science, engineering and health studies

Research Article

Science, Engineering and Health Studies
https://lio1.tci-thaijo.org/index.php/sehs
ISSN (Online): 2630-0087

An operating model design of medical agile noninvasive data governance

Tiwaporn Innun[1], Sotarat Thammaboosadee[1] and Bordin Sapsomboon[2]*

[1] Faculty of Engineering, Mahidol University, Nakhon Pathom 73170, Thailand
[2] Faculty of Medicine-Siriraj Hospital, Mahidol University, Bangkok 10700, Thailand

***Corresponding author**:
Sotarat Thammaboosadee
sotarat.tha@mahidol.ac.th

***Received**: 04 April 2022*
***Revised**: 08 May 2022*
***Accepted**: 17 July 2022*
***Published**: 20 December 2022*

***Citation**:
Innun, T., Thammaboosadee, S., and Sapsomboon, B. (2022). An operating model design of medical agile noninvasive data governance. Science, Engineering and Health Studies, 16, 22020008.

ABSTRACT

Data governance is defined as general data management practices and redundant data structures; it sets direction and controls to ensure compliance with rules, policies, and regulations. However, large organizations with large amounts of data and complex structures require more focus on people and interactions, based on the agile concept. It entrusts a co-design and decision-making team with no invasion of the original role to support the organization's business in operations. The data should be embedded in the analysis group to sprint the data analysis cycles. This research focused on an operating model, the medical agile noninvasive data governance, which aimed to formally assign roles and responsibilities to groups with specific expertise. The resulting streamlined workflow benefited from various planning strategies for further healthcare services; thus, the healthcare organization in Thailand chose this as a case study. This research emphasized the roles and responsibilities throughout the organization to show a more accurate implementation process of the prototype. Implementation and evaluation were categorized into two levels: organizational and operational. An in-depth organizational-level interview evaluated the resulting the responsible-accountable-supportive-consulted-informed matrix for the policy establishment process. The operational-level assessment made the function of the concept visible through a role-playing representation of data operations. A questionnaire of role-playing roles was used for assessment in terms of agility, connectivity, redundancy, reducing roles, and process responsibilities. The highest level of overall satisfaction was 4.65 on a 5-point rating scale. After comparing the results of existing frameworks or studies, the researchers found that this prototype design was complete, with coverage of both roles and responsibilities of each level according to the organizational structure. It could streamline work processes and lead to analytics to connect with valuable, accurate, and transparent targeted outcomes for organizations.

Keywords: data governance; noninvasive data governance; agile; healthcare

1. INTRODUCTION

The data management system is necessary to understand the data structure of an organization because it creates or stores data permanently and destroys it at the end of its lifecycle. The data lifecycle may not be sufficient to adapt and compete with rapidly changing data. All data management functions are overseen by data governance, which is the fundamental concept for any organization. The concept and relationship between data governance and data management functions are illustrated in Figure 1. Data governance defines and enforces rules, regulations,

and etiquette on data manipulation processes, with the activity wheel's outer rim representing the content and context. Data management activities in the middle of the wheel are oversighted by data governance. The inner wheel presents the data management functions that require different sets of data governance decisions. On the contrary, other processes or times are used in all ten components (Henderson et al., 2017).

Moreover, organizations are increasingly adopting the agile way of working method beyond the information technology (IT) setting. Agile interactions include communication between working groups, assigning a team to work together on the design, and making project decisions through role assignments. Therefore, those interactions' responsibilities must be formal without aggression in the original role (Peeters et al., 2022).

Consequently, the perception of the personnel takes over, or the workload increases. The organization must consider the noninvasive data governance (NIDG) concept to define official roles and responsibilities in the work process without invading the actual responsibilities. The formal responsibility of doing so must not make personnel feel aggressive toward their previous duties or new tasks (Seiner, 2020). However, the agility of the operating model with regard to this framework is not mentioned.

Especially in the healthcare domain, data governance is an essential mechanism for directing, controlling, and verifying data management for quality and competition in terms of financial and human resources. For example, if the patient's disease and medical records were accurate, medical errors would be reduced. On the other hand, it may affect the quality of life because everyone who uses public health services prefers to receive the correct and appropriate information, which is considered a fundamental right of patients and their relatives.

Therefore, the researcher proposed the medical agile noninvasive data governance (MANI-DG) concept, which is specified in the operating model design and applied in public health services. It started with the management of the internal data operation process, which must be systematic, clear, and less complex. This would lead to the formal assignment of roles and responsibilities to the team, which would enable them to decide and operate quickly and iteratively regarding the project. It was different from the actual operation, which was modified after the completion of the project.

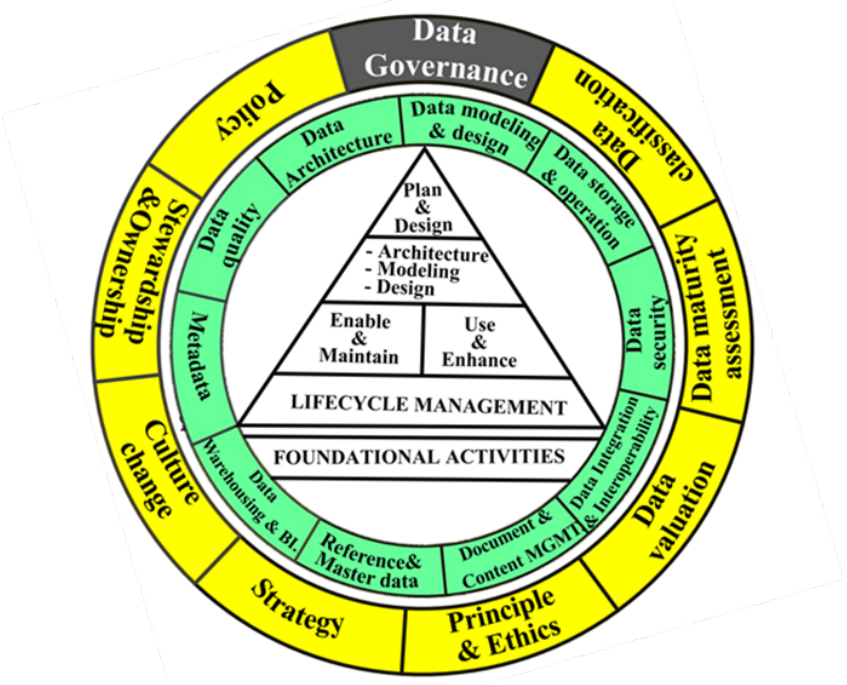

Figure 1. Data management functions oversight by data governance (Henderson et al., 2017)

1.1 Agile data governance

With the increase in the number of local and global information regulatory organizations, developing countries face challenges in implementing data governance programs that support the agility of managing corporate information assets. Therefore, based on literary studies and reviews, identifying the structure and streamlined data capabilities, data governance, and data management are essential. The research has found that there are restrictions on data governance that rapidly respond to changes in the information environment. Performing the following tasks effectively requires agile data governance (Lillie and Eybers, 2019):

1. Competence: this is the individual's skill in the team
2. Flexibility: flexibility in data transmission
3. Leanness: limiting the loss of resources during the process
4. Reusability: the efficiency of the iterative cycle; it affects the speed of delivering results
5. Scalability: scaling the data process to support growth
6. Speed: agility that can quickly deliver results
7. Responsiveness: recognize and respond to potential risks associated with data collection.

In determining the problems and screening, analyzing, and synthesizing the data, the research aimed to develop research models for agile governance and data

management following systematic literature review processes (Jia et al., 2015). Data management and restrictions exist in the organization, including the procedures, policies, and regulations within the agency and positioning and controlling technology and data to improve the organization's business. By studying the strengths of the agile scrum, the emphasis is on consistently delivering beneficial results to organizations in a short time. Moreover, they will be able to realize the benefits of data processes, such as accuracy, risk management, and quality data (Jia et al., 2015). These articles have proposed the methods of preparing, designing, and implementing data governance programs with agile configuration management methods. Creating a data governance framework requires the right people to make the right decisions, and it is essential to support senior management. Further-more, the framework has a data governance team leader, who can communicate with executives the value of the data governance program (Brickson, 2016).

During the pandemic, another critical factor in working with the agile concept may offer several benefits, including faster deployments, adaptability, and best-fit alignment to fulfill customer needs. The implementation of agile projects is a key to survival in the post-pandemic situation (Vestues et al., 2022).

1.2 Noninvasive data governance in healthcare

NIDG practices are established by the official in charge of data handling and organizing data operation processes (Seiner, 2020). Identifying official data related to the roles in the processes of each level provides a clearer view of the NIDG activities. Communication recognition and implementation in the organization can be measured as successful according to the formula presented in Table 1.

Whether Thailand's public health management system will adapt to digital transformation is still unclear. Nevertheless, information technology is engaging in the data management process in the public health system. It can alleviate the personnel burden primarily to ensure that the patients receive services effectively and improve their quality of life. Data governance in healthcare includes defining a framework for understanding the roles and decision-making rights in the data governance domain. The use of the agile approach promotes person-centered care (PCC). In particular, the agile processes help staff know how to honor preferences during quarantines, which necessitates a shift to individualized (not group) approaches for meeting the preferences of the social contact, comfort, and belonging (Abbott et al., 2022). The framework must provide the limitations of data governance components to lead an efficient data management process that aims to deliver data to the organization for further strategic planning (Stephens, 2018). A data-driven health program design puts people at risk of misuse or data breach of sensitive personal data. The digital health data governance model is presented in four main domains to ensure ethical use: consent, access protection, sustainability of data use, and enforcement of relevant laws that can digitize health information, reduce the risk of data misuse, and promote access to information for greater utilization (Winter and Davidson, 2019)

Table 1. Noninvasive data governance framework

Role	Component				
	Role (authority)	**Process**	**Communication**	**Metric**	**Tool**
Executive	Steering committee (delegate)	Endorse processes	Support sponsor understand	Metric approval act	Policy directive
Strategic	Council (decision)	Resolution processes	Meetings Status	Metric acceptance	Best practice guideline
Tactical	Domain stewards owners (subject)	Domain processes	Subject project	Domain metrics	Standards requirements workflow
Operational	Data steward (daily)	Daily processes	Orientation on-boarding ongoing	Daily measurements	Glossary dictionary metadata
Support	DG lead work groups partners (function)	Enforce processes	Plan develop deliver	Collect report metrics	Artifacts common data activity matrices

2. MATERIALS AND METHODS

2.1 Contribution of the existing frameworks

The related studies and contribution frameworks are explained in Table 2. According to the concept and theory applied to data processes. The assignment of rights, decisions, and responsibilities related to data governance was changed. The working group's tasks, roles and responsibilities did not take over the original duties. Therefore, the MANI-DG for a healthcare organization in Thailand has been proposed.

As shown in Figure 2, the overall process in the research to propose possible theories and ideas to determine the operating model through a NIDG program framework enhanced with the agile concept. The processes consisted of studying the status of the organization (organization structure, data policy, operating model, and stakeholder's interview), MANI-DG design, evaluation by in-depth interviews with stakeholders at the organization level and role-play (Pereira and Wahi, 2021) at the operational level, and analysis.

2.2 Studying current status of the organization

The Faculty of Medicine, Siriraj Hospital, Mahidol University, was selected as a case study. It is primarily responsible for providing medical services, supporting education, and research management. The primary units are both a clinic and a support line. Information management in the strategic plan was developed to determine the compass that guided corporate information management

goals toward the same direction as the reform of technology information management. In a data working group, the data were collected and managed by staff: they may data consult and collaborate with other departments as well as direct, supervise, and control the use of corporate data.

2.3 Design of MANI-DG

The researcher aimed to create the best view of defining the role and responsibility of the MANI-DG framework in a pyramid that indicated a clearer position, which works from the bottom of the existing organizational structure. As presented in Table 3, the roles and responsibilities, where decisions were made, differed at various levels.

2.3.1 Organizational level

Six purposive sampled assessors, selected from executives and experts, were extensively interviewed, regarding the position and nature of the current processes in the organization. The in-depth interview questions are presented in Table 4.

In Figure 3, the model adapted to the organizational structure, based on the agile concept in the decision-making process in data governance, to suit all levels of corporate action. The key stakeholders responsible for data processing appointed working committees at the executive and strategic levels of the board to support decision-making. In addition, the data working group at the strategic and support levels was assigned to be the leading operators in the organization's data processes to ensure smooth and agile operations throughout the organization.

2.3.2 The operational level

Eleven purposive sampled assessors were chosen as role-players. The role-play was performed by assigning roles and responsibilities to the working team for data processing, based on the concept of data governance. The process, role understanding, and satisfaction questionnaires are presented in Tables 5 and 6. The design and evaluation results in both levels are summarized in the next section.

Table 2. The related studies and the contribution frameworks

Study or framework name	Contribution
Data infrastructures for asset management are viewed as complex adaptive systems (Brous et al., 2014).	This work studied the complexity of adaptive systems of data governance to adapt and create prototypes that can be applied to all departments.
Challenges to agile project management during the COVID-19 pandemic: an emerging economy perspective (Vestues et al., 2022).	Researchers applied the concept of the essence of competence as an agile capability to the data management process of the COVID-19 pandemic.
DAMA-DMBoK2 framework (Henderson et al., 2017).	This book provides the definitions and functions of each data management component and data governance as well as creates a prototype that covers all elements of the data management process.
Governance, risk and compliance: conceptual muddle and technological tangle (Hardy and Leonard, 2011).	This paper investigated the importance of corporate governance risk management and compliance.
How to use relevant data for maximal benefit with minimal risk: digital health data governance to protect vulnerable populations in low- and middle-income countries (Tiffin et al., 2019).	A framework for data governance reduces the risk of health data breaches or abuse in digital health programs. Managing key components of each domain by emphasizing its relevance to vulnerable populations of low- and middle-income countries.
The conceptualization of data-driven decision-making capability (Jia et al., 2015).	They designed a model to define the roles and responsibilities in each position that need to make appropriately informed decisions.
Designing data governance in Brazil: an institutional analysis (Filgueiras and Lui, 2022).	They performed dynamics analysis to design a data governance framework in the field of data policy for the Brazilian Federal Government.
Data governance: how to design, deploy and sustain an effective data governance program (Ladley, 2012).	They studied the definition, set goals, and implemented data governance and management strategies to balance risk and opportunity to improve the organizational operating model.
Agile governance theory: conceptual development (Luna et al., 2015).	The study shows the concept of governance based on agility principles to increase the success rate of their practice, achieve operating model performance, and map its constructs, mediators, moderators, and disturbing factors to help organizations improve.
Quality and value of the data resource in large enterprises (Otto, 2015).	The study points to the importance of facing problems in managing the complex operating model of large enterprises.
Noninvasive data governance (Seiner, 2020).	This work proposed the guidelines for defining roles and responsibilities and applying them to the operating model by assigning the person responsible for the data governance process the roles and responsibilities.

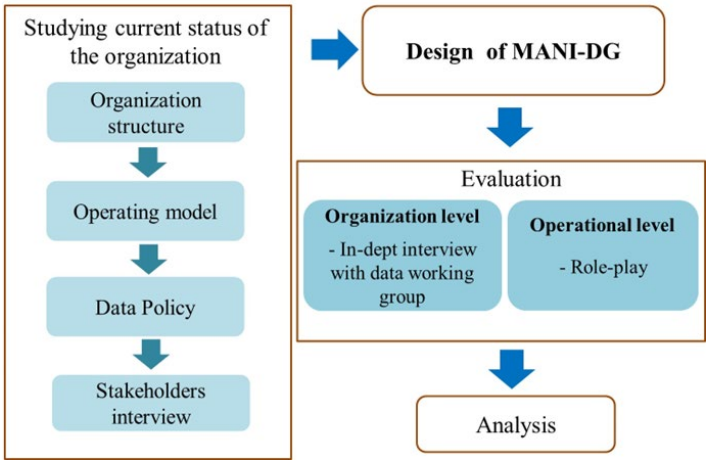

Figure 2. Overall research methodology

Table 3. Roles and responsibilities

Role	Responsibility
Executive level	The top level of the pyramid responsible for contributing is the data steering committee responsible for approving the organization's data governance.
Strategic level	The level management/representative of the data governance committee has the authority to certify/approve that the designed program enhances the organization through performance improvements.
Tactical level	Link at the strategic level assigned to the operational level in action, track, and performance reports. The tactical steward roles at this level are data steward coordination. Data domain stewards are authorized or appointed to oversee their data domains.
Operational level	The data custodian is formally appointed to maintain/verify/import data under the rules, regulations, and corporate policies.
Support level	Facilitate the delivery and support data governance activities at the level.

Table 4. In-depth interview questions at the organizational level

Category	Question
Position	1. Is it appropriate/clear to define the roles and responsibilities of data governance at each level? 2. Are personal knowledge and abilities suitable for the style of operation? How?
Operation	1. Can the roles and responsibilities at each level limit the loss of resources that impede the flow of processes? 2. Working together in different roles provides excellent flexibility and efficiency. Is it worth the speed of data delivery? How? 3. Delegated roles and responsibilities can reduce redundancy in the data preparation process. Is it able to deliver critical information quickly?

3. RESULTS AND DISCUSSION

An in-depth interview for evaluating the design of the MANI-DG at the organizational level gives a conclusion as a content analysis interview. Moreover, the operational level was a hypothetical representation of the co-researchers role to more clearly illustrate the data governance implementation process and assess using the role-playing satisfaction questionnaire.

3.1 Organizational level

Six data executives, experts, and stakeholders assessed the operating model and recommended appropriate rules and positions aligned with the organization's strategic plan. Then, the researcher analyzed the content and verbatim concepts until they were concluded in the form of operations, as presented in Figure 3

The MANI-DG's role in the data processes and the organization activity matrix is presented in Table 7. An example of the policy and data development process demonstrated the relationship between the data management process in the organization and the personnel's roles and responsibilities at different levels, which is relevant to the project. However, the RASCI matrix demonstrated the relationships of the processes, making it known that everyone involved has a role (Seiner, 2020). The scope of responsibility, "what is in it and to complete the process?", and at least one person must perform his/her duties, roles, and responsibilities in the responsible, accountable, and informative part of the process.

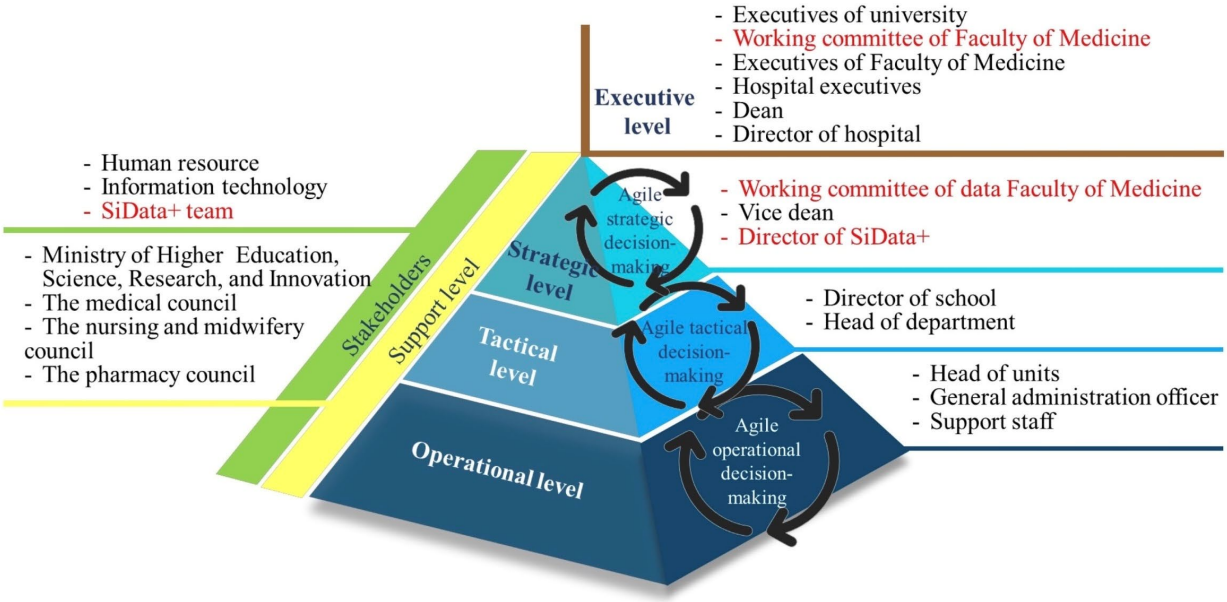

Figure 3. Medical agile noninvasive data governance

Table 5. Questionnaire at the organizational level

Categories	No.	Questionnaire at the organizational level
Position	1.	Is the designation of the roles and responsibilities of data governance consistent with the structure, regulation, and culture? Any precautions or considerations?
	2.	Is it appropriate to define each level's data governance roles and responsibilities? Any precautions or considerations?
	3.	Is the assignment of responsibilities and coherence in the roles and duties at the organizational and department levels appropriate? Any precautions or considerations?
Operation	4.	How are data governance roles and responsibilities aligned with the current responsibilities? Any precautions or considerations?
	5.	Is the assignment of roles and responsibilities at each level clear and practical? Any precautions or considerations?
	6.	Is the collaboration of each role at the identical level more streamlined? Any precautions or considerations?
	7.	Is the interaction of each role at different levels more evident? Any precautions or considerations?
	8.	The operating model can reduce redundancy in data-related workflows? Any precautions or considerations?
	9.	In actual operation, the tools need to be changed or developed in Information Technology (IT). How can it be successful and sustainable?

Table 6. Questionnaire at the operational level

No.	Questionnaire at the operational level
1	Assigning roles and responsibilities in role-playing makes work more agile?
2	Assigning roles and responsibilities can reduce redundancy in the data preparation process?
3	Are the roles and responsibilities of staff at each level clear?
4	Are responsibilities and coherence in roles and responsibilities within the organization placed?
5	Can assigning roles and responsibilities make processes, governance, and resources open, transparent, and accessible?

3.2 Operational level

After evaluating the operating model at the organizational level to operate under examples of the MANI-DG by role-playing and the responsibility of the operating model at the tactical and operational levels, the role-playing performance was assessed using a satisfaction questionnaire containing five items by order of statistical analysis in an annotated tabular form. The evaluation was performed with 11 personnel, as shown in its role-playing process in Figure 4.

Figure 5 presents the overall satisfaction level of the respondents' role-play. As can be seen from the figure, the respondents were satisfied at the highest level, with the average score of 4.65 and the distribution of satisfaction characteristics of the data preparation process of 0.48, as measured by the standard deviation.

Table 7. Medical agile noninvasive data governance: tool-activity matrix

Phase	Process	Role and responsibility					
		Executive level	Strategic level	Tactical level	Operation level	Support level	Stakeholder
Concept	1. Formulation of policies and data operations	I	A/R	S	S		I
Plan phase activities	2. Determination of value and risk	I/A	A			R	
	3. Budgeting and approval	I/A	A			R	
	4. Determine the operating model	I	A			R	
Execute phase activities	5. Standardization of accounting data set (metadata)	I/C	A	S	S	R	
	6. Internal communication	I	A	R	I	S	
	7. Linking and importing data to the system (metadata)	I	A	S	R	R	
	8. Architecture and design	I	A/S			R	
	9. Use data	I	A	I	S	R	
	10. Verifying accuracy and current data	I	A/I	I		R/S	
	11. Publish (announcement)	A	A/I	I		R/S	
	12. Linking data with external agencies	A/R	A/R			R	I
Close phase activities	13. Evaluation / review	I	A/R			R	
	14. Achieve	C	A/I	I		R	
	15. Destroy / cancel	I	A/I	I			I

Note: R: responsible, A: accountable, S: support, C: consult, and I: inform

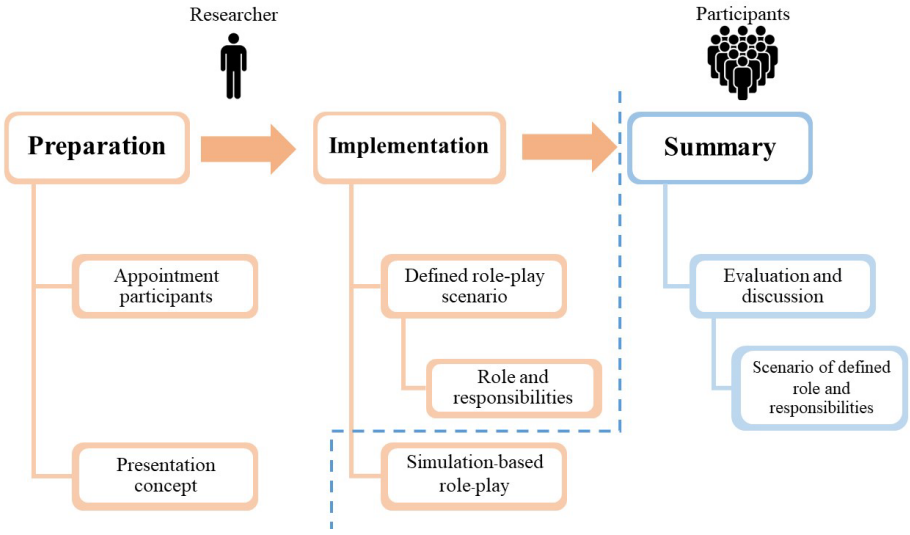

Figure 4. Process of role-playing

3.3 MANI-DG at operational level workflow

The results of MANI-DG's role-playing are summarized in Figure 6. It presented two dimensions: roles and data management activities. To begin with the project requirement or coordinator, a tactical level was assigned, and a working team for the project was formed. Then, the scrum master got a task from the head of the tactical level, brought it to the development team, and sprinted planning to determine the work, then the meeting was arranged. The development team then planned to assess, research, develop, and test some of the prototypes and then sent them to the team pilot to receive feedback for further development, review, and improvements. The process was iterated until the complete project was ready to be used by the whole organization. The development team had a daily meeting, in which the test demon was regarding the issue; for example, "What will you do today?" "What is the problem?" "What kind of help do you need?" Nevertheless,

if the problem could not be solved at the team level, it would be escalated to the scrum master.

A prototype operating model for the MANI-DG benefited the organization in assessing the organizational and operational levels. Hence, a working group was assigned to data controllers with roles and responsibilities for which data was most understandable. This must decide on each day's data and get accurate and approvable results. Data have been considered an asset based on the MANI-DG with an agile workflow, with communication and sprints throughout the process. The data stewards were the ones that understood the data and the impact of the decision-making functions. However, if the data controller could not plan, the top management would support and acknowledged them.

3.4 Comparative results with the existing framework

The main comparative contributions of the current study and framework and a summary of the evaluation results of the MANI-DG are presented in Tables 8 and 9, respectively.

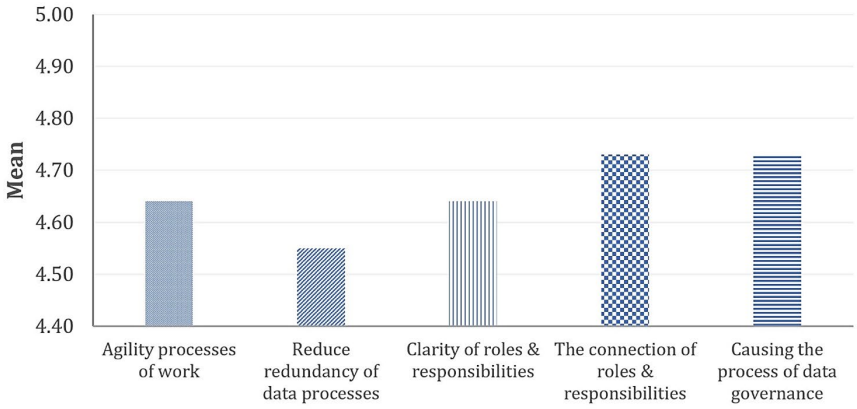

Figure 5. Assessment result of role-playing at the operational level

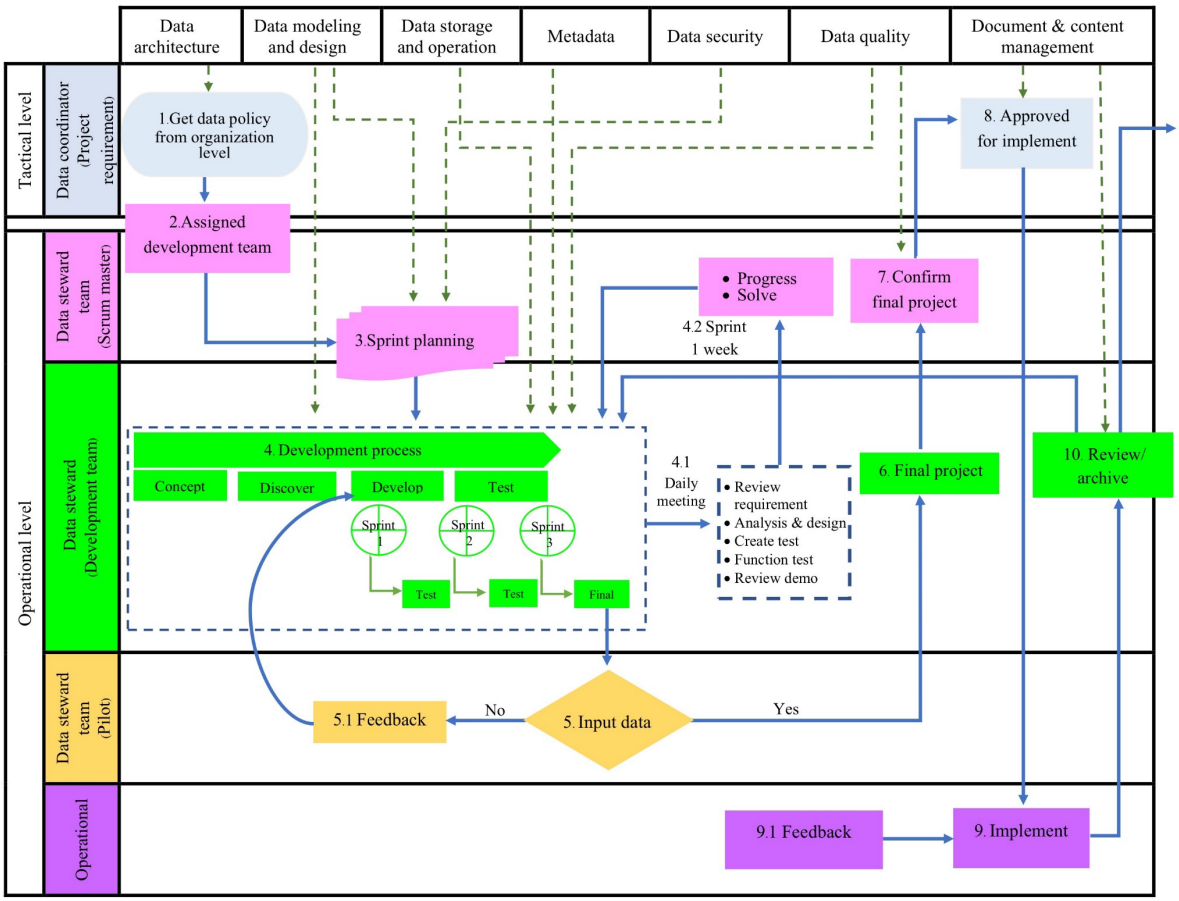

Figure 6. Agile noninvasive data governance workflow

Table 8. The advantage of medical agile noninvasive data governance (MANI-DG) compared with related study and contribution framework

Study or framework name	Advantage of MANI-DG
Data infrastructures for asset management viewed as complex adaptive systems (Brous et al., 2014).	The operating model and its agility are explained clearly.
Data governance: A conceptual framework, structured review, and research agenda (Abraham et al., 2019).	In designing a conceptual framework of data governance, the perspective of the worker should be taken into account as another element.
DAMA-DMBoK2 framework (Henderson et al., 2017).	More details in operational process design and proposes a novel evaluation method such as role-playing.
Designing data governance in Brazil: an institutional analysis (Filgueiras and Lui, 2022).	Data governance is path-dependent and shapes actions, situations, and understanding of the choices of tools and perspectives surrounding policy design.
Data governance: how to design, deploy and sustain an effective data governance program (Ladley, 2012).	More details in the operational process design and proposes a novel evaluation method such as role-playing.
Agile governance theory: conceptual development (Luna et al., 2015).	Application to data governance operating model.
Challenges to agile project management during COVID-19 pandemic: an emerging economy perspective (Vestues et al., 2022).	The agile concept provides benefits for deployment, the ability to quickly adapt to the assigned team, and the most suitable alignment to efficiently meet customer needs.
Noninvasive data governance (Seiner, 2020).	More details in operational process design with the agile/scrum concept.
How to use relevant data for maximal benefit with minimal risk: digital health data governance to protect vulnerable populations in low-income and middle-income countries (Tiffin et al., 2019).	Principles of micro-data governance for evaluating digital tools for health practitioners, including data governance and ethics for the development of unbiased health data governance standards.

Table 9. Summary of the benefits of the MANI-DG

Category	Advantage of MANI-DG
Agile	Provide new working ideas focused on people and communication, resulting in a streamlined workflow.
Operational model	Provide an operating model that outlines the interconnected processes of roles and responsibilities across the organization.
Specificity knowledge	Provides healthcare data routine approach leads to corporate strategic planning.
Role-playing	Clarifies the roles and responsibilities of the process from role-playing.
Culture change	Emphasizes the operation of new processes and makes data governance effective.

4. CONCLUSION

This research proposed a prototype of the MANI-DG for healthcare organizations in Thailand. The results of in-depth interviews with experts and corporate data stakeholders suggested that the MANI-DG can clarify the appropriate roles. There was a link in the placement of responsibilities, and the operating model emphasized accountability. The decision-making at each level streamlined operations, thus reducing redundancy in data processes through role assignment to personnel without making them feel aggressive toward their previous duties. The organization can consider the organization's data operating model to identify opportunities for further development. It can be concluded that role-playing through roles and responsibilities was apparent in the assignment of roles performed, agility in execution, smooth work linkages, communication with daily meetings, and simplification of the data creation process. This made the workpiece results accurate, fast, transparent, and accessible.

The limitation of this research is that the healthcare organization has a systematic work structure within the government, is large, and has many departments. As a result, the workflow is diverse and complex. Each agency will have its own data management, and the appropriateness of the application of this concept to each project should be considered, such as the requirement of a complete documentation. Approvals that require rigorous scrutiny may not be suitable for this concept in terms of flexibility. The organization must define the official roles and responsibilities of each level in an operating model that facilitates the adaptation of the MANI-DG to the characteristics of each organization, which enables the transition to change contexts continually.

ACKNOWLEDGMENT

This research is supported by the Institutional Review Board of the Faculty of Medicine Siriraj Hospital, Mahidol University, Thailand. (IRB4) 253/2564, No. COA: 374/2021, 25 May 2021.

REFERENCES

Abbott, K. M., Hulshult, A., Eshraghi, K., Heppner, A., Crumbie, V., Heid, A. R., Madrigal, C., Spector, A., and Haitsma, K. V. (2022). Applying agile methodology to reengineer the delivery of person-centered care in a nursing home: A case study. *Journal of the American Medical Directors Association*, 23(9), 1442-1447.

Abraham, R., Schneider, J., and vom Brocke, J. (2019). Data governance: A conceptual framework, structured review, and research agenda. *International Journal of Information Management*, 49, 424-438.

Brickson, P. (2016). *Implementing data governance with agile project management methodologies*. Master's thesis. The College of St. Scholastica, USA.

Brous, P., Overtoom, I., Herder, P., Versluis, A., and Janssen, M. (2014). Data infrastructures for asset management viewed as complex adaptive systems. *Procedia Computer Science*, 36, 124-130.

Filgueiras, F., and Lui, L. (2022). Designing data governance in Brazil an institutional analysis. *Policy Design and Practice*. [Online URL: https://www.tandfonline.com/doi/epdf/10.1080/25741292.2022.2065065?needAccess=true&role=button] accessed on April 16, 2022.

Hardy, C., and Leonard, J. (2011). Governance, risk and compliance (GRC): Conceptual muddle and technological tangle. In *Proceedings of the 22nd Australasian Conference on Information Systems*, 42. Sydney, Australia.

Henderson, D., Earley, S., Sebastian-Coleman, L., Sykora, E., and Smith, E. (2017). *DAMA-DMBOK Data Management Body of Knowledge*, 2nd, New Jersey: Technics Publications, pp. 17-52.

Jia, L., Hall, D., and Song, J. (2015). The conceptualization of data-driven decision making capability. In *Proceedings of the 21st Americas Conference on Information Systems*, pp. 811-823. Fajardo, Puerto Rico.

Ladley, J. (2012). *Data Governance: How to Design, Deploy and Sustain an Effective Data Governance Program*. Massachusetts: Morgan Kaufmann Publishers, pp. 7-20.

Lillie, T., and Eybers, S. (2019). Identifying the constructs and agile capabilities of data governance and data management: A review of the literature. In *Proceedings of the 10th International Development Informatics Association Conference*, pp. 313-326. Tshwane, South Africa.

Luna, A. J. H. de O., Kruchten, P., and de Moura, H. P. (2015). Agile governance theory: Conceptual development. In *Proceedings of the 12th International Conference on Management of Technology and Information Systems*, arXiv:1505.06701. Sao Paulo, Brazil.

Otto, B. (2015). Quality and value of the data resource in large enterprises. *Information Systems Management*, 32(3), 234-251.

Peeters, T., Van De Voorde, K., and Paauwe, J. (2022). The effects of working agile on team performance and engagement. *Team Performance Management*, 28(1-2), 61-78.

Pereira, A. S., and Wahi, M. M. (2021). Development and testing of a roleplaying gamification module to enhance deeper learning of case studies in an accelerated online management theory course. *Online Learning Journal*, 25(3), 101-127.

Seiner, R. S. (2020). *Non-Invasive Data Governance: The Path of Least Resistance and Greatest Success*. New Jersey: Technics Publications, pp. 11-20.

Stephens, J. J. (2018). *Data governance importance and effectiveness: health system employee perception*. Doctoral thesis. Michigan University, USA.

Tiffin, N., George, A., and LeFevre, A. E. (2019). How to use relevant data for maximal benefit with minimal risk: Digital health data governance to protect vulnerable populations in low-income and middle-income countries. *BMJ Global Health*, 4, e001395.

Vestues, K., Hanssen, G. K., Mikalsen, M., Buan, T. A., and Conboy, K. (2022). Agile data management in NAV: A case study. In *Proceedings of the 23rd International Conference on Agile Software Development*, pp. 220-235. Copenhagen, Denmark.

Winter, J. S., and Davidson, E. (2019). Big data governance of personal health information and challenges to contextual integrity. *The Information Society*, 35(1), 36-51.