals [9].

This paper provides an accessible and interpretive overview of design science research to explain, contextualize, and reflect on its identity, practicality, and relevance to research in health IS. The objectives include synthesizing insights from key studies and representative research in the field, and shedding light on the foundations, origins, positioning, processes and outcomes of this research paradigm. In doing so, the paper aims to increase awareness of DSR – particularly among local researchers – and highlight its importance and relevance to research in health informatics. Furthermore, the paper explores how DSR concepts and outcomes can inform future research and practice with the Libyan health informatics context.

2. Methodology

This study adopts a narrative review approach to examine the use of Design Science Research (DSR) as a methodological framework in health information systems and health informatics research. A narrative review was considered appropriate because the purpose of this study is to conceptually clarify and contextualize DSR within the healthcare domain, rather than to systematically map or quantify all existing studies. Narrative reviews are particularly suitable for methodological topics, where interpretive synthesis and conceptual discussion are required.

The literature included in this review was purposefully selected to represent influential contributions to the development of DSR as well as representative studies applying DSR in healthcare and health informatics contexts. Studies applying DSR in healthcare showcase the diversity of artefacts and study locations and included those published between 2015 and 2024. The review therefore draws on both seminal methodological publications and recent empirical studies illustrating the application of DSR in healthcare-related research.

Relevant literature was identified through searches conducted in PubMed and Google Scholar, which were chosen due to their broad coverage of healthcare and interdisciplinary research. Citation tracking was also used to identify influential references frequently cited within DSR literature.

Selected publications were analysed using a thematic analysis approach, focusing on how DSR is conceptualized, applied, and evaluated in healthcare-related research. Key information extracted from each study included the research objectives, type of artefact developed, methodological framework used, evaluation approaches, and type of knowledge contribution. The extracted information was manually organized into thematic categories to identify recurring methodological patterns and illustrative examples of DSR applications in healthcare. The thematic organization of the reviewed studies is summarized in (Table 1)

This review does not aim to exhaustively identify all studies employing DSR in healthcare. Instead, it provides a conceptually informed overview of key approaches, influential contributions, and practical lessons relevant to the application of DSR in HI research. Another limitation worth mentioning is the possible selection bias, although efforts were made to include representative, diverse, and relevant empirical studies.

3. Design science research

DSR is a problem-solving research approach with its roots in engineering and design disciplines. Its primary focus is the development of artefacts and the generation of knowledge about their design and

effects within organizational environments. DSR typically follows an iterative process of building and evaluating artefacts, guided by knowledge derived from kernel theories originating in reference disciplines. Through this process, DSR engages in a process of learning through the act of building, seeks to address organizational problems, develops relevant and practical solutions while simultaneously contributing to scientific knowledge [10, 11]. DSR has also be described as trans-disciplinary, sociotechnical research methodology and proposed as the most adequate for digital transformation in healthcare [12].

In DSR, artefacts refer to constructs, models, methods, or instantiations created to address organizational problems. Artefacts are considered solutions and could be in form of new implementation process, healthcare pathway, human/computer interfaces, or new technical/social/informational resources [12]. Constructs represent the vocabulary and symbols used to describe problems and solutions; models provide abstractions and representations of the problem space and potential solutions; methods consist of procedures and algorithms that guide problem solving; and instantiations represent implemented systems or prototypes that operationalize these elements [6]. Artefacts may therefore exist as tangible technological systems, conceptual models, or structured processes designed to improve existing situations [13]. The environment in which artefacts are applied – namely the organizational and social context – is considered crucial for ensuring that artefacts are well designed and effective in practice [6, 14].

DSR contributes to the knowledge base of IS through both artefacts and design theories [15]. Behavioral science research complements DSR by helping to understand and predict the phenomena surrounding the use and impact of artefacts [3]. Both paradigms contribute to and draw upon the IS knowledge base, which consists of accumulated findings from prior IS research as well as theories from reference disciplines. These reference theories are often referred to as kernel theories and typically originate from the natural science's behavioral sciences [10]. The knowledge base also provides the conceptual frameworks and methodologies necessary for conducting the iterative build – evaluate cycles that characterize DSR. As these theories and frameworks are applied in solving practical organizational problems, they are assessed and refined, thereby contributing to the advancement of IS knowledge [6].

Design theory represents an important outcome of DSR by providing prescriptive guidance for the design of artefacts and actions required to implement them effectively. Such theories are developed through processes of inference and circumscription during the design and evaluation phases of DSR [16]. Cognitive activities of abduction, deduction, and abstraction create opportunities for developing and refining both kernel theories and design theories [10, 16]. Within this perspective, theory building

occupies a central position in DSR activities, linking problem diagnosis, technology design, and artefact evaluation. The resulting knowledge highlights the relationship between the problem space, the solution space, and the utility that connects them [17].

DSR contributions may also be classified according to different levels of knowledge. At the first level, the artefact represents a specific instantiation designed to address a particular problem. The second level corresponds to nascent design theories (mid-range design theories) expressed in the form of constructs, models, methods, or design principles. The third level involves well-developed design theories that provide generalized explanations and guidance for designing artefacts related to the phenomenon under investigation [13]. Another framework categorizes DSR projects as invention, improvement, exaptation, or routine design [13]. Invention involves developing new artefacts to address new problems, whereas improvement focuses on developing new artefacts to solve known problems, exaptation refers to applying existing artefacts to new problems, while routine design involves applying well-known solutions to well-defined problems and typically does not generate new research knowledge. The key distinction between DSR and routine design lies in the fact that DSR is scientifically grounded, rigorously documented, and intended to contribute to both scientific and technological knowledge.

Several methodological frameworks have been proposed to guide the conduct of DSR. One of the most widely used approaches is the methodology proposed by Peffers and colleagues, which include six activities: problem identification, definition of objectives for a solution, design and development, demonstration, evaluation, and communication [5]. In addition, Hevner and colleagues proposed seven guidelines for effective DSR, emphasizing that research should produce a viable artefact, address a relevant problem, rigorously evaluate the artefact, provide a clear research contribution, apply rigorous research methods, follow an iterative research process, and communicate results effectively [6]. Building on these principles, the three-cycle view of DSR describes the interaction between the relevance cycle, which connects research with the application environment; the rigor cycle, which links research to the knowledge base; and the design cycle, which represents the core process of building and evaluating artefacts. This view was later extended to include a fourth cycle (change and impact cycle) to cope with the dynamic nature of the artefact and its induction of organizational change [18]. Another process model proposed by Viashnavi and Kuechler includes five stages: awareness of the problem, suggestion, development, evaluation, and conclusion [16].

In a different perspective based on the premise that artefacts embody the design theories on which they are based, reverse engineering has been suggested as a useful approach for uncovering underlying

design knowledge. Reverse engineering refers to the process of analyzing a product to determine how it functions, often for the purposes of duplication, maintenance, or modification. Likewise, reverse design can be used to reveal design principles and design theories that underpin an artefact by examining its structure and behavior [3].

DSR is particularly well suited for addressing complex real-world problems, often described as wicked problems, where multiple social and technical elements interact to form sociotechnical systems [6]. Healthcare environments represent a typical example of such complexity. Healthcare processes are characterized by multidisciplinary collaboration, political influences, high levels of uncertainty, limited resources, and involvement of highly independent professionals [8]. These characteristics make the development and implementation of HIS particularly challenging and reinforce the relevance of DSR as a research approach capable of addressing such complexity through iterative design, stakeholder collaboration, and rigorous evaluation.

Despite its strengths, several challenges are associated with conducting DSR projects. Designing effective artefacts often relies on the researcher's creativity, intuition, and experience, combined with iterative experimentation and trial-and-error processes [6]. Another challenge involves identifying and appropriately applying concepts and theories from reference disciplines to ground the research [3]. In addition, DSR outcomes may become perishable due to rapid technological advances that quickly render certain solutions obsolete [6]. Debates within the IS community also continue regarding the nature of theoretical contributions in DSR and whether research outcomes should primarily take the form of artefacts, theories, or a combination of both. Some even propose a different classification for artefact types developed in DSR projects to include eight types: system design, method, language/notation, algorithm, guideline, requirements, pattern, and metric [19]. Practical challenges may also arise in applied contexts such healthcare, including difficulties in engaging busy healthcare professionals, the significant time and resources required to complete DSR projects, and the potential for organizational resistance when interventionist research approaches are introduced [8].

HISs shares the fundamental characteristics of information systems while also being designed to support complex healthcare processes. These processes are multidisciplinary, politically influenced, uncertain, and often constrained by limited resources. This paper therefore provides an accessible and interpretive overview of DSR in order to explain its foundations, contextualize its role in HIS research, and reflect on its practical relevance. The paper aims to synthesize insights from key studies in the field, shed light on the origins, processes, and outcomes of DSR, and increase awareness of this research

paradigm, particularly among practitioners and researcher working in health informatics within the Libyan context.

4. DSR application in healthcare

The application of DSR in HIS research led to the development of a diverse range of artefacts aimed at addressing complex healthcare challenges. These artefacts include system instantiations, method artefacts, and model artefacts, each contributing to both practical problems solving and the advancement of knowledge. Across the reviewed studies (Table 1), DSR demonstrates flexibility in addressing healthcare problems through context-sensitive design, stakeholder engagement, and theory-informed development.

4.1. Instantiation artefacts

Instantiation artefacts identified in the reviewed studies include mobile applications, decision support tools, and online service platforms. These artefacts are typically designed to address real-world healthcare problems and are often co-developed with end users to ensure relevance and usability. Furthermore, the proposed solutions are grounded in theories and frameworks drawn from established knowledge bases, thereby bridging the gap between theory and practice.

For example, Dang et al. developed a mobile application to improve adherence to oral medication among cancer patients in Australia [20]. The application represented an enhanced version of an earlier system that had limited effectiveness and user acceptance. The authors argue that the use of DSR enabled them to overcome prior design limitations through iterative refinement, deeper stakeholder engagement, and rigorous evaluation. In addition to grounding the developed digital health solution on behavioral science theories to persuade users and deploy behavioral change effects.

Similarly, a Hospital-based Business Intelligence System (HBIS) was developed to support performance monitoring and decision making in Taiwan [21]. Using DSR, the researchers designed, developed, and validated the system while also producing practical guidelines for future implementations. The study highlights the novel application of DSR in a non-traditional domain, demonstrating its applicability beyond conventional IS contexts and addressing the research gap of inexistence of an appropriate methodology for the construction and assessment of HBISs.

Another study developed an online pharmaceutical service to support chronic disease management by enabling active participation of community pharmacists in Portugal [22]. The design process incorporated multiple data collection methods, including surveys, observational (time-and-motion) studies, and semi-structured interviews, and employed service modelling techniques alongside agile

development practice. The authors emphasized that DSR was particularly suitable due to its sociotechnical orientation, its focus on artefact creation, and its ability to bridge theory and practice.

Collectively, these studies illustrate that instantiation artefacts in HIS research are characterized by strong stakeholder involvement, sound scientific foundation, and context-aware design; besides practicing deeper problem analysis and extensive development process.

4.2. Method artefacts

In addition to system instantiations, DSR has been used to develop method artefacts that provide structured approaches for addressing healthcare problems. These include guidelines, process models, and organizational routines aimed at improving system design, interoperability, and operational performance.

One example involves the development of guidelines for selecting eHealth standards to address interoperability challenges in HIS within a South African context, with implications for Low-and Middle-Income Countries (LMIC) [23]. The artefact was developed using the five-step process proposed by Viashnavi and Kuechler, incorporating additional four sub-cycles – awareness, suggestion, and development – within the development phase. The study emphasized that the detailed documentation of the DSR process constituted a contribution in itself, particularly given the limited transparency in pertinent prior research. The method artefact was evaluated using a descriptive case study approach, employing qualitative observations and scenario-based analysis.

Another study developed a health analytics process model to address the lack of standardization and limited acceptance of existing analytical approaches [24]. The researchers adopted DSR to construct a theoretically grounded model by synthesizing knowledge from multiple disciplines, including management science, software engineering, and data mining. The study identifies its contribution as exaptation, referring to the adaptation of existing solutions to a new healthcare context. However, iterative DSR cycles were not clearly demonstrated, as the artefact appeared to be developed through a single pass of the methodology.

A further example involves the development of outcome-specific routines to improve patient flow within a hospital in the UK [8]. In this study, DSR principles were applied implicitly through a cyclical process of design and evaluation. The researchers adopted the Context-Intervention-Mechanism-Outcome (CIMO) logic as a guiding framework, enabling the development of context-sensitive interventions and mechanisms for reconciling stakeholder differences. The study highlights the importance of integrating theoretical insights, from process management in this case, with practical considerations to support organizational change.

These examples demonstrate that method artefacts play a critical role in HIS by providing transferable knowledge and structured approaches that support both system design and organizational improvement.

4.3. Model artefacts

The third category of artefacts identified in the reviewed studies is model artefacts, which provide conceptual representations and architectural designs for HIS. One study developed a model representing the architecture and prototype of an integrated Personal Health Record (PHR) system that enables patients to manage their health data and interact with multiple health information systems within the Indonesian healthcare system [25].

The development process followed established DSR guidelines, incorporated the relevance, design, and rigor cycles, and demonstrated iterative design and evaluation. Evaluation was conducted through qualitative interviews with IT and eHealth experts to assess feasibility and applicability of the model. In addition to its theoretical contribution, the study provided practical guidance for stakeholders involved in designing integrated PHR systems, particularly within LMIC – addressing the gap of lack of utilization of DSR for mHealth research in such context.

4.4. Evaluation practices in DSR-based HIS research

Evaluation represents a central component of DSR and was consistently applied across the reviewed studies using a variety of approaches. These included usability testing, mixed-methods evaluations, and field studies, often grounder in established theoretical frameworks.

For instance, usability evaluations of decision support systems employed standardized instruments such as Post-Study System Usability Questionnaire (PSSUQ) alongside established IS success models [21]. In other cases, mixed-methods approaches combined quantitative surveys with qualitative interviews to capture both measurable outcomes and user experiences. Field studies incorporating task-based scenarios and observational techniques, including eye-tracking [22], were also used to assess system usability and contextual fit.

These evaluations strategies demonstrate a strong emphasis on user-centred and context-sensitive assessment, reflecting the socio-technical nature of HISs. They also highlight the importance of combining multiple evaluation methods to ensure both rigor and relevance.

Table (1) Thematic analysis of reviewed studies

Ref	Artefact - country	Targeted problem	Objectives	DSR process	Utilized knowledge	Evaluation type	Knowledge contribution
Adebesin, F 2017 [23]	Method: Selection Method for eHealth interoperability (SMeHI) – South Africa	lack of guidance for LMIC for selecting eHealth interoperability standards	Develop a generic method for the selection of systems interoperability standards	Vaishnavi et al 5-stage method over 3 sub-iterations	prescriptive from DSR knowledge base AND descriptive from eHealth knowledge base	descriptive and observational evaluation; case study analysis	prescriptive knowledge for selecting eHealth standards and maps improvement quadrant
Ahangama, S 2015 [24]	Method: Unified structured Analytical Method (USAM) – Singapore	lack of standardized methodology for Health Analytic (HA)	the orderly conduct of HA and provide support for novice analysts	Vaishnavi et al 5-stage method	reviewing previous data mining models	case study analysis and formative evaluation	prescriptive knowledge for conducting HA projects that maps exaptation quadrant
Dang, T.H., et al 2024[20]	Instantiation: mobile app to address Medication Adherence (MA) for cancer patients in Australia	lack of cancer patient's adherence to medication routine	design and develop an app to address medication non-adherence	Peffer et al's 6 stage method over 2 iterations	behavioural science, current interventions addressing medication non-adherence	mixed method study: quantitative survey and qualitative interviews	1)Prescriptive : use of DSR in health context. 2) to the literature of MA interventions
Harahap, N.C 2023 [25]	Model: integrated PHR model and high-fidelity prototype – Indonesia	lack of understanding of design requirements of integrated PHR in LMICs	develop a well-integrated PHR in tiered health system in Indonesia	a process guided by Hevner 7 guidelines and three-cycle view of DSR	PHR implementation literature AND health application architecture development	qualitative (eHealth experts' interviews)	prescriptive guiding PHR implementation and contributions to the PHR research
Johnson, M., 2020 [8]	Method: outcome-specific routines – England	suboptimal productivity in a hospital in the UK due to inefficient patient flow	design and develop theoretically grounded user-based work routines to produce favourable productivity outcomes	implicit and guided by DSR principles and the CIMO logic:	socio-technical perspective, operation, and change management	quantitative evaluation: performance measurement	prescription: DSR bridging theory and practice AND literature of process improvement in healthcare
Kao, H. 2016 [21]	IS instantiation: Hospital-based Business Intelligence System (HBIS) - Taiwan	lack of implementation of well-integrated HBIS for indicator management	development, implementation, and evaluation HBIS	Peffer et al 6- stage method	BI systems and their application in healthcare	usability testing using a questionnaire	prescriptive knowledge: guidance for HBIS design and development

Ref	Artefact - country	Targeted problem	Objectives	DSR process	Utilized knowledge	Evaluation type	Knowledge contribution
Lapão, L.V. 2017 [22]	IS instantiation: ePharmacare – Portugal	integration of community pharmacists in multi-disciplinary Chronic Disease Management (CDM)	design online pharmaceutical services to enable community pharmacists to contribute to CDM	Peffer et al 6-stage method	pharmaceutical care provision services and IS evaluation literature	semi-structured interviews, usability testing, eye-tracking glasses	to CDM and prescriptive knowledge of the development of online pharmaceutical service
Sumarsono, S., et al., 2023 [26]	IS instantiation: mHealth application - Indonesia	address the prevalence Non-Communicable Diseases (NCD) in rural areas	design mHealth application addressing NCD in rural areas	Peffer's s6 stage method	mHealth and IS implementation literature	TAM based evaluation for the app	prescriptive knowledge of mHealth application development in LMIC

5. Discussion

Research in HIS and HI draws on two complementary paradigms: social science and design science. Social science research, with its roots in the natural sciences, seeks to generate descriptive knowledge by explaining the phenomena that arise from the implementation and use of HIS within their social and organizational contexts. In contrast, DSR focuses on producing prescriptive knowledge through the development of artefacts intended to address practical problems. The iterative nature of DSR, its integration of design as a central research activity, and its adoption of a sociotechnical perspective make it particularly well suited for addressing complex IT-enabled intervention in healthcare [15].

The findings of this study demonstrate that DSR has been successfully applied in a wide range of HI research projects. The artefacts produced are diverse, including methods, models, and system instantiations, and have been applied across various domains and contexts, including LMICs. Most of the reviewed studies contributed prescriptive knowledge in form of design principles, documented design processes, and what are often referred to as mid-range design theories. Furthermore, DSR's emphasis on rigor was evident in key stages of the research process, particularly in defining solution objectives, where researchers draw upon both social and technical knowledge bases to inform artefact design. However, the extent to which DSR principles are applied varies across studies. While some research explicitly follows established DSR methodologies and demonstrates iterative design cycles, others adopt more implicit or hybrid approaches, integrating complementary frameworks such as CIMO. In particular, limited evidence of iterative cycles in some studies suggests that the practical implementation of DSR does not always fully reflect its methodological prescriptions.

The reviewed studies also addressed a variety of important healthcare challenges, including IS

interoperability through standard selection, medication adherence, management of non-communicable diseases in resource-constrained settings, and improvements in healthcare productivity and outcomes in healthcare institutions. Much more healthcare challenges addressed by DSR approach were cited in literature [27]. The utility of the developed artefacts was consistently evaluated using appropriate methods, reinforcing rigor and relevance of DSR in this domain. A review study points out to DSR emphasis on the utility of developed mHealth applications as it strives to create user-friendly and beneficial applications [15].

Several challenges are associated with applying DSR in healthcare contexts. These include the limited availability of time among healthcare professionals, the demanding and often lengthy duration of DSR projects, and the reliance on the creativity and intuition of the designers in developing effective solutions. Despite these challenges, a number of best practices for applying DSR in health informatics can be identified. These include actively engaging users throughout the design process [27], systematically documenting design decisions and processes, maintaining iterative design cycles with continuous feedback, utilizing both qualitative and quantitative evaluation methods, and ensuring alignment with local organizational norms and available infrastructure.

DSR is particularly relevant for studying and improving healthcare information systems in developing healthcare environments, where organizational complexity and resource limitations coexist. Its emphasis on context-sensitive design, stakeholder engagement, and practical problem solving makes it well suited for addressing the unique challenges faced in such settings.

6. Conclusion

Design Science Research provides a powerful and practical methodology for innovating within health information systems. An interpretive overview has been offered in this paper that examined this research paradigm's conceptual foundations, underlying principles, and practical applications. DSR has been effectively applied across a wide range of health informatics contexts for developing a variety of artefacts. These artefacts are typically grounded in relevant theoretical foundations, developed through stakeholder engagement, and evaluated using rigorous and context-sensitive methods. The findings also suggest that DSR supports the integration of theory and practice, enabling the development of solutions that are both scientifically grounded and practically relevant.

At the same time, the analysis reveals variability in how DSR is implemented in practice. While some studies explicitly follow established methodologies and demonstrate iterative design cycles, others adopted more implicit approaches, integrating complementary frameworks and exhibiting limited

evidence of iteration. This suggests that, although DSR provides a structured methodological foundation, its application in health informatics remains flexible and context dependent.

Researchers in LMICs used DSR as the methodology for designing and developing mobile applications for addressing non-communicable diseases in rural areas, developing standard procedures for selecting eHealth standards to enable HIS interoperability, and developing a high-fidelity prototype for the design of integrated PHR to sustain patient-centric healthcare. All these artifacts adapted contextual factors, addressed significant health problems, and grounded on relevant scientific theories.

Overall, the findings reinforce the relevance and value of DSR in contexts where HIS solutions must be adapted to local clinical workflows, cultural factors, and resource constraints. It emphasize on sociotechnical design, problem solving, and practical utility, as well as its structured yet flexible approach, makes it especially suitable for generating actionable knowledge and advancing HIS in developing healthcare contexts.

7. Declarations

7.1 Conflict of Interest Statement

The authors have no conflict of interests to declare.

7.2 Funding Disclosure

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

7.3 Abbreviations

HI : Health Informatics
CIMO : Context-Intervention-Mechanism-Outcome
DoI : Diffusion of Innovation
DSR : Design Science Research
HBIS : Hospital-based Business Intelligence System
HIS : Health Information System
IS : Information Systems
ISD : Information System Development
LMIC : Low-and-Middle-Income-Countries
PHR : Personal Health Record
PSSUQ : Post-Study System Usability Questionnaire
TAM : Technology Acceptance Model

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