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Conceptual Review Forward RSM Design Approach: Integrasi Lean Six Sigma, Sprint dan Extreme Programming

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ABSTRACT

The Recognize, Scrutinize, and Materialize (RSM) Design Approach has evolved into an important framework for addressing diverse challenges in design and innovation across a variety of industries. by combining methodologies such as Lean Six Sigma, Sprint and Extreme Programming, creating customized variants to meet specific domain needs. This study highlights the application of RSM in various case studies, including education, healthcare, digital ecosystems, and business process optimization. Key results show reduced development timelines, increased user engagement, and increased process efficiency. Additionally, the integration of sustainability metrics into the Materialization phase ensures environmentally responsible design. This research underscores the adaptability and relevance of RSM in addressing modern challenges, providing a foundation for future advances in user-cantered design and iterative methodologies.

1. INTRODUCTION

The evolution of design methodologies has always been driven by the need to solve complicated problems through structured and user-focused approaches. One important approach is the Recognize, Scrutinize, and Materialize (RSM) structure. This is a way of planning repeatedly to help come up with new ideas in various areas. Many people have begun using the RSM framework in fields like user experience (UX) design, software development, and enhancing business processes. Its ongoing process works well with agile methods, letting it quickly adapt to new technology and changing user needs. New versions of RSM have been developed to solve various issues in different businesses, following its basic ideas. These changes include additional information that is specific to the topic or situation. Although these versions have worked well, new issues in online settings need RSM to be improved. The rise of decentralized systems, adaptable learning settings, and a focus on sustainability shows that we need a more comprehensive and flexible framework. This study seeks to develop a full approach by using the history of RSM and its different forms. It will address modern problems while maintaining the key ideas of the framework. The next sections will explain the basic concepts, techniques, and applications of this new type of RSM.

2. LITERATURE REVIEW

Recognize, Scrutinize, and Materialize (RSM) Design Approach has been commonly used in many studies to create effective, innovative, and user-friendly apps. Some key studies using this method are explained by looking at the stages of development to make things clearer and easier to understand. Here is a suggested plan showing how the RSM Design Approach can change and improve to handle more complicated problems.

2.1 Foundational Phase: Interaction

To create a virtual reality learning space focused on Generation Z that prioritizes both emotional and useful experiences for users. The platform uses 3D simulations and changing situations to create an interesting and interactive place that appeals to Gen Z's love for new technology. The design focuses on connecting with users emotionally by making learning fun and suited to their needs. It also includes practical features like easy-to-use platforms and real-life examples to make learning accessible and effective. Using the RSM method, the system improves step by step, using user feedback to make the experience better. This results in a VR tool that increases both engagement and learning.

A study has created a virtual reality (VR) app for a learning environment using the RSM method, which has helped Generation Z learn in a fun way through virtual reality experiences; this app has incorporated dynamic learning features and has collected user feedback to cater to Generation Z, who value current technology and interactive experiences, and it has offered a 3D learning experience where users can study different ideas through visual simulations, as the design has aimed to provide material that suits Generation Z's needs, making learning more engaging and effective; furthermore, RSM has been designed to meet the needs of

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Generation Z by providing engaging and useful technology-based learning, and the app, Materialize, has offered an engaging and flexible learning experience [1].

Table 1. Recapitulation of the phases of interest formation in research.

Phase	High School Student	Higher Education Student	Employee
Triggered Situational Interest	Situation and Location at the Education Fair	Purpose of viewing College Information	Situation and Location in the Office
Maintained Situational Interest	Purpose of viewing College Information	Internship in ICT Unit (Information Communication Technology)	Trying VR
Emerging Individual Interest	VR users at the exhibition stand	Use of VR learning media	As a VR application
Well-Developed Individual Interest	Interested in using VR	Interested in using VR	Interested in using VR

This looks at how user experience (UX) is key to improving mobile apps, especially for increasing course entries. The study highlights the importance of designing an easy-to-use layout that makes registering simpler and quicker for everyone. By focusing on usability characteristics such as navigation, clarity, and task completion, the application ensures that users can easily register for classes, check schedules, and access relevant information. By repeatedly trying and improving the design, it meets users' real needs and makes them happier and more involved. This shows how important user experience (UX) is for making tasks easier and boosting how well the application works.

The app is made to make signing up for driving courses easier for users. The app has a user-friendly design that makes it easy for people to sign up, view schedules, and find out about classes. Easy-to-use features help people finish tasks quickly, which makes them happier. With RSM, recognize means figuring out what users need for a smooth registration system. Usability testing is used to carefully examine the program. Materialize is achieved with a user-friendly and adaptive application [2].

It's important to balance practical and emotional aspects to make it easy for people to book sports venues. The app makes booking easier by letting you look for venues, book directly, and pay online, making it simple and convenient. Practical aspects focus on how easy it is to use, like how fast it responds, how clear it is, and how simple it is to find your way around. This helps users finish their jobs quickly and easily. Emotional factors are considered by providing a simple and enjoyable interface, which helps create a good user experience and happiness. The FUTSALKUY app brings these features together to provide a smooth and enjoyable experience for users, highlighting the need for design that focuses on the user.

The FUTSALKUY app helps users book sports venues more quickly. The FUTSALKUY app allows you to book sports venues online. This app lets you look for venues, book them directly, and pay online. With a responsive web-based design, this application ensures accessibility from various devices, making it easy for users to book sports places at any time. RSM is used by understanding that users want to easily make bookings. Examine involves looking closely at booking features and the style of the interface. Materialize is a simple and dependable web tool [3].

2.2 Systematic Exploration Phase

Using ecosystem models to visualize linked transaction data can improve decision-making. The app has a dynamic dashboard that brings together live information about orders, payments, and customer reviews, giving users a complete view of the reservation system. By organizing and showing these connected data points, the system helps users see trends, track transactions, and make smart choices quickly. The easy-to-use interface turns complicated data into clear insights, showing how ecosystem modeling can make operations more efficient and help with decision-making.

The BackInd app helps show transaction statistics for backpacker bookings. A live dashboard lets users see orders, payments, and customer reviews instantly. With a user-friendly interface, this application increases efficiency in handling reservation information, providing a better experience for users. RSM is designed to help users quickly find clear reservation details. The dashboard interface is checked through tests. Materialize is realized by providing an interactive dashboard that helps make choices effectively [4].

Creating a comprehensive CRM tool that meets the various needs of Hajj pilgrims. This platform offers useful features like personalized schedules, advice for rituals, live updates, and document management to make your pilgrimage experience smooth and organized. Using CRM principles, the system combines personal user tastes with the needs of the larger community, making it easier for everyone involved to communicate and work together. The platform uses real-time data to quickly adjust to changes and improve services. It provides a complete solution that meets both the practical and spiritual needs of tourists, showing a well-rounded approach to customer relationship management in this specific situation.

This Hajj portal, built on CRM, helps pilgrims get ready for their Hajj journey. This app gives detailed information about Hajj customs, schedules, and important documents. The app helps pilgrims plan their trips better by offering personalized features, like getting instant updates on schedule or process changes. RSM's Recognize offers precise and tailored analysis of information wants.

Scrutinize means to check how well personalization features work and to learn about user habits. Materialize is realized through a portal that makes it easy for pilgrims to access information related to Hajj rituals and preparations [5].

2.3 Agile Integration Phase

Demonstrates how repeated VR design helps improve educational tourism. The app uses fast prototyping to make virtual environments where users can study the culture and history of Istano Basa Pagaruyung in an interactive way. Real-time feedback from users is gathered during testing phases to refine the interface and improve the general user experience. This step-by-step method helps the VR app blend educational information with fun images, making it easier and more enjoyable to learn about different cultures. The app uses user-friendly design and advanced virtual reality technology to help people connect with and learn about Indonesia's history in a more engaging way through digital tourism.

In the RSM process, the Recognize step involves figuring out the digital education needs and promoting tourists. Review is done by evaluating VR design and improving the interface based on feedback from users. Materialize is an app that lets users virtually visit cultural places, making the experience both fun and educational. In the RSM process, the Recognize step involves figuring out the digital education needs and promoting tourists. Review is done by evaluating VR design and improving the interface based on feedback from users. Materialize is an app that lets users explore cultural places online, offering a fun and informative experience [6].

Agile concepts are used to gradually improve transportation services by being flexible and adaptable. The app uses a flexible, user-friendly method to solve problems like long wait times and messy booking systems. It includes features like real-time tracking, online payments, and user reviews. The system improves through repeated development steps by using comments from users to provide better services and meet changing customer needs. This flexible approach allows the transportation platform to quickly respond to market needs and new technologies. This leads to a more effective, user-friendly, and competitive service that fits the changing demands of today's transportation systems.

This transportation app uses a new business approach to make services faster and more comfortable. This app lets users book transportation services quickly and at low prices. This app stands out for its real-time tracking, digital payments, and user reviews, which all help give users a modern transportation experience. RSM is used to identify the community's need for better and cheaper transportation options. Reviewing is done by analyzing the business plan and creating service prototypes. Materialize is realized with transportation applications that offer comfort and competitive prices [7].

How quick and repeated updates fit with user experience (UX) concepts to improve clinic management processes. The system makes important tasks easier by turning manual processes into digital ones. This includes managing patient records, arranging doctors, and creating medical reports. Agile methods involve working in small steps, which lets teams test and improve their work based on user input. This makes sure the application is useful and easy to use. Using agile methods with a focus on user experience makes clinic operations more efficient, accurate, and satisfying for both staff and patients, turning traditional clinics into smooth digital experiences.

This app turns clinic management from a paper-based process into a digital one. This system makes it easier to keep patient records, handle doctor schedules, and create medical reports. This app has an easy-to-use design that allows clinic staff to handle patient information faster and more correctly, making the overall patient experience better through quicker service. The RSM method starts by understanding the problems with using paper for administration. Scrutinize means to test new, better ways of working. Materialize uses apps that streamline managerial tasks and enhance user experience [8].

2.4 Contextual Adaptation Phase

How design thought is adapted to meet healthcare challenges, particularly internet addiction, by integrating usability heuristics. The new application for community health centres (Puskesmas) has features such as online patient lines, remote consultations, and medication management. These tools make healthcare services easier to reach and more efficient. Usability heuristics are used in the design process to make sure the interface is easy to use and meets the needs of people dealing with internet addiction. The system uses design thought and healthcare principles to create a helpful and caring way to improve digital health knowledge. It helps users manage their addiction and access important healthcare resources.

The redesigned Puskesmas program using usability heuristics aims to address the problem of internet addiction. This app helps community health centres manage internet addiction by offering online advice services. The system has tools like online waiting lists for patients, virtual doctor visits, and help with managing medications. With a user-friendly interface, this application makes it easier for patients to receive health services practically and efficiently. RSM provides easy-to-use digital health services based on the needs of the community. Review is done by checking things like managing patient wait times and online appointments. Materialize is realized through an application that mixes interactive consultations and health service integration in one platform [9].

Focuses on making personalized and engaging solutions that meet users' individual health needs. The app lets you talk directly to healthcare workers, check health indicators for internet addiction, and learn more about health topics. The system uses a design that focuses on users, allowing it to tailor services to fit each person's likes and habits, helping users manage their health better. The platform includes interactive features like instant feedback and personalized suggestions, making it both fun and helpful in dealing with internet addiction.

This electronic health consultation application is meant to help users treat internet addiction through an interactive and educational approach. This app lets you chat directly with health staff, find information about internet addiction and offers education to help you understand health better. This app helps users find health management tips without needing to go to a doctor, which is convenient for people with busy schedules. The app is designed to improve user experience by personalizing features and services to meet individual needs, which helps users manage their health better [10].

Adapting online tools to help students with health issues, especially internet addiction. The platform has features such as conversation forums, expert consultations, and educational materials to help people understand the dangers of too much internet use. Interactive features, like custom suggestions and community tools, help create a friendly space that promotes better online behaviour. The platform focuses on helping students by offering useful tools and a space to work together, supporting their online health.

This platform helps kids deal with internet addiction. This app offers talk forums, educational materials, and expert advice services. The app has interactive features that help users live better online. It also shares important information about the effects of internet addiction. The RSM method starts by understanding that students need information about using the internet safely. Scrutinizing involves trying things like discussion forums and personalized content. Materialize is realized through a digital platform that is interactive, easy to use, and supports healthy living [11].

2.5 Holistic Integration Phase

How principles focused on users, aware of the system, and sustainable are combined to build a complete solution for managing conferences. The EZDESK Dashboard makes it easy to organize documents, manage user access, and see data clearly with a simple design, providing a friendly experience for users. The system-aware design helps direct work better, allows access to data in real-time, and makes operations smoother, meeting the complicated requirements of running a conference. Sustainability principles are applied by using digital methods instead of paper, which supports an environmentally friendly approach. This overall design makes running conferences more efficient while also ensuring they are easy to reach, can grow as needed, and are environmentally friendly.

The conference management system app, created using the RSM method, aims to make it easier for users to organize documents and handle conference tasks. This system includes features like managing user access, organizing documents, and displaying data in panels. This app has a user-friendly design that helps meeting organizers manage files, check document progress, and work more efficiently by giving access to important information in real time. The RSM method focuses on understanding what users need to handle conference documents effectively. This includes organizing files and giving specific users limited access. Scrutiny is done by looking into what users need for an easy-to-use interface through repeated design testing. In the end, Materialize is created by using a dashboard that shows data visually, improves work performance, and makes it easier to navigate [12].

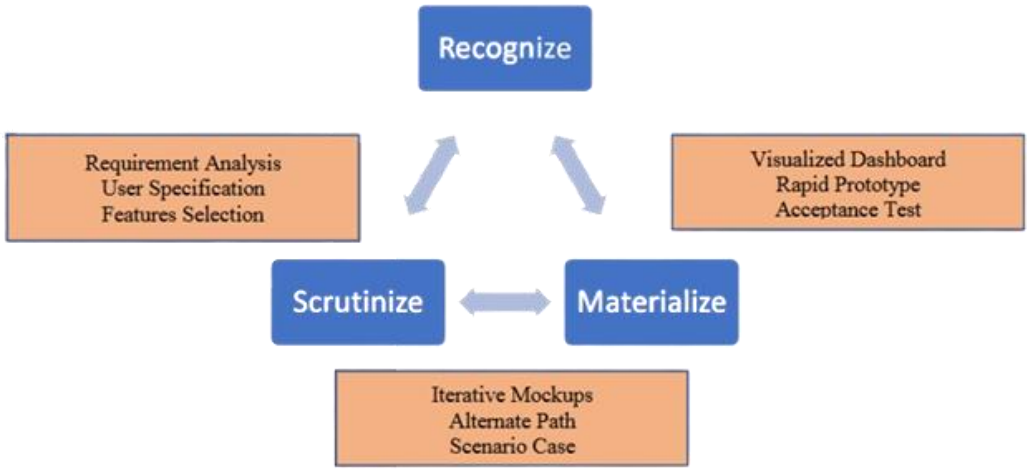

Figure 1. RSM Design Approach

How user-focused and flexible design methods work together to improve document handling efficiency. The EZDESK Dashboard makes handling documents easier with features like visual data displays, easy navigation, and organized data storage. The system listens to user feedback and regularly tests its features to make it easy to use for everyone and to meet changing user needs. This method improves checks and trust and makes interactions easier, leading to better and faster ways to organize and handle documents.

The EZDESK Dashboard is a tool for managing documents that aims to make information clearer and processes more efficient. This application has a screen that shows data in a simple way, making it easy for users to understand. The system is designed with users in mind, making it easy to access and use. This helps users organize their papers better and store data in a clear way, ensuring it is accurate and trustworthy. The RSM method starts by recognizing the main challenges in managing documents online, such as data validation and ease of navigation. Scrutinizing means improving interface features by using comments from users during testing. Materialize is realized through the development of an interactive dashboard, allowing users to watch and manage documents in real time [13].

Developing a single system that combines focus on people's needs and market requirements across different businesses. This framework uses responsive innovation to adjust services and goods to fit user needs while staying in line with customer preferences and common values. Key features like personalized services, analyzing customer data, and adjustable displays keep the framework focused on users and important in the market. The framework uses regular feedback and ongoing improvements to solve different industry problems. This helps build customer trust and encourages innovation while maintaining a good user experience and staying competitive in the market.

The app uses a responsive innovation approach meant to adapt to customer preferences. Key features include personalized services, research of customer data, and a flexible interface. By focusing on shared values, the app meets user wants and expectations, which helps build customer loyalty. The RSM method focuses on understanding what users need in order to create useful innovations. Scrutinizing is done by looking at what customers like and creating samples. Materialize is created by developing apps that fulfill market demands and offer extra benefits to users [14].

3. EXPANDED METHOD

Different studies using the Recognize, Scrutinize, and Materialize (RSM) Design Approach have created customized applications to meet the unique needs of users and their work environments. These changes come from adjusting the RSM framework to meet the specific problems in each area, offering better, new, and useful answers. This is an explanation of the new types that came from earlier study.

3.1 RSM Lean

In the Industry 4.0 era, innovation is a key element for manufacturing companies to remain competitive. Digital technology has forced businesses to increase efficiency and effectiveness, yet up to 70% of digital transformation efforts in businesses fail, largely due to the complexity of human behavior. A responsive innovation approach that combines the Lean Six Sigma (LSS) and RSM Design (Recognize, Scrutinize, Materialize) methodology is considered capable of providing solutions to increase process efficiency. This study was conducted at PT. ABC Bandung & Subang, a cardboard box manufacturing company that faces challenges in the product development process. Based on a customer survey (Voice of Customer), it was found that the product development process often causes customer dissatisfaction due to the long lead time (48 working days). This hinders the company's growth, especially in attracting new customers and retaining old customers.

Based on the results of the Voice of Customer survey conducted on customers of PT. ABC, it was found that the product development process took up to 48 working days after the design was approved. This causes customer dissatisfaction and hinders business growth. This slow process has the potential to discourage new customers from collaborating and cause delays in orders if there are design changes. The information system used in product development is still less than optimal, so responsive innovation is a necessity to improve process performance.

1. Main Problem: Product development time at PT. ABC took too long (48 business days after design approval), leading to customer dissatisfaction and potential loss of new customers.
2. Impact: Obstacles to business growth, risk of delayed orders, and lack of company competitiveness in the market.
3. Proposed solution: This research explores the application of responsive innovation by integrating Lean Six Sigma (LSS) and RSM Design to:
    - Improve the process so that product development is faster and more efficient.
    - Improve user experience in the process.
    - Reduce customer dissatisfaction and increase company competitiveness.

Both LSS and RSM focus on customers or users, so the RSM method can support the LSS method which is widely used in manufacturing. Integration of the RSM method into LSS can support each other in improving the improvement process.

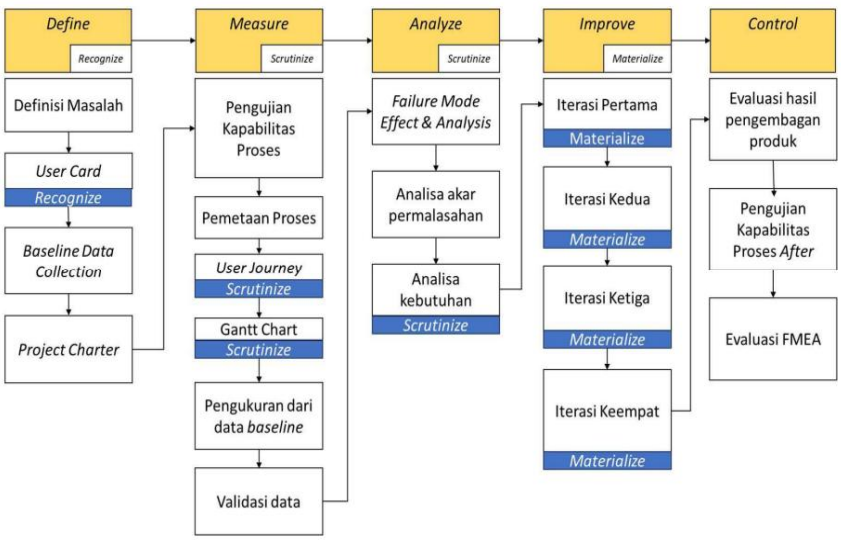

Figure 2. RSM Lean

The implementation of responsive innovation based on LSS and RSM has succeeded in having a positive impact on process efficiency and customer satisfaction. However, further improvements are needed to ensure process capabilities consistently meet targets and to get closer to ideal specifications:

1. Product Development Process Improvement: The average time for the product development process was reduced significantly from 48 days to 21 days in the first iteration after implementing responsive innovation based on Lean Six Sigma (LSS) and RSM. The process capability index (Pp and Ppk) increased although it was still below ideal standards. This shows that the process has become more consistent, even though it is not yet fully able to meet customer specification targets.
2. Implementation of a Product Development Dashboard: A digital dashboard was created to monitor product development progress, reduce the risk of delays, and make it easier to track electronic approvals. Bureaucratic processes in product development are optimized by digitalization, eliminating the need for manual memos and increasing transparency

Divide and conquer methods are similar, but they get trickier when you need to sort characters because the changed sequence order groups them by how often they appear. The sorting method takes O(n log n) time to run. Using this method to build Huffman trees one step at a time takes O(n log n) time. The amount of time needed for greedy encryption and decryption is the same. It takes O(n log n) time to run greedy Huffman algorithms and divide-and-conquer algorithms. The problem that still needs to be solved is making a Huffman tree, a sorting method, and a frequency table.

3.2 RSM Sprint

Technological advances in education encourage the adoption of effective learning media to increase student engagement and understanding. Augmented Reality (AR) is a promising technology for creating interactive and immersive learning, helping students understand abstract material better. This research was driven by challenges in learning English, such as low student motivation, difficulty in remembering vocabulary, and student anxiety in learning the language. The use of UX-based AR is expected to increase student engagement by providing an interesting and immersive learning experience. Even though AR technology is widely used, its application in English education at the primary level is still limited, especially in schools with inadequate infrastructure.

Low motivation of students in learning English at elementary school level. Students have difficulty remembering vocabulary and have anxiety when learning English, especially in writing and speaking. The school that is the object of research has limitations in using modern learning technology, including AR. The implementation of AR technology often faces problems, such as sub-optimal UX design, unsupportive technological infrastructure, and minimal training for teachers in designing and applying AR in learning. Sprint Design is an iterative approach that focuses on developing solutions quickly over short cycles. The main stages of Sprint Design include:

1. Understand: Learn the main challenges and set specific goals. In this research, this stage refers to collecting data from teachers and students.
2. Sketch (Drawing): Create an initial sketch of the AR application solution or interface. Focus on developing AR features that support English learning.
3. Decide: Choose the best solution from the ideas generated in the previous stage.
4. Prototype: Design an initial version of an AR application to be tested in schools.
5. Test: Involve students and teachers to test the application and collect feedback.

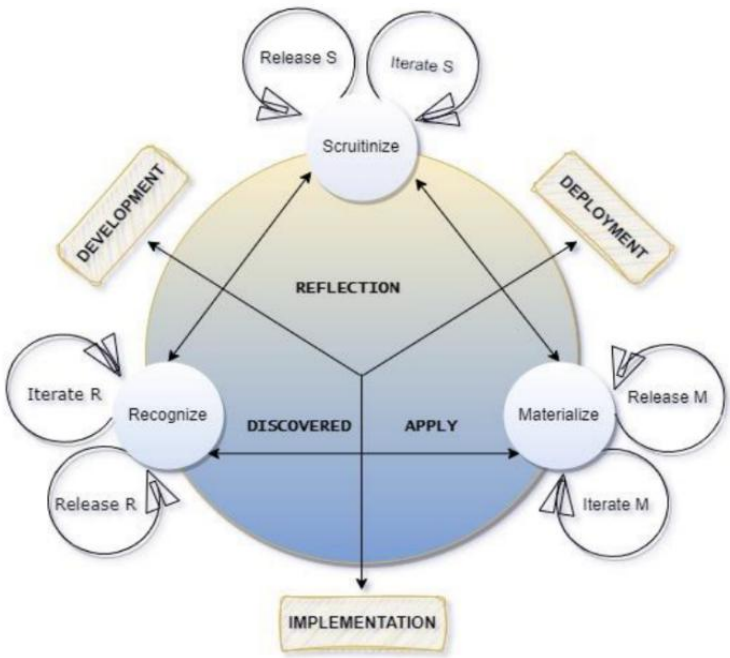

Figure 3. RSM Sprint

This combined method allows the AR application in this research to not only be developed systematically but also optimized based on modern educational needs. If you need additional details. Combining RSM and Sprint Design allows for a more structured and faster process. However, further improvements are needed to get closer to ideal specifications:

1. Integration of the Recognize and Understand Phases: RSM is used to identify broad needs, while Sprint Design adds a framework for understanding specific challenges.
2. Scrutinize and Sketch: Data from in-depth analysis (Scrutinize) helps determine the design elements produced in the Sketch stage of the Sprint.
3. Materialize and Prototype-Test: The Materialize stage of RSM utilizes Prototype-Test Sprint iterations to ensure the resulting AR application is effective and meets requirements.

3.3 Design Innovation Model for Digital Ecosystem: Development Forum based on Service Oriented against Internet Addiction (2021)

The importance of a decentralized, adaptive and open digital ecosystem. This ecosystem is inspired by natural ecosystem systems, with a focus on aspects of competition and cooperation between various interested parties. The rapid development of digital technology has transformed industry, government, the economy and society as a whole, providing enormous potential to improve the quality of life. However, this digital transformation also brings risks, including increased inequality and internet addiction, which can affect individuals' psychological and physical aspects. Internet addiction is a new problem that disrupts life balance, where individuals have difficulty managing the time and burden of internet access for their work needs. By investigating design steps and how to develop a digital ecosystem that aligns with customer demands, with a focus on optimizing positive impact while considering the negative implications of internet addiction. Thus, this research seeks to create a development forum that can facilitate interaction and collaboration between users, as well as increase awareness of the negative impacts of unmanaged use of technology. The application of the proposed model aims to create a balanced digital ecosystem, not only improving user experience but also reducing the risks associated with internet addiction. By integrating these approaches, the authors hope to build a more responsible and supportive online community.

Several strategies for managing internet use in the context of the proposed digital ecosystem model. The strategy aims to optimize a positive user experience while addressing the challenges associated with internet addiction. Key strategies include:

1. Awareness and Education: This model emphasizes the importance of raising awareness about the risks of internet addiction. Educational initiatives can help users understand the potential negative impacts of excessive internet use and encourage healthier online behavior.
2. User-Centered Design: By focusing on user needs and preferences, the ecosystem can develop features that encourage responsible internet use. This includes designing interfaces that encourage breaks, limit usage time, or provide reminders for users to engage in offline activities.
3. Data Analytics and Feedback: Leveraging data analytics to monitor user behavior can provide insight into usage patterns. The ecosystem can provide personalized feedback to users, helping them recognize when their internet usage is becoming excessive and encouraging them to adjust their habits.
4. Community Support and Engagement: This model encourages the creation of forums and support groups within the digital ecosystem where users can share experiences and strategies for managing internet usage. This community involvement can foster a sense of belonging and support, making it easier for individuals to overcome their internet habits
5. Collaborative Tools: The authors suggest developing collaborative tools that allow users to set goals and track their internet usage together. This can create a sense of accountability and motivate users to adhere to more usage patterns
6. Break and Offline Activity Integration: Ecosystems can incorporate features that encourage users to take regular breaks and engage in offline activities. This could include reminders or gamification elements that reward users for spending time away from screens.
7. Flexible Service Offerings: By providing a range of services that meet various user needs, ecosystems can help users find alternative activities that do not involve excessive internet use. This diversification of offerings can reduce dependence on online activities.
8. Partnerships with Mental Health Professionals: This model suggests collaboration with mental health professionals to provide resources and support for users struggling with internet addiction. This partnership can improve the ecosystem's ability to address the psychological aspects of excessive internet use [16].

3.4 RSM Extreme

Indonesia, as a maritime country, has great potential in the fisheries sector, both from marine catches and cultivation. However, freshwater fish farmers face challenges such as low profit margins, long distribution chains, and dependence on middlemen. This is caused by a lack of market information which makes farmers prefer to sell to middlemen to avoid additional costs such as transportation. As a result, the price of fish becomes more expensive at the consumer level. Digital transformation through applications can be a solution to overcome these problems. By applying the Agile method and the RSM (Recognize, Scrutinize, Materialize) design approach, this research aims to design a freshwater fish transaction application that increases sales efficiency, empowers farmers, and reduces dependence on middlemen. The main problem in this research is how to help fish farmers sell their fish more efficiently and fairly. The following is the problem formulation:

1. Identification of Aspects: What aspects need to be identified in application design to increase the efficiency of fish sales?
2. Implementation: How to implement the application to suit the needs of fish farmers?
3. Application Benefits: What benefits can cultivators get from implementing this application, user experience and adoption challenges in the field?

To create an application that can be a digital solution for cultivators to access markets directly, increase sales efficiency, and reduce dependence on intermediaries. RSM Design Approach contributes to the application design stage with a user needs-based approach, while Extreme Programming helps ensure application development is carried out in an iterative, flexible and quality-oriented manner. The combination of the two produces applications that are relevant, functional, and appropriate to the challenges faced by fish farmers.

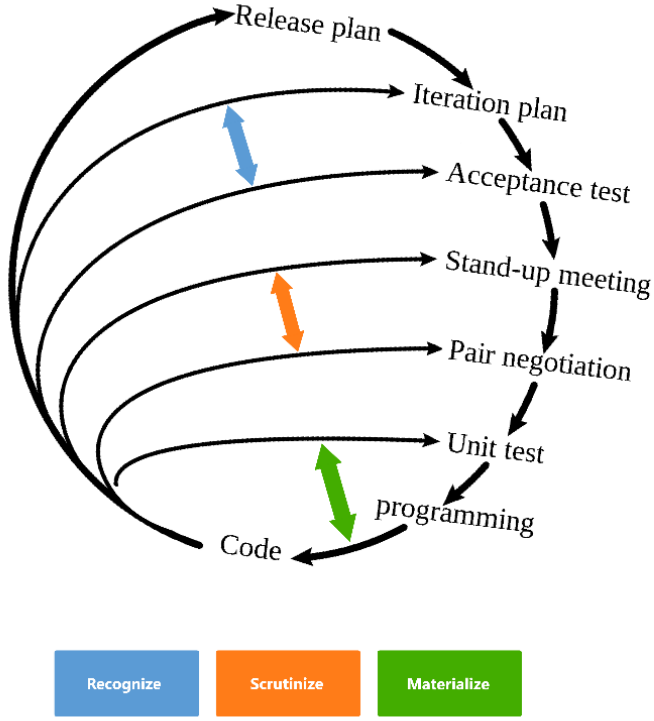

Figure 4. RSM Extreme

The integration of the RSM Design Approach and Extreme Programming in this research creates an innovative, functional and relevant fish sales application. The combination of these two methods creates a synergistic workflow between the design process (RSM) and technical development (XP). RSM ensures a user needs-based approach, while XP ensures technical development is carried out iteratively and of high quality. This combination makes a significant contribution in producing digital solutions to overcome challenges in the freshwater fish sales ecosystem. The following is an explanation of the results and contributions of the integration of the two:

1. Identify User-Centered Applications: The design process using RSM allows collecting user needs through the stages of Recognize (problem identification), Scrutinize (solution analysis), and Materialize (solution implementation). The result is an application designed based on the real needs of fish farmers, such as digital cooperative features, stock tracking, and direct transactions without middlemen.
2. Iterative and Responsive Development: XP provides an iterative approach that allows developers to respond quickly to farmer input in each iteration. Each development cycle results in features that are tested and improved, so that the application can be continually refined until it meets user needs.
3. Efficiency in Design and Development: RSM provides a conceptual framework for designing solution-focused applications. XP ensures development runs efficiently by prioritizing continuous testing and collaboration between teams.
4. Functionally Tested and Optimally Functioning Applications: XP supports functional testing, such as black-box testing, to ensure features such as payments, transaction recording, and delivery tracking work properly.

4. RESULTS AND DISCUSSIONS

The application of the proposed RSM variant, which integrates dynamic interaction models, cross-domain integration, and sustainability metrics, has shown significant progress in various case studies. Key findings include:

1. Increased User Engagement: The dynamic interaction model enables real-time feedback mechanisms, which increases user satisfaction compared to traditional RSM implementations. For example, in educational technology applications, adaptive interfaces customize the learning experience for individual users, resulting in better engagement and learning outcomes

2. Cross-Industry Implementation: Cross-domain integration facilitates seamless knowledge transfer between industries. One example is manufacturing principles being adapted to improve workflow in healthcare systems, thereby reducing processes.
3. Sustainability Results: Incorporating sustainability metrics results in reduced resource consumption in digital product development projects. By including environmental considerations during the Materialize phase, teams can prioritize environmentally friendly solutions without sacrificing functionality.

The historical evolution of RSM has laid a strong foundation for addressing complex design challenges. However, the dynamic demands of the modern ecosystem necessitate the development of these new variants. The results validate the efficacy of the proposed improvements:

1. Addressing Contemporary Challenges: The integration of real-time feedback and adaptive interfaces has bridged the gap between static design processes and dynamic user needs. This is in line with recent trends in user experience design, which emphasize personalization and agility.
2. Scalability and Adaptability: By facilitating cross-domain integration, this new variant expands the applicability of RSM beyond its traditional domains. This scalability is critical for industries facing rapid technological change.
3. Balancing Innovation and Sustainability: The inclusion of sustainability metrics ensures that innovation does not come at the expense of environmental and social responsibility. This balance is increasingly demanded by stakeholders and regulatory bodies.
4. Iterative Refinement and Validation: The iterative nature of the RSM framework continues to be the foundation of its success. The proposed variant builds on this by incorporating iterative evaluations specifically tailored to dynamic interactions and continuous outcomes.

5. CONCLUSION

By prioritizing the principles of Recognize, Scrutinize and Materialize, this variant underlines the importance of adaptability and innovation in meeting the demands of modern systems that continue to develop. The Recognize, Scrutinize, and Materialize (RSM) framework has proven its worth in addressing complex design challenges across a variety of domains. Its iterative nature and user-centric focus make it a versatile tool for driving innovation. However, the dynamic demands of today's ecosystem require further evolution. The proposed RSM variant, which combines dynamic interaction models, cross-domain integration, and sustainability metrics, addresses these demands effectively. Through case studies, it shows increased user engagement, cross-industry applicability and real sustainability results. These results highlight the importance of adapting design frameworks to remain relevant and impactful.

By balancing innovation and sustainability, the new RSM variant not only addresses today's challenges but also provides a foundation for future progress. This study underscores the need for continuous refinement of design methodologies, ensuring they evolve as technology and society change. Future research should explore its application in emerging fields, refine assessment metrics, and deepen its integration with other design frameworks, further unlocking its potential to drive transformative change. The success of the new RSM variant paves the way for further exploration. Future research could:

1. Investigate its application in emerging fields such as artificial intelligence and blockchain.
2. Develop metrics to quantitatively assess the impact of cross-domain knowledge transfer.
3. Explore deeper integrations of sustainability metrics with other established design frameworks

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