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Management Model of Telemedicine Services in Post- Covid-19 Era: A Systems Thinking Approach

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ABSTRACT

To benefit community welfare, a set of policies to improve access to—and the quality of—basic health services by encouraging thorough efforts via technological adoption is necessary, such as by implementing telemedicine. This study aims to determine the readiness of telemedicine adoption and evaluate telemedicine implementation policies to enhance community welfare in the post-COVID-19 era. Using a case-study and qualitative descriptive method, the data were analyzed using Powersim Studio 10 through systems thinking approach. A post-COVID-19 Telemedicine Service Policy and Management Model was developed using system dynamics through simulation. Secondary data included COVID-19 case numbers and telemedicine platform usage during the pandemic. The findings reveal three key reinforcing loop (R) relationships in telemedicine service management: (1) the enhancement of service speed positively influences users' convenience; (2) the improvement of telemedicine provision enhances the service simplicity and users' convenience; and (3) a rise in telemedicine users stimulates improvements in service quality. These loops demonstrate mutual benefits, where advancements in one aspect positively affect others. These findings provide valuable insights for policymakers and providers to optimize telemedicine delivery in the post-pandemic era. Recommended actions include increasing public awareness of telemedicine's benefits and ensuring user-friendly platforms without compromising service effectiveness and efficiency.

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I. INTRODUCTION

National development serves as a key criterion for measuring a country's progress in achieving development goals, which prioritize the welfare and well-being of its people. Indicators of a respectable standard of living include adequate access to education, infrastructure, and essential services, particularly healthcare. In this regard, community-centered, integrated healthcare services play a crucial role in achieving universal health coverage, as outlined in the Sustainable Development Goals (SDGs) (Herrick et al., 2017; Haldane et al., 2019). As a member of the United Nations, Indonesia actively promotes the SDGs to enhance the welfare and health of its population across all age groups (Lestari, 2019). Indonesia's commitment for implementing the SDGs was demonstrated through the enactment of the Regulation of the President of the Republic of Indonesia (*Perpres*) Number 59 of 2017 on the Implementation of Achieving Sustainable Development Goals. Additionally, the National Medium-Term Development Plan (RPJMN) for 2020–2024 emphasizes promotive and preventive efforts, supported by innovation and technology, to improve access to—and the quality of—basic health services. For this reason, technological health measures are critical to develop (Chauhan et al., 2022), suggesting that collaborative efforts among the government, health service organizations, healthcare infrastructure providers, healthcare personnel, and patients are essential for advancing health technology. Through such collaboration, innovative health technologies can maximize societal benefits (Saputra et al., 2018).

The COVID-19 pandemic has profoundly reshaped healthcare systems worldwide, accelerating the adoption of telemedicine as a critical means for service delivery. Telemedicine, which utilizes digital communication technologies to provide healthcare services remotely, emerged as a lifeline during the pandemic. It enabled the continuity of patient care while minimizing physical contact and reducing the risk of viral transmission. As pandemic era causing global health crisis has shifted into post-pandemic era, the sustainability and optimization of telemedicine services have become a paramount to meet the evolving needs of healthcare systems and patients alike.

In the post-pandemic context, telemedicine holds the potential to address several critical challenges. It can bridge access gaps to healthcare services, especially in remote or underserved areas where physical healthcare facilities are limited. It also enables better management of chronic conditions through remote monitoring and virtual consultations, reducing hospital admissions and improving patients' conditions. Furthermore, by diversifying service delivery channels, telemedicine enhances the flexibility and resilience of healthcare systems in the face of future crises. Moreover, telemedicine empowers patients by providing greater convenience, reducing travel burdens, and offering more personalized care options.

However, despite these numerous advantages, the transition to a sustainable telemedicine practices are still hindered by challenges that necessitate a strategic and system-oriented approach. Disparities in access to digital devices, internet connectivity, and digital literacy exacerbate health inequities, particularly among vulnerable populations. Thus, it is still considered a significant hurdle to ensure seamless integration of telemedicine platforms using the existing electronic health records and other healthcare technologies. Besides, the lack of standardized regulations and reimbursement policies across regions complicates telemedicine implementation, while concerns about data security and privacy must be carefully addressed to maintain patients' trust. Additionally, both healthcare providers and patients require ongoing training and support so that they can effectively utilize telemedicine platforms.

To address these challenges, systems thinking approach provides a comprehensive way, namely by examining the interconnection among various elements within the telemedicine ecosystem. Three key principles of systems thinking, namely feedback loops, causal relationships, and dynamic modeling, can guide the development of a robust telemedicine management framework. By emphasizing collaboration, continuous learning, and adaptability, system thinking ensures that telemedicine services remain responsive to the dynamic needs of healthcare systems and users.

Telemedicine has emerged globally as a transformative solution to enhance healthcare accessibility and quality. In Indonesia, its alignment with the SDGs and national policies, including RPJMN 2020–2024, highlights its significance for improving community welfare. Several prior studies had explored the adoption, public perception, and challenges concerning telemedicine. However, a comprehensive analysis utilizing systems thinking to evaluate telemedicine service policy and management remains lacking. Therefore, this study aims to fill

this critical gap by examines the government's readiness, policy, and administration regarding telemedicine service management. This study, conducted in 2022 in Surabaya, Indonesia, examines this matter to provide a service policy framework for policymakers and governments in realizing a robust telemedicine service management in the post-COVID-19 era.

II. ANALYTICAL FRAMEWORK

As its research framework, this study integrates systems thinking and system dynamics to holistically examine telemedicine service management. By using causal loop diagram (CLD), the relationships among key variables influencing telemedicine effectiveness are visualized. This approach supports policy formulation through iterative simulation and validation using Powersim Studio 10.

Powersim Studio 10 was chosen owing to its robustness in modeling dynamic systems with user-friendly application interfaces for generating simulation and validation. It supports iterative refinements, which are crucial for capturing the complexities of telemedicine service management.

Telemedicine has been adopted in many countries to enhance the quality of healthcare services, mostly by facilitating remote consultations between patients and medical professionals via telephone, internet, and other communication devices (Nagra et al., 2021). Telemedicine provides real-time healthcare services over large distances (Hilty et al., 2013), which means it encompasses diverse applications, such as telepathology, telepsychiatry, teleradiology, teledermatology, and many more (Napi et al., 2019). It enables secure, cost-effective, and equitable patient-doctor communication while meeting demands for convenience, access, efficiency, and cost savings (Hall et al., 2015; Anderson et al., 2017).

The origin of telemedicine dates back to 1840–1920 through the use of telegrams and telephones for transmitting electrocardiograms. In the Post-World War II era, European militaries developed radio-based photo transmission, and during the 1950s–1980s, television and space technologies were incorporated, followed by digital advancements in the 1990s (Anonim, 2021). During the COVID-19 pandemic, telemedicine expanded rapidly through several platforms, such as WhatsApp, Skype, and Facetime, alongside the initiatives of private providers (Ohannessian et al., 2020).

In Indonesia, the use of telemedicine was piloted in DKI Jakarta before expanding to Bali, West Java, Central Java, and East Java, primarily in urban areas like Surabaya and Malang. Since 2003, these cities have leveraged information technology (IT) for urban administration purpose (Ministry of Health of the Republic of Indonesia, 2019). However, the government's limited readiness to implement telemedicine led to reliance on commercial platforms, particularly for self-isolation during the pandemic. Thus, a critical review of telemedicine policies and readiness is essential to address this issue so as to enhance community welfare.

The topic of telemedicine during the COVID-19 pandemic has been extensively studied in 30 international journals since 2020, but they primarily only focused on public acceptance, perceptions of virtual technologies in healthcare, and workforce adoption. In fact, there does not seem to be any study that specifically examines telemedicine policies and services through systems thinking approach. Systems thinking, defined as an analytical framework to understand, predict, and modify systems holistically (Arnold & Wade, 2015; Langen et al., 2022), is vital for addressing the complexities of practices, education, and policy in the health sector (Swanson et al., 2012). The application of systems thinking is particularly effective in managing health systems transformation, highlighting its potential to improve telemedicine services.

In the health sector, telemedicine has transitioned from a supplementary service to a central pillar of modern healthcare delivery. The COVID-19 pandemic has forced healthcare providers and policymakers to overcome long-standing barriers to telemedicine adoption, such as restrictive regulations, reimbursement challenges, and resistance to change. These efforts have resulted in a significant expansion of telemedicine infrastructure, users' capabilities, and acceptance between both providers and patients. However, as emergency measures and temporary policies introduced during the pandemic are reevaluated, the long-term integration of telemedicine into healthcare systems certainly requires careful planning and management.

The rapid deployment of telemedicine services during the pandemic has revealed both its potential and its limitations. On the one hand, telemedicine demonstrates its capacity to enhance healthcare accessibility, particularly for patients in rural or underserved areas, reduce the burden on overstrained healthcare facilities, and support chronic disease management. On the other hand,

several challenges, such as inequities in access to digital services, interoperability issues, data privacy concerns, and providers' readiness, underscore the need for a more structured and systematic approach for implementing a robust telemedicine service management.

III. METHODOLOGY

This study was conducted in Surabaya by employing a qualitative descriptive case-study approach, which was linked to place, time, and meaning of the research's scope. Due to the multifactorial, dynamic, and nonlinear nature of the situation, segregated knowledge from scientific silos was considered a hindrance to understand the interrelationship among the major variables selected (Leischow et al., 2008). Qualitative descriptive approach was chosen as it can observe and collect factual and actual meanings of a situation; investigate person, group, and daily activities; and explain or interpret a case and its context without being influenced by external factors.

The primary and secondary data were collected, then the data were examined using Powersim Studio 10 through systems thinking approach. Meanwhile, system dynamics simulation was employed to develop the post-COVID-19 Telemedicine Service Policy and Management Model. Secondary data from the COVID-19 pandemic, such as case numbers and platform users, were organized using causal loop diagram (CLD), building on the foundations of systems thinking, as defined by Sterman (2001) that CLD maps feedback relationships. The visualization depicted by CLD can highlight the dynamics of key variables within telemedicine ecosystem, such as users' behavior, service delivery speed, and administrative efficiency, enabling better-informed policy decisions.

After validated, the data were then simulated and interpreted. System dynamics included CLD, where data collection variables were causally related (Sterman, 2001). The simulation results will demonstrate telemedicine policy and management in the post-COVID-19 era based on the business-as-usual (BAU) scenario. The CLD depiction regarding societal responses about the pandemic shows how systems thinking may link public health concerns to their social relations, perceptions, attitudes, and behaviors (Bradley et al., 2020).

This study used mixed-method data collection, including desk study/literature study, survey, focus group discussion (FGD), and in-depth interviews. Several respondents, namely the informants who possess adequate knowledge of telemedicine policy and management, were chosen for purposive sampling. These respondents consisted of the city mayor; the head and staff of the Health Service Division in charge of the telemedicine service; members of the Regional People's Representative Council (DPRD) whose commission are relevant to healthcare; heads of public health centers (*Puskesmas*), hospitals, and their staffs; and community members.

IV. RESULTS & DISCUSSION

A. Knowledge of Telemedicine

Various aspects of telemedicine knowledge among respondents were assessed, in which the findings are displayed in Table 1. The majority of respondents (85.6%) were familiar with the concept of telemedicine, indicating a widespread awareness of its existence. This suggests that telemedicine has successfully penetrated public consciousness, most likely due to its prominent role during the COVID-19 pandemic. However, their awareness does not necessarily translate into practical usage, as evidenced by the fact that only 48.9% of respondents reported having used telemedicine services. This gap between knowledge and utilization highlights the need for strategies to encourage the practical adoption of telemedicine.

The recognition of telemedicine's urgency was nearly unanimous, with 98.5% of respondents acknowledging its importance. This overwhelming consensus underscores the critical role telemedicine plays in healthcare delivery, particularly to ensure accessibility during emergencies or when it is not possible to treat patient via conventional measures. Such high level of recognition by respondents reflects a good understanding of telemedicine as a vital tool in modern healthcare systems.

Despite the general awareness of telemedicine's importance, only 53.2% of respondents revealed that they knew how to use telemedicine services effectively. This finding reveals a significant gap in operational knowledge, which could hinder the widespread adoption and effective utilization of telemedicine technologies. For this reason, educational initiatives and user-friendly platforms are essential to bridge this gap and empower individuals so that they can reap the maximum benefits from telemedicine services.

Respondents also demonstrated a strong understanding of telemedicine's specific functions, as evidenced by 92.8% of them who were aware that telemedicine could be used to consult with healthcare personnel. This high level of awareness suggests that telemedicine is widely recognized as a tool for direct communication between patients and medical professionals. Furthermore, 88.6% of respondents understood that telemedicine could facilitate the ordering and redemption of medications. These findings strongly affirm telemedicine's potential to streamline the healthcare process by integrating consultations and medication services into a single, accessible platform.

However, the findings also highlight areas that require improvement, as evidenced by 46.8% of respondents who lacked knowledge on how to use telemedicine, as they represent a substantial portion of the population that may struggle to access its features. Moreover, 7.2% and 11.4% of respondents were unaware of telemedicine's consultation and medication functions, respectively, thus necessitating a more targeted awareness campaigns. These efforts should focus on educating the public about the telemedicine's full-range capabilities, emphasizing its convenience, efficiency, and capability to improve healthcare outcomes.

Table 1. Respondents' Knowledge of Telemedicine

Aspect	Yes	No
Knowledge of telemedicine	85.6%	14.4%
Use of telemedicine	48.9%	51.1%
Urgency level of telemedicine	98.5%	1.5%
Knowledge on how to use telemedicine	53.2%	46.8%
Understanding the function of telemedicine: can consult with medical professionals	92.8%	7.2%
Understanding the functions of telemedicine: can order and redeem medications through telemedicine	88.6%	11.4%

Overall, these findings illustrate a landscape where telemedicine is widely recognized but not yet fully utilized. Thus, addressing the gap between operational knowledge and practical usage is crucial for maximizing the potential of telemedicine to enhance healthcare accessibility, efficiency, and quality. By implementing targeted educational campaigns, simplifying platform usability and functionality, and addressing barriers to health access, stakeholders can ensure that telemedicine becomes an integral and effective element of healthcare delivery in the post-COVID-19 era. To realize this, the only option is to switch from a purposeful approach employed in "*normal times*" to an emergent knowledge strategy devised nowadays (Bratianu & Bejinaru, 2021).

B. Health Administration

In recognizing the urgency of telemedicine implementation and public responses about the increase of telemedicine educational campaigns, another critical aspect to consider is the effective administration of telemedicine services. Previous findings indicate that public is already aware of telemedicine's primary functions, namely providing convenient health consultations and facilitating the ordering or purchasing of medicines without the necessity to queue at health clinics. However, healthcare systems still face significant challenges, such as global medicine shortages (including life-saving drugs), barriers to accessing patient care, and a growing shortage of healthcare professionals (Khojah et al., 2021). To address these issues, three aspects were evaluated: the convenience of health administration services, the importance of maintaining the storage and tracking system of patients' activities in telemedicine applications, and the need to reduce document requirements for accessing healthcare services through telemedicine.

Table 2. Respondent's Awareness on the Role of Telemedicine in Health Administration

Aspect	Yes	No
The importance of ease in health administration	96.2%	3.8%
The importance of maintaining the storage and tracking system of patients' activities	87.3%	12.7%
The importance of reducing document requirements	92.3%	7.7%
The effectiveness and efficiency level of telemedicine services	98%	2%

As seen in Table 2, concerning the role of telemedicine in health administration, a significant majority (96.2%) of respondents emphasized the importance of ease in health administration processes. This finding highlights a widespread demand for streamlined administrative procedures that reduce the burden on both patients and healthcare personnel. Simplified procedures not only improve patients' satisfaction, but also enhance the overall efficiency of healthcare system.

Secondly, the importance of maintaining the storage and tracking system of patients' activities was recognized by 87.3% of respondents. This underscores the value of maintaining accurate and accessible records of healthcare interactions, as it can facilitate the continuity of care, support clinical decision-making, and improve patients' conditions. Telemedicine platforms, equipped with robust documentation and data storage capabilities, can play a pivotal role in addressing this need.

Thirdly, the importance of reducing document requirements was identified by 92.3% of respondents. Excessive administrative paperwork has long been a barrier for realizing efficient healthcare delivery. By leveraging digital technologies, telemedicine can significantly reduce the reliance on physical documentation, enabling faster and more convenient service delivery. This aligns with the broader goal of enhancing efficiency and reducing burden of administrative procedures.

Fourthly, almost all respondents (98%) recognized the effectiveness and efficiency of telemedicine services in health administration. This high level of approval reflects the perceived benefits of telemedicine in optimizing administrative workflows, reducing the necessity to wait and queue, and ensuring timely access to healthcare services. The integration of telemedicine into health administration processes not only improves the overall efficiency of its operational activities, but also contributes to a more patient-centered healthcare experience.

These findings suggest that telemedicine is well-positioned to address critical challenges in health administration. However, to maximize its potential, efforts must be directed towards three things: improving digital infrastructure, ensuring data security, and training healthcare personnel to master the effective use of telemedicine tools. Improving these areas will help solidify telemedicine's role as a cornerstone of modern health administration in the post-pandemic era.

Furthermore, in this regard, a new relationship can be assumed to emerge, namely the increasing quality of telemedicine services management in health administration will also increase the effectiveness and efficiency of telemedicine application usage. The quality of a proposed solution is highly dependent on how adequately the problem's complexity is defined and conceptualized (Jackson, 2020). Simplicity and the ease of use of positive telemedicine services is achievable when the delivery of these services is carried out by improving service administration.

Next, the simulation results highlight the pivotal role of administrative improvements to accelerate the adoption of telemedicine services (Figure 1.). The base case (without intervention) scenario depicts a steady but modest growth, where the number of users increases from 100,000 in 2022 to 160,000 in 2026. This represents a natural progression without targeted enhancements, suggesting that current strategies may not be sufficient to address barriers to telemedicine adoption.

In contrast, the improved management (with intervention) scenario demonstrates a significant boost in users' adoption, with number rising up to 220,000 by 2026. This scenario assumes simplified administrative processes, such as reducing documentation requirements and improving system usability, which lead to higher users' satisfaction and ease of access. This shows that administrative efficiency directly influences users' engagement and can serve as a critical lever for broadening the adoption of telemedicine services.

The comparison between these two scenarios underscores the reinforcing effect of enhanced administrative practices on the growth of telemedicine services. Administrative simplifications reduce users' frustrations, streamline workflows, and improve accessibility, which, in turn, attracts more users and drives overall growth. These improvements align with broader health policy goals, such as increasing equity and efficiency in healthcare access, particularly in underserved areas.

For policymakers and stakeholders, these findings highlight the need for strategic measures that go beyond simply expanding infrastructure or providing telemedicine platforms. These simulation results suggest that small, targeted changes in how telemedicine services are managed—such as introducing user-friendly application interfaces or automating routine processes—can significantly amplify the services' impact. Moreover, improving these operational aspects can overcome critical bottlenecks, such as limited digital literacy or bureaucratic inefficiencies, thereby improving the overall performance of healthcare system.

In future studies, these findings can be deepened by exploring additional factors that influence telemedicine adoption, such as socio-economic disparities or healthcare provider availability. In addition, the use of simulation tools, such as Powersim, along with real-world implementation projects, can serve as a dynamic framework to examine the continuous learning and adaptation of telemedicine service management, ensuring that telemedicine policies remain responsive to the evolving needs and challenges.

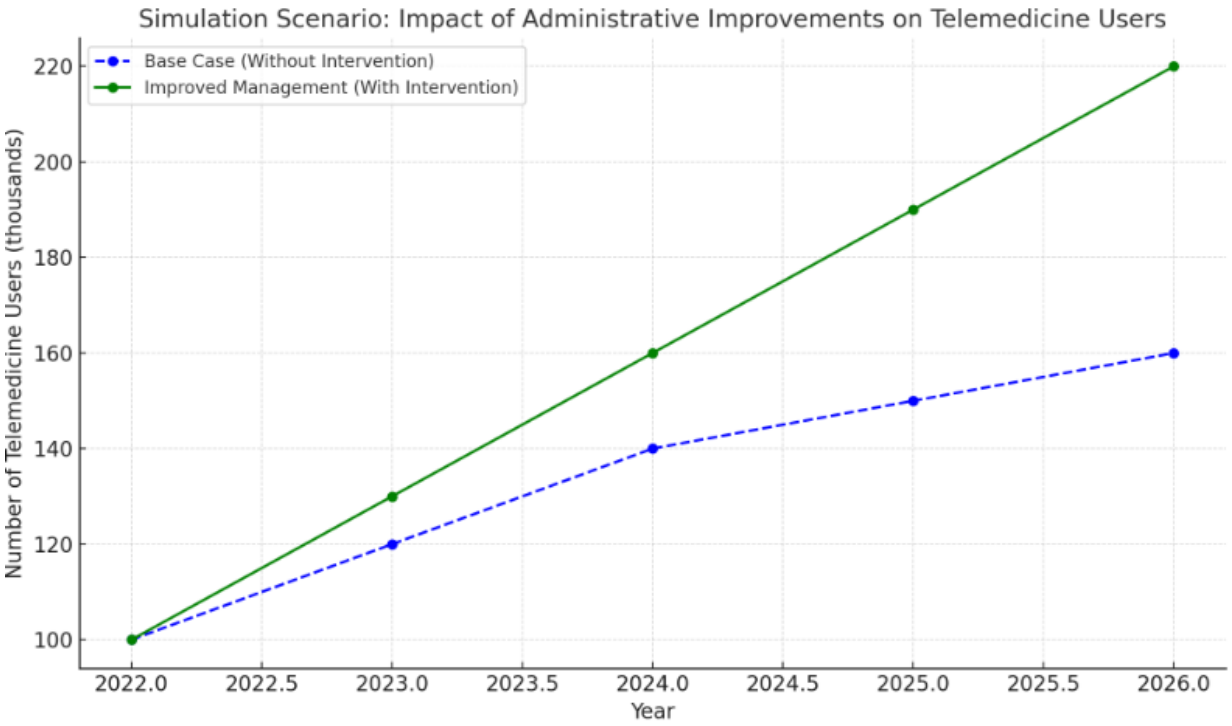

Figure 1. Simulation scenario concerning the impact of administrative improvements on the adoption of telemedicine services

C. Convenience of Use

The telemedicine knowledge, which was described at the beginning of the discussion, is further supported by the dynamics of three aspects that support the convenience of using telemedicine services, namely the speed level of telemedicine services, the targeting accuracy of telemedicine services, and the usefulness level of telemedicine services to users.

Table 3 depicts the respondents' perceptions on the convenience of using telemedicine services. Firstly, the speed level of telemedicine services was rated as "Very Good" and "Good" by 59.9% of respondents in combination, with 37.6% considering it "Enough". Only a small percentage (2.5%) in combination rated the service speed as "Less Good" and "Very Less Good", indicating that the majority of users find the service speed of telemedicine satisfactory. These findings suggest that telemedicine platforms generally meet users' expectations for timely service delivery, while also indicating several areas for improvement.

Secondly, the targeting accuracy of telemedicine services was also well-regarded, with 60.5% of respondents in combination rating it "Very Good" and "Good". However, 34.5% rated it as "Enough", and 5% in combination rated it as "Less Good" and "Very Less Good". These findings highlight a need for further refinement to ensure that telemedicine services consistently meet the specific needs of users. Enhancing targeting accuracy can improve patients' satisfaction and ensure more effective healthcare outcomes.

Table 3. Respondents' Perception on the Convenience of Using Telemedicine Services

Aspect	Very Good	Good	Enough	Less Good	Very Less Good
Telemedicine service speed	19.4%	40.5%	37.6%	2%	0.5%
Targeting accuracy of telemedicine service	20%	40.5%	34.5%	4.3%	0.7%
Usefulness level of telemedicine services	24.9%	51.8%	21.8%	1%	0.5%

Thirdly, the perceived usefulness of telemedicine services received the highest ratings, with 76.7% of respondents in combination rating it "Very Good" and "Good". This strong approval reflects the value that users see in telemedicine as a tool for accessing healthcare conveniently and efficiently. Only a small fraction (1.5%) in combination found the level of usefulness "Less Good" and "Very Less Good", indicating that telemedicine is widely appreciated for its practical benefits.

Despite these positive perceptions, the relatively high percentage of "Enough" ratings across all parameters suggests the improvement of telemedicine platforms in certain areas. Addressing critical issues, such as platform usability, personalized care, and technological

reliability, could help enhance users' experiences and further solidify telemedicine's role as a cornerstone of modern healthcare.

Overall, these findings underscore the general satisfaction regarding the convenience of using telemedicine services, while also pointing to specific areas for improvement. By leveraging users' feedback and incorporating advanced technologies, telemedicine providers can continue to optimize their services to meet the evolving needs of diverse patient populations.

D. Dynamics in Telemedicine

Figure 2 depicts a causal loop diagram (CLD) that shows the relationship among various variables in the telemedicine service management model. The main goal or end point of depicting the causal relationship among these variables is to formulate a policy framework for realizing a better telemedicine service delivery.

The graphic depicts the reinforcing loop (R) link between service speed and users' convenience. As telemedicine services, such as consultations and pharmaceutical purchases, speed up, users' convenience increases. Users' technological expertise and data storage quality of telemedicine service providers affect users' comfort. Thus, increasing service speed, simplifying application functionality, and ensuring good data storage can improve users' convenience.

There is also a reinforcing loop (R) where increasing medication service deployment automatically simplifies and eases use. In this context, the providers are actually improving their telemedicine services when they are able to adopt a user-friendly management paradigm. In other words, telemedicine service providers must continue to develop their technology and innovation to promote service simplicity and enhance users' convenience. This relationship was chosen to avoid too many parameterization assumptions, which could cause the model to fail in capturing system's behavior (Jarukasemkit et al., 2022). By adopting user-friendly management paradigm, telemedicine services, which are administered more due to medicinal purposes, have become simpler and easier to utilize.

Furthermore, as telemedicine services improve, more people will use them. This is an example of how environment shapes human behavior, namely the better the quality of certain services and/or products, the greater the users' number. However, this can also lead to unintended consequences. In a study by Rovetta and Bhagavathula (2020), it was revealed that many internet users sought and shared various COVID-19-related information and, as a result, the over-abundant and often misleading information—known as "infodemic moniker"—on this topic was commonly founded in social media content.

The users' understanding of telemedicine's benefits and functionalities and their technological competence also determine how frequent they use the services. Thus, to broaden the adoption, telemedicine service providers should educate the public about the benefits of telemedicine and how easy it is to utilize.

Finally, the findings suggest that simplifying administrative procedures, such as reducing document requirements and maintaining the storage and tracking system of patients' activities, could significantly enhance telemedicine adoption and users' satisfaction. Given the importance, policymakers should prioritize integrating these features into national health platforms.

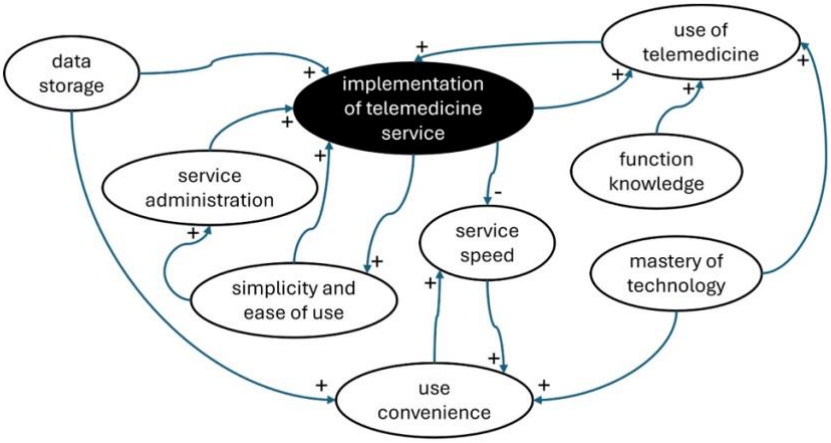

Figure 2. Causal Loop Diagram (CLD) depiction on the relationship among key variables in telemedicine service management model

V. CONCLUSION

This study has identified the critical policy gaps in telemedicine service management and offers actionable recommendations to enhance the quality of telemedicine service delivery in Indonesia, contributing to the achievement of health-related Sustainable Development Goals (SDGs).

The findings reveal that a significant proportion of respondents are aware of telemedicine services, indicating a strong foundation for adopting a service management approach. However, fewer than half of them actually have utilized telemedicine. Given the community's recognition of its importance and their willingness to engage with educational and outreach efforts, initiatives from governments and stakeholders concerning telemedicine must be expanded and intensified.

Another key focus of this study is the administration of telemedicine services. Respondents emphasized the importance of several features, such as reducing document requirements and maintaining the storage and tracing system of patients' activities. Enhancing the quality of telemedicine administration services can significantly improve the effectiveness and efficiency of telemedicine application usage. Moreover, simplifying service processes and improving service management are essential to optimizing telemedicine delivery.

The interaction between service speed and users' convenience forms a reinforcing loop (R), where faster telemedicine services, such as consultations and medication orders, lead to greater users' convenience. Another reinforcing loop emerges as improved medical service implementation enhances the ease of use, which, in turn, drives adoption. A third reinforcing loop shows that as healthcare providers continue to enhance the quality of telemedicine services, public engagement to utilize the services will also increase, creating a self-reinforcing cycle of growth and improvement within healthcare ecosystem.

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