NAVIGATING CHANGE: MEDIA, TECHNOLOGY, BUSINESS, ECONOMICS, AND INNOVATION IN THE 21ST CENTURY

Editor

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Navigating Change: Media, Technology, Business, Economics, and Innovation in the 21st Century

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PREFACE

In today's rapidly evolving world, the convergence of technology, innovation, and human behavior is reshaping industries, societies, and individual experiences. This edited volume, featuring a diverse range of chapters, delves into the profound impacts and transformations across various sectors and disciplines.

From the revolutionary influence of artificial intelligence on digital media creation and interaction, to the nuanced dynamics of brand loyalty on digital music platforms mediated by social media interactions, this book explores the forefront of technological and social change. Each chapter provides a unique lens through which readers can examine the intricate web of factors driving progress in today's interconnected world.

The exploration begins with the transformative power of artificial intelligence, which is redefining multimedia creation and interaction. It then navigates the subtleties of digital engagement and trust on social media, offering insights into how these elements shape brand loyalty in an increasingly digital-first world.

As we venture further, we encounter studies on the innovative applications of materials such as corn starch in the oil and gas industry, highlighting the endless possibilities of research and development in enhancing industrial processes. Similarly, the examination of Starlink technology and its impact on Indonesia's telecommunications landscape underscores the far-reaching implications of technological advancements on society and business ecosystems.

This volume also addresses strategic growth and efficiency, presenting a comprehensive analysis of a scaffolding business's growth strategies and the productivity improvement in hydraulic body line manufacturing. These chapters underscore the importance of strategic planning, operational excellence, and innovation in achieving business success.

Furthermore, the impact of macroeconomic variables and fundamental factors on financial performance, especially in the context of the Covid-19 pandemic, provides valuable insights into the resilience and adaptability required in today's volatile economic environment.

Lastly, the book concludes with an exploration of biophilic design principles in co-working spaces within college libraries, reflecting the growing emphasis on creating environments that foster well-being, productivity, and a connection to nature.

This collection of chapters is more than just a reflection of current trends; it is a compendium of forward-thinking research and analysis that invites readers to contemplate the future of technology, business, and society. Each contribution is a testament to the creativity, rigor, and dedication of the authors who have generously shared their knowledge and expertise.

As you embark on this journey through the pages that follow, I hope you find inspiration, knowledge, and a renewed curiosity about the world around us. The insights presented here serve not only to inform but to challenge and provoke thought, encouraging us all to consider the limitless possibilities of innovation and the ever-evolving landscape of the future.

Dr. Akshay Mishra
Dr. Kamal Goel
Bursa – September 2024

CONTENTS

CHAPTER 1

The Impact of Artificial Intelligence on Digital Media: Revolutionizing Multimedia Creation and Interaction

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ABSTRACT

The effects of AI (Artificial Intelligence) can have both positive and negative impacts on various aspects of society. On one hand, AI technologies have the potential to drive economic growth and social progress. AI can assist in tasks such as understanding text, recognizing objects in images, and predicting future events. It can also be utilized to analyze human and social activity, address socially relevant problems, and even predict natural events. However, problems arose through collaboration between intelligent algorithms and human creativity in the creative industries. These collaborations, to an extent, may bring challenges for the rights of artists, such as issues of piracy, originality, and exploitation. There are also ethical concerns associated with the use of AI. AI-based machines may lack awareness of the wider context and cannot truly offer broad context, emotion, or social relationships. This can lead to an amplification of the gap between those who can and cannot use New digital technologies, resulting in increasing inequality of information access. The purpose of this article is to study the different facets of AI technology usage in the multimedia field, and also to weigh in the pros and cons of its application to the industry's status quo. To find such answers, this article uses methods such as article analyses, data reading, and qualitative surveys. The conclusion of this research will determine whether or not our society is ready to implement AI usage properly. It'll also answer questions regarding if AI truly has an adequate urgency to qualify so it can apply its usage in current mainstream media.
Keywords: AI, Multimedia, Revolution.

INTRODUCTION

Artificial Intelligence (AI) is increasingly being used in the multimedia industry, especially in the areas of advertising, film analysis, content capture, content creation and gaming. In advertising and film analysis, AI can help creators more effectively match content to their audiences by recommending music and films on streaming services like Spotify or Netflix. AI can also be used to characterize and target individual audiences, optimizing the time they spend on ads. Additionally, AI can provide information about how ads should be presented to increase their effectiveness by identifying suitable customers and showing ads at the right time. Contextualization of social media conversations can help advertisers understand consumer sentiment and detect fraudulent ad impressions using Natural Language Processing (NLP) methods. (Kumar et al., 2019)

In content sourcing, AI plays an important role in many creative processes by assisting in research and data retrieval. Producing new works often requires a large amount of research, and AI can help simplify this process.

The use of AI in the creative industries has experienced significant growth in recent years. Research publications on AI relevant to creative industries have increased by more than 500% in many countries, with a growth rate of 1490% in Taiwan. AI is predominantly used in games, immersive applications, advertising, and marketing compared to other creative applications.

AI has also been used in content creation, supporting artists and designers in their creative process. For example, AI technology has been used to produce scripts and films. In one example, a fictional short film called “Sunspring” had its script written entirely by an AI machine named Benjamin, which was trained using a recurrent neural network architecture.

However, when it comes to creative direction, AI's weaknesses can be attributed to the limitations of current machine learning technology. AI algorithms still rely heavily on guided learning, where ground truth data or labeled datasets are used to train models. However, a true creative process does not have a predetermined outcome that can be easily classified as good or bad. Creativity often involves combining ideas from different domains or experiences, driven by curiosity and experimentation. This makes it difficult to label data for AI applications in creative industries.

Additionally, generating low-level features from semantics in the context of creating a new work of art can result in inconsistencies between output results. For example, if a group of artists were asked to draw a cat, the results would differ in terms of color, shape, size, context, and pose. The creative process tends to be unstructured, making it difficult for AI to produce consistent, high-quality output. (Russell, 2021)

Additionally, AI lacks the ability to understand broader context, emotions, and social relationships, which are important elements in creative direction. While AI can provide probabilities or predictions based on trained models, it cannot truly understand the broader context or provide the same level of human imagination and originality. These limitations hamper AI's ability to fully contribute to creative endeavors. (Anantrasirichai & Bull, 2022)

Overall, AI's weaknesses in terms of creative direction stem from difficulties in labeling data for the creative process, producing consistent output, and understanding the broader context as well as the human imagination and intuition required for original ideas.

Graphic designers rely on intuition as a temporary ability to support their creative design process. Intuition is a feeling that momentarily enters consciousness and reinforces decision making that was taking place without awareness, or causes a shift toward a conscious reasoning strategy. In the study mentioned, twelve professional graphic designers used intuition throughout their creative design process. They rely on intuition to obtain and select information from clients, fill in information gaps, envision starting points, and guide subsequent actions and evaluations necessary to develop a design. Intuition is considered

invaluable to graphic designers, but they no longer rely solely on intuition. Instead, they combine it with other strategies and approaches to enhance their creative process. By understanding and recognizing the intuitive practices they rely on, graphic designers can further advance their understanding of design creativity and continue to develop theories, methods, and tools to support their work. (de Rooij et al., 2021)

AI can help the design field in several ways, namely:

1. Improve and expand the human experience: AI can improve the design process by making it more concrete through images, text, animation or sound. It can provide designers with tools and technology that enable them to create more immersive and engaging experiences for users.
2. Allows for speculation and ideation: Due to the difficulty and limitations of AI prototypes, speculation becomes a powerful technique for designers to propose, think about, and idealize how AI could work. By using AI as a tool for speculation, designers can explore new possibilities and push the boundaries of what is currently possible.
3. Improve user experience: AI can be used to analyze user data and behavior, allowing designers to gain insight into user preferences and needs. This information can then be used to create personalized and customized experiences that better meet user expectations.
4. Automate repetitive tasks: AI can automate repetitive and tedious design tasks, freeing up designers' time to focus on the more creative and strategic aspects of the design process. This can increase productivity and efficiency in the design workflow.
5. Helps in decision making: AI can provide designers with data-driven insights and recommendations, helping them make more informed decisions during the design process. By analyzing large amounts of data, AI can identify patterns and trends that humans might miss, resulting in more effective design solutions.

AI has the potential to revolutionize the field of design by providing designers with new tools, insights and possibilities. This can enable a more innovative and human-centered design approach, which will ultimately revolutionize the overall user experience. The aim of studying the AI multimedia revolution is to understand and exploit the potential of artificial intelligence in the creative industries. AI has the ability to help creators in a variety of ways, such as recommending music and movies to audiences, optimizing advertising strategies, and analyzing social media conversations to understand consumer sentiment. AI can also be used in content retrieval, assisting in the research process to create new works. By studying the AI multimedia revolution, researchers and professionals can explore the advances and applications of AI in enhancing human creativity and improving various aspects of the creative industry. (Kahn & Winters, 2021)

The following is an example of AI implementation in the entertainment industry:

1. Artificial intelligence (AI) is used to improve various aspects of the creative industry by providing assistance and improving the creative process. Here are some ways in which AI is used:
2. Image search and editing: AI tools can help artists in searching for relevant images and editing them according to their creative vision. This helps save time and simplifies the creative process.
3. Non-creative tasks: AI can tackle tasks that are repetitive or predictable, allowing artists to focus on the more innovative and imaginative aspects of their work. This includes tasks such as organizing files, managing data, and handling administrative tasks.
4. Autotune and vocal intonation: AI technologies like Autotune have been used for decades to correct vocal intonation errors in music production. This helps artists achieve a sound that sounds clean and professional.

5. Produce original creative works: AI algorithms can be trained to create new works of art, music, or writing based on user input. These AI-generated works can often imitate the styles and techniques of human artists, blurring the boundaries between human and AI creativity.
6. Improve narrative: AI methods can be used to generate new narratives in books or film screenplays. Although the results are sometimes unusual, they can spark new ideas and perspectives in the creative process.
It is important to note that while AI can help and improve various aspects of the creative industry, it cannot completely replace human creativity and imagination. The human touch and unique perspective are still essential in producing truly original and creative works.
The conclusion is that although artificial intelligence (AI) has developed the state-of-the-art in various creative applications, AI is not yet able to replace human creativity. AI works well for clearly defined problems that do not depend on external context or require long chains of inference or reasoning. AI also greatly benefits from large, diverse, and bias-free amounts of data for training. However, AI still lacks the ability to understand broader context, emotions and social relationships. Therefore, technological developments in the creative industries will continue to be human-centred, with the aim of enhancing human creativity rather than replacing it. As AI methods become more common, it will be important for developers and implementers to build trust, address ethical concerns, consider data bias, and understand the broader social impact of AI. (Szarowicz et al., 2001)

LITERATURE REVIEW

The theoretical basis of these articles is the development of a framework for understanding and studying manipulated advertising. The articles combine existing literature and theory surrounding advertising manipulation and its impact on consumers and society. They combine research often conducted in separate streams to provide insight into the fundamentals of consumer response to manipulated advertising. This framework focuses on various methods of advertising manipulation, ranging from manual analog tools to interactive digital tools to synthetic tools powered by artificial intelligence. It explores the mechanisms of verisimilitude, creativity, and awareness of advertising dishonesty, and how they influence consumer responses. The framework also considers the intensification of these relationships when personal data is used to personalize advertising for target consumers. Overall, the theoretical basis of these articles is to contribute to both the theory and practice of advertising by providing a comprehensive understanding of manipulated advertising and its implications.
The article "Preparing for an Era of Deepfakes and AI-Generated Ads: A Framework for Understanding Responses to Manipulated Advertising" by Colin Campbell, Kirk Plangger, Sean Sands, and Jan Kietzmann discusses the impact of technological innovation on the advertising industry. This article highlights how advances in artificial intelligence (AI) have provided advertisers with digital and automated tools to automate advertising processes and create synthetic ads. These synthetic ads are generated using techniques such as deepfakes and competitive generative networks (GANs), which produce convincing but artificial versions of reality.(Campbell et al., 2022)
The authors propose a general framework to better understand consumer responses to all forms of advertising manipulation, including deepfakes. They emphasize the need for research in three key areas: advertising deceptiveness, consumer response, and originality. By studying these aspects, researchers can gain insight into how consumers react to manipulated advertising and the implications this has for theory and the industry.
In addition to the articles mentioned, there are also relevant studies in the field of AI media. For example, the paper “The impact of AI on the advertising process: The Chinese experience” by Qin and Jiang explores the influence of AI on advertising in the Chinese

context. It provides insight into how AI technology is shaping the advertising landscape and influencing consumer behavior.

This process generally involves two main stages: training and generation. During the training stage, the AI model learns to understand and replicate the patterns, features, and movements present in the training dataset. This training dataset can consist of images or videos of certain people or objects. The model analyzes the data and learns to produce new content that closely resembles the original dataset. (WHITE & KATSUNO, 2021)

Once the model is trained, it can be used to generate deepfake content. This is done by feeding new data, such as videos or images of different people, into the trained model. The model then applies the learned patterns and features to the new data, producing a manipulated version that appears authentic.

AI deepfake technology has raised concerns because of its potential for abuse, such as spreading false information or creating convincing fake videos. As a result, researchers and policymakers are actively exploring ways to detect and mitigate the harmful effects of deepfakes.

Thus, the development of AI in media has progressed from simple algorithms to more complex systems involving a layered structure of AI algorithms. The focus is on creating realistic and intelligent behavior for the computer-controlled characters, with movement layers playing an important role in providing smooth, realistic movement.

AI and its algorithms can be very complex, especially in the context of computer games. The basic principle of AI in games is to make computer-controlled characters behave as if they were controlled by a human player. It involves various skills such as smooth and realistic movement, dynamic decision making, automatic strategy planning, efficient path finding, and so on.

The complexity of AI in games increases along with the complexity of the game itself. Although some effects that create the illusion of intelligence can be achieved with customized animations or graphical tricks, the actual logic of game agent AI has become very complex. Most modern games require a layered structure of AI algorithms.

There are two main layers of AI in the game: group AI and unit AI. Group AI focuses on group strategy, maintaining formation, cooperative movements, and other group behavior. AI units, on the other hand, determine the behavior of a single artificial intelligence agent and consist of decision-making, path-finding, and movement layers.

Here are some examples of applications that use artificial intelligence to produce media content:

1. Animation: Tools powered by artificial intelligence can help in creating animated content by automating tasks such as character movements, facial expressions, and background design.
2. Video Editing: Artificial intelligence algorithms can analyze video footage and automatically generate an edited version based on a predefined style or user preferences. This can save time and effort in the post-production process.
3. Image Generation: Artificial intelligence models can generate realistic images from scratch or modify existing images by applying various styles, filters, or effects. This can be useful in graphic design, advertising, and visual storytelling.
4. Music Composition: Artificial intelligence algorithms can compose original music by analyzing patterns and structures in existing compositions. It can help in creating background music or music for various kinds of media projects.
5. Virtual Reality (VR) and Augmented Reality (AR): Artificial intelligence can enhance immersive experiences in VR and AR applications by generating realistic virtual environments, characters, and interactive elements.

6. Content Recommendation: Recommendation systems powered by artificial intelligence can analyze user preferences and behavior to suggest personalized media content, such as movies, TV shows, music or articles.
7. Voice and Speech Synthesis: Artificial intelligence models can generate human-like voices and speech patterns, enabling applications such as voice assistants, audiobooks, and voice narration.
8. Text Generation: Artificial intelligence algorithms can generate written content, such as news articles, blog posts, or social media captions, based on predefined topics or user input.
The movement layer is the base layer of any AI system and provides realistic movement for the characters. Without a well-designed and implemented movement layer, agent movement will be chaotic, unrealistic, and difficult to animate. The complexity of the movement layers depends on the movement capabilities of the character and the game itself. (Nakada et al., 2018)
The decision-making layer processes the agent's internal and external knowledge to produce abstract decisions, such as “explore the map” or “run because of a wound.” The pathfinding layer links decision making with movement, allowing agents to navigate the game world in a controlled manner.
The complexity of the AI algorithm may vary depending on the specific requirements of the game. For example, enemies in a platform game may only require simple decisions and basic movement, while bots in a first-person shooter game may require more sophisticated maneuvers and follow more complex paths. (Wong, 2018)
For example, AI rotoscoping works by using artificial intelligence algorithms to automate the process of creating rotoscoped shapes. Rotoscoping is a technique used in animation and visual effects to trace a live image frame by frame, creating a matte or mask that can be used to separate the foreground from the background. In the context of the stop-motion animated film LAIKA, AI rotoscoping is being developed to speed up digital painting and rotoscope tasks.
The AI rotoscoping process involves training a model using machine learning techniques. These models are trained to predict landmarks and rotoscoping shapes based on rough cuts of facial regions. The training data includes just a few finished shots, along with renders produced during LAIKA's digital character design workflow. Using this data, custom training models can be created for each character.
Once the models are trained, they are integrated into artists' workflows through tools developed by Intel. This tool, a Nuke plugin, provides a simple and intuitive user interface for artists to work with. Artists can use character source footage and define areas of interest. The AI tool then generates rotoscoping shape and tracking data, which is delivered directly within the Nuke interface. Artists have the option to use the data as is, modify it further in Nuke, or export it to other software such as SilhouetteFX.
The goal of AI rotoscoping is to automate and simplify rotoscoping and painting tasks in LAIKA's stop-motion animated films, reducing the burden on the visual effects team. The collaboration between LAIKA and Intel aims to improve the accuracy of AI tools and training models, allowing a higher percentage of shots to be completed. The AI tools are designed to fit LAIKA's VFX production pipeline seamlessly, giving artists control over the results and maximizing the potential of AI technology. (Stringer et al., 2020)
AI is needed in media, especially in animation, to automate and improve the creation of animated sequences. Although modern animation packages offer a degree of automation between key frames, creating scenes with multiple interacting characters still relies heavily on manual work by animators. AI can overcome the current limitations of automated behavior in animated sequences by providing autonomous intelligent behavior to animated characters.

Current limitations of automated behavior in animation are as follows:
1. Lack of autonomy: Today's automatic behaviors in animated sequences tend to be rigidly programmed and lack autonomy. Characters move without autonomy, purpose, or awareness of their surroundings. For example, when a character moves from point A to point B, they may accidentally come into contact with an obstacle. Instead of taking the action of avoiding or experiencing realistic collisions, the animation package produces scenes where the characters simply pass through the obstacles.
2. Limited environmental awareness: Although the latest versions of commercially available animation packages have included limited environmental awareness and a degree of collision avoidance, there is still much room for improvement. Characters in animated sequences lack a comprehensive understanding of their environment, which limits their ability to interact with the environment realistically.
Manual fixes required: When events occur where characters come into unintentional contact with obstacles, these events must be manually corrected by human animators. This manual intervention is necessary to ensure that the animation sequence looks realistic and error-free
Overall, AI in computer games has evolved to include a layered structure of algorithms that address various aspects of character behavior. Implementation of AI algorithms in game engines varies, with some engines providing support for decision making but little touching on the movement layer. Popular decision-making algorithms in game AI development include behavior trees and state machines, which can be integrated with general control behavior to create more sophisticated AI systems.
AI and its algorithms have enabled the creation of better media than ever before in several ways:
1. High-quality content: Professional content creators, such as advertisers, can now produce much higher-quality content using AI tools. This includes the ability to quickly change a model's ethnicity, age, expression or gender, creating ads that are more tailored to a specific target audience.
2. Synthetic ad production: AI technology has made synthetic ad production possible and accessible to advertising agencies. Start-ups like Rosebud AI offer tools that make it possible to generate or modify advertising through the automatic production and modification of data. This means ads can be created without the need to hire human models or other professionals, resulting in cost savings and greater efficiency.
3. Creation of new content: AI algorithms, such as Generative Adversarial Networks (GANs), can automatically generate synthetic models and objects that do not exist in reality. This opens up new opportunities to create unique and engaging content that captures consumers' attention.
Advances in deepfake technology: Deepfakes, a popular method in synthetic advertising, use AI to replace attributes of the source with those of the target. This includes swapping faces, voices, and other characteristics. As technology advances, it becomes increasingly difficult for consumers to differentiate between synthetic content and reality.
AI has the ability to redefine our era. The emergence of AI technology has brought significant progress in various fields, including advertising. With the use of AI tools such as deepfake technology and synthetic advertising tools, advertisers can create highly engaging ads in a very different way. This technology makes it possible to change a model's ethnicity, age, expression and gender, allowing consumers to see models who look like them. Additionally, AI can generate synthetic models and content that do not exist in reality. This opens up new opportunities and raises questions about the future of advertising and its impact on consumer doubt, trust and engagement.

Artificial intelligence (AI) has the potential to redefine our media era in several ways. According to the articles provided, here are some key points:

1. Automated Advertising Processes: Technological advances in AI have enabled advertisers to automate many advertising processes. This includes the production and modification of data to create synthetic advertising. AI techniques such as deepfakes and competitive generative networks (GANs) are used to automatically generate content that can depict unreal, but convincing, artificial versions of reality.
2. Manipulated Ads: The rise of synthetic ads, especially deepfakes, is a sophisticated form of ad manipulation. Deepfakes use AI algorithms to create highly realistic fake videos or images that can be used for advertising purposes. This form of manipulation raises concerns about the authenticity and trustworthiness of advertising content.
3. Consumer Response: Understanding how consumers respond to manipulated advertising is important in the era of AI-generated media. These articles suggest that consumers may have different reactions to different forms of advertising manipulation. Research in this area can help understand consumer hesitation, trust, and engagement with AI-generated advertising.

Research Agenda: To further explore the impact of AI on advertising, the articles propose a research agenda focused on three areas: advertising deceptiveness, consumer response, and originality. By investigating these aspects, researchers can gain insight into the impact of AI-generated media on consumer behavior and perceptions.

RESEARCH METHODS

The semiotic theory that is most suitable for discussing AI in multimedia is the theory developed by Charles Sander Peirce. Peirce's semiotic theory emphasizes the logic and philosophy of signs in society, and he believes that human reasoning is always carried out through signs. In the context of AI in multimedia, Peirce's theory can be applied to understand how AI systems interpret and produce meaning from various signs and symbols in multimedia content. (Mudjiyanto et al., 2013)

To understand how AI systems interpret and produce meaning from various signs and symbols in multimedia content, we can apply Peirce's semiotic theory. Semiotics is the study of signs and symbols and how they convey meaning. According to Pierce's theory, there are three main components involved in the process of interpretation and meaning formation:

1. Sign: A sign is anything that represents something else. In the context of AI systems and multimedia content, tags can include text, images, animation, video, and audio. These signs are encrypted with meaning and are used to communicate information to users.
2. Interpretant: Interpretant refers to the mental representation or understanding that forms in the user's mind when they encounter a sign. In the case of AI systems, the interpretant is the meaning or message drawn by the user from the signs presented in multimedia content.
3. Object: An object is a real world referent or concept represented by a sign. This is the actual thing or idea that the sign is trying to convey. In the context of AI systems, objects may vary depending on the specific application or purpose of the multimedia content.

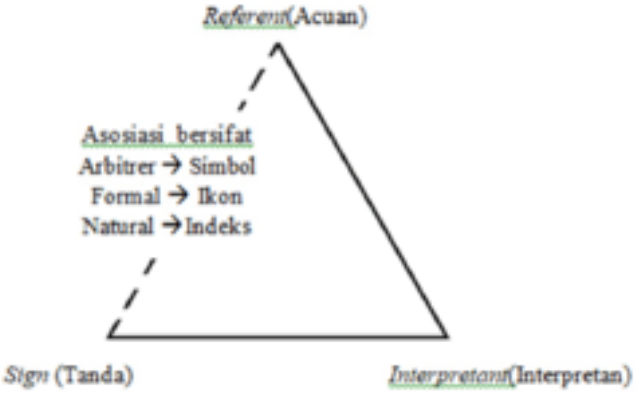

Figure 1. Peirce's Trichotomy of Semiotics. Source: (Alnoza, et al., 2021, p. 5

AI systems use various techniques and algorithms to analyze and interpret signs in multimedia content. Natural language processing (NLP) is one technique that allows AI systems to understand and derive meaning from text-based signs. NLP algorithms process text input and apply pattern matching rules and linguistic analysis to extract information and generate meaning. (Gunawan et al., 2020)

Apart from NLP, AI systems can also use computer vision algorithms to interpret visual signs such as images and videos. These algorithms analyze visual features, patterns, and context in multimedia content to generate meaning and understanding

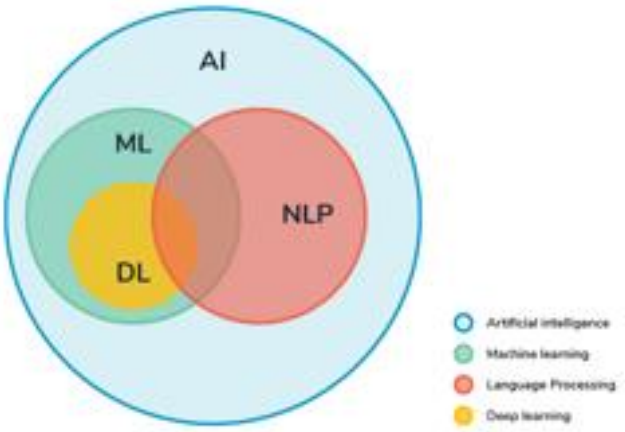

Figure 2. AI and NLP System Coverage. Source: (Sigg, et al., 2019, p. 13)

AI interprets and generates meaning from various signs and symbols in multimedia content by applying semiotic principles and using special algorithms and techniques such as NLP and computer vision.

AI uses NLP to generate meaning in a given medium by applying heuristic pattern matching rules to human input. In the context of this document, AI-based interactive learning media, which includes a chatbot named A.L.I.C.E (also known as Alicebot or Alice), engages in conversations with humans using NLP. NLP allows chatbots to understand and interpret human input, creating meaningful conversations. In addition, the use of Artificial Intelligence Programming Language (AIML) further enhances AI's ability to process and produce meaningful responses. This combination of AI and NLP enables the production of interactive learning media that can effectively communicate and provide a personalized learning experience for students. (Halim & Prasetyo, 2018)

AI is a technology that involves the use of machines to perform tasks that normally require

human intelligence or strength. This is a branch of computer science that aims to imitate the intelligence possessed by living creatures and apply it through machines to solve problems. AI is not limited to simple goals, but is expected to carry out tasks that can be done by humans.

The uses of AI are wide and varied. It can be applied in various fields such as education, healthcare, finance, transportation, etc. In education, AI can be used to develop intelligent tutoring systems that provide personalized learning experiences for students. It can also be used to create chatbots that simulate intellectual conversations and help answer common questions asked by students. AI can analyze large amounts of data to identify patterns and make predictions, which can be useful in healthcare and finance. Additionally, AI can be used in autonomous vehicles to improve transportation systems. (Hernawan et al., 2022; Putra Hastungkara & Triastuti, 2019)

Learning about content media uplifted customer fantasies, through repeated conduction with pleasant feelings, and the creation of fantastic imaginations. (Murwonugroho W, & Deny Tri Ardianto, 2019)

The meaning of AI is creating machines that can exhibit intelligent behavior and carry out tasks that normally require human intelligence. It involves developing algorithms, mathematical models, and complex code systems to enable machines to learn, think, and improve themselves. AI is a dynamic field of study that encompasses various disciplines such as computer science, technology, mathematics, and others. (Mendoza et al., 2022)

Due to the dynamic field of study, AI can be used to influence students more academically. Video learning material for students is very significant, so AI accuracy can really help students. The following are several key points about the advantages of using video materials as a learning system:

1. Time savings: Video learning allows students to access information and learn at their own pace, which can save time compared to traditional classroom lectures.
2. Fast learning: Videos can present information briefly and interestingly, making it easier for students to understand complex concepts quickly.
3. Cost savings: Video learning eliminates the need for physical textbooks or additional learning materials, reducing costs for students.
4. Access to a wealth of information: Videos provide a variety of information on a variety of topics, allowing students to explore and learn more than is covered in their regular curriculum.
5. Latest information: Video learning platforms like YouTube offer extensive content libraries, ensuring students can access the latest information and stay current in their subjects.
6. Connectivity and collaboration: Videos allow students to connect with others who are learning the same topic, encouraging collaboration and the exchange of ideas.
7. Alternative decision making: Videos provide students with alternative viewpoints and approaches to problem solving, allowing them to make decisions based on different views.

Overall, video learning materials can enhance students' learning experiences by providing flexibility, access to a variety of information, and opportunities for collaboration and critical thinking. The implementation of AI in video learning materials also provides accessibility to students who do not have access to locked journals, where AI can open them to the public. (Ivan et al., 2021)

Apart from that, AI can also be implemented in VR (Virtual Reality) technology. VR can provide children with fantastic visual experiences and amazing imaginations, allowing them to learn about nature and animal life in a more immersive and engaging way. It also emphasizes the need to develop VR technology with a humanist approach, emphasizing moral aspects and raising awareness about the importance of the survival of living beings. (Murwonugroho & Ardianto, 2019)

RESEARCH RESULTS AND DISCUSSION

AI has the potential to revolutionize the media landscape by automating advertising processes, introducing new forms of ad manipulation, and influencing consumer responses. It is important for marketers and policymakers to be aware of these developments and prepare for the challenges that may arise in this era of advanced technology.
Details of the implementation of AI in the media revolution can be seen in Table 1 below:

Tabel 1

No.	Advertising Techniques using AI	AI in Advertising Manipulation	Consumer Response to Advertising Manipulation	Implications of AI for Theory and Industry
1.	Deepfake: An artificial intelligence technique that produces a realistic but artificial version of reality.	Synthetic Ads: Ads that consist of content based on the artificial and automatic production and modification of data	Advertising Untruth: How consumers respond to false or manipulated advertising	Research Agenda: Develop a research agenda to guide further study in the field of manipulated advertising.
2.	Generative Adversarial Network (GAN): An artificial intelligence technique used to automatically generate content.	Deepfakes: The most advanced form of advertising manipulation, using artificial intelligence techniques to create unreal but convincing content.	Consumer Response: Understand how consumers react to various forms of manipulated advertising.	Theory: Examines the theoretical implications of artificial intelligence-generated advertising and its impact on consumer behavior.
3.			Originality: Exploring the implications and consequences of synthetic advertising on consumer behavior.	Industry: Consider the practical implications and challenges for the advertising industry

To stay relevant in the AI era, there are several strategies and approaches to consider:
1. Stay Informed: Continuously educate yourself about the latest developments in AI technology. Follow trusted sources, such as research papers, industry publications, and conferences, to stay up to date on the latest trends and breakthroughs.
2. Apply Lifelong Learning: Develop a mindset of continuous learning and adaptability. AI technology is constantly evolving, so it is important to be open to learning new skills and gaining knowledge in areas such as machine learning, data analysis, and programming.
3. Collaborate and Network: Engage with professionals and experts in the field of AI. Attend conferences, join online communities, and participate in forums where you can connect with like-minded individuals and exchange ideas. Collaborating with others can help you gain insights, share experiences, and stay ahead.
4. Experiment and Explore: Take advantage of AI tools and platforms that are accessible to individuals and businesses. Experiment with various AI applications and explore how they can be integrated into your work or personal projects. This hands-on experience will help you understand the capabilities and limitations of AI technology.

5. Ethical Considerations: As AI technology becomes more pervasive, it is important to consider the ethical implications and potential risks associated with its use. Stay informed about ethical guidelines and best practices in AI development and deployment to ensure responsible and ethical use.
6. Adapt and Innovation: Embrace AI as a tool for innovation and find ways to leverage its capabilities in your field or industry. Explore how AI can improve existing processes, increase efficiency and create new opportunities. By adapting and innovating, you can stay competitive in the AI era.
Applying artificial intelligence (AI) in media work can greatly simplify and optimize various tasks. With the use of AI tools, such as deepfakes and competitive generative networks (GANs), the production and modification of media content can be automated, reducing the need for manual effort. This has the potential to make work more efficient and save time for media professionals.
AI can enable the creation of synthetic ads, where content is created based on artificial and automated data production. This technology makes it possible to create highly engaging ads without the need for extensive human involvement. Advertisers can use AI to instantly change a model's ethnicity, age, expression or gender, enabling the creation of ads that resonate with diverse target audiences.
Additionally, AI can generate completely new content, including individuals and objects that do not exist in reality. This opens up new opportunities for creativity and innovation in media work. For example, GANs can automatically generate synthetic models tailored to achieve specific advertising goals, eliminating the need to hire human models or other professionals.
Artificial intelligence is very important in digital media. With advances in artificial intelligence technology, computers can now produce media content from raw materials, such as animation, which was previously mostly done by humans. The development of digital media platforms powered by artificial intelligence has the potential to revolutionize the way digital media is created and interacted with. By utilizing artificial intelligence technology and virtual reality display technology, this platform can make abstract information real, easy to manage and interactive. Artificial intelligence technology, with its ability to simulate human brain processes, can significantly reduce the workload and human error in creating digital media. It also enables the development of immersive and interactive experiences through virtual reality. The integration of artificial intelligence in digital media opens up a wide range of application possibilities in various fields, including education, healthcare, cultural heritage and public welfare services. Overall, artificial intelligence plays an important role in enhancing the capabilities and potential of digital media.
While the implementation of AI in media work offers many benefits, it is important to consider the ethical implications and potential challenges associated with the use of deepfakes and synthetic media. It is critical to ensure transparency and responsible use of AI tools to maintain trust and avoid misleading or deceiving audiences.
It can be said that the advertising industry has sufficient competence to do so. The use of AI tools has shown potential in creating highly engaging advertisements, and professional content creators, such as advertisers, are likely to be able to produce even more high-quality content. The possibilities made possible by synthetic advertising tools, such as changing a model's ethnicity, age, expression, or gender, or generating completely new content, demonstrate the potential for a paradigm shift in advertising.

CONCLUSIONS AND SUGGESTIONS

While the implementation of AI in media work offers many benefits, it is important to consider the ethical implications and potential challenges associated with the use of deepfakes

and synthetic media. It is critical to ensure transparency and responsible use of AI tools to maintain trust and avoid misleading or deceiving audiences.

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CHAPTER 2

The Influence of Social Media Interaction from Digital Music Platform Brands on Brand Loyalty Through Cognitive Aspects and Advertising Trust as A Mediator on Social Media

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ABSTRACT

This study aims to analyze the effect of social media interaction on brand loyalty through cognitive aspects (knowledge & affection) and advertising trust as mediators. The data used in this study are primary data sourced from online surveys via Google Form questionnaires with research objects as active subscribers of paid services on digital music platforms Spotify, YouTube Music, or Apple Music in Indonesia. The research sample was selected using a non-probability sampling method with a total sample of 160 respondents. Data analysis was performed using descriptive statistics by finding the average and standard deviation and using AMOS SEM for hypothesis testing. The results of the study show that social media interaction has a positive effect on brand loyalty through the role of advertising trust as a mediator partially. In addition, social media interaction has a positive influence on the cognitive aspects of knowledge and affection. The managerial implications of this research are strengthening social media interaction aspects with customers, strengthening branding through consistent brand identity visualization, developing customer service, ensuring the credibility of information in interactions and advertising activities, and giving appreciation to loyal customers.
Key Words: Social Media Interaction, Knowledge, Affection, Advertising Trust, Brand Loyalty.

INTRODUCTION

The development of technology and information currently has a very rapid trend in line with increasingly massive efforts towards the era of technology 4.0, an era where many aspects of life are helped by the development of technology to become completely digital (Wibawa & Pritandhari, 2020). This development has also changed the perspective and implementation of various activities, not only in the economic and business fields where the internet and digital media have become a tool to help achieve targets. Therefore, businesses are competing to adapt to technological developments so as not to be less competitive in doing business. Efforts that can be made are looking for ways to attract consumer attention in a fast, efficient and effective way, one of which is through determining a marketing strategy along with implementing the marketing activities themselves. (Purba et al., 2021; Tunjungsari & Ginting, 2020). In this context, marketing involves technology and devices such as the internet and social media, both of which have a significant impact along with developments in its implementation.

The use of the internet and social media in Indonesia is found to be growing very rapidly, based on a survey conducted by the Indonesian Internet Service Providers Association (APJII) it was recorded that internet penetration in Indonesia has reached 78.19% in 2023 or reaching 215,626,156 people from the total population, amounting to 275,773,901 people (Nurhanisah, 2023). On the other hand, social media can provide various conveniences and speed in disseminating information that can be accessed by all groups at affordable costs. This is the reason why social media is the media that many businesses choose and use to market their products. One form of communication media in question is through advertising on social media, which is currently a trend for businesses to introduce their products, build company image, reputation, branding, and support sales (A. M. Dewi, 2018). This is supported by data where 91% of companies use social media as part of their marketing mix, with digital advertising as the most widely used industry channel (Hillier, 2021; Salesforce, 2021).

With existing technological developments, products offered through advertising on social media are not limited to physical products, but also include digital products. The one that is currently often becomes a trend and shows rapid development is music products found through digital music platforms. The digital music platform is a development of CD cassettes and vinyl records which are tools used as a medium for storing various data, especially music and song recordings, with streaming services being the main feature (Soimah, 2022). Music streaming services are becoming the most popular method for consumers to listen to music with unlimited access to large music catalogs (Noviani et al., 2020). The use of digital music platforms as supporting media to promote music is increasingly being carried out. The data shows that around 97% of music sales are currently controlled by music streaming services or digital music platforms, and the remaining 3% for physical sales (Rahma, 2020).

The trend of digital music platforms is not only increased in terms of the number of users, but also users of premium music streaming services who are willing to pay for "subscription packages" or what is known as "paid subscription". In 2010 there were only 8 million paid users, then in 2014 this increased rapidly to 41 million subscribers and continued to increase to 68 million subscribers in 2015. Indonesia is in seventh position as the largest digital music platform market in Asia, with revenues reaching 21 million US dollars in 2015. In 2016, McKinsey & Company stated that Indonesia was one of the four countries with the most potential for the digital music industry (International Federation of the Phonographic Industry, 2014; Kementerian Pariwisata dan Ekonomi Kreatif Republik Indonesia, 2021).

Even though the industry and the number of paying subscribers are experiencing rapid growth, specifically (especially on digital music platforms), it is found that several platforms are often experiencing a downward trend or negative trend in terms of finances and market share. Spotify, the most popular digital music platform in the world, is known to experience a

decreasing trend in operating losses from year to year even though the number of paying subscribers continues to increase every year as shown in Table 1.

Table-1: Number of Spotify Paid Service Subscribers and Spotify's Total Losses in the Last 5 Years

Year	Number of Subscribers	Total Loss (in Euro)
2022	205.000.000	430,000,000
2021	180.000.000	34,000,000
2020	155.000.000	581,000,000
2019	124.000.000	186,000,000
2018	96.000.000	78,000,000

Source: Spotify *Annual Report* 2018 – 2022

Furthermore, Apple Music, as the second largest digital music platform in the world after Spotify, is experiencing an increase in the cost of sales, which will peak with an increase in subscription fees in 2022 from the original monthly individual rate of $9.99, monthly family plan $14.99, and annual rate $99 becomes $10.99, $16.99, and $109. These things have an impact on decreasing usage by 4% in a year (Susic, 2023), until complaint customers resulting in termination subscriber paid (Chadwick, 2022).

Table-2: Cost of Sales Apple Music in the Last 5 Years

Year	Cost of Sales (in USD)
2022	22,075,000,000,000
2021	20,715,000,000,000
2020	18,273,000,000,000
2019	16,786,000,000,000
2018	15,592,000,000,000

Source: Apple, Inc. *Financial Statement* 2018 – 2022

YouTube Music is no exception, which currently has a market share of 13.66% even though it has been in the industry since 2015. This value can be categorized as low compared to Apple Music, which has also entered the competition since 2015 with market share amounting to 15.2% (Curry, 2023). Therefore, it is necessary to analyze the factors that can influence customer loyalty as an implication of the increase in the number of customers amidst this phenomenon.

Referring to the rapid development of social media and other digital media as a tool to achieve targets/goals, digital music platforms are no exception. Each platform also maximizes the use of existing social media and digital media to carry out marketing activities, with one of the most dominant being advertising. This is known as one of the outputs of the phenomenon where high competition makes each platform have the urge to create brand loyalty (A. S. Dewi, 2021). They see that a company's success depends on how it can create loyalty among customers, not just how to get as many customers as possible. Loyalty is seen as a tool to be able to excel in competition, which has been proven to play a role as a main factor in increasing a company's comparative advantage (Atulkar, 2020; C. C. Huang, 2017).

Basically, activity on social media is part of the interaction created between consumers and a brand to create trust through sharing credible information and knowledge, so that it can provide emotional stimulus in the form of affection and positive attitudes to create attachment or commitment in the form of loyalty (Alsamydai, 2016; B. Alexander, 2014; Chaudhuri & Holbrook, 2001; Mahayani, Odytri Caesar, Ismiarta, 2019). This can be seen from the increasing proliferation of content from digital music platforms which often appears when social media users are actively using it, in the form of interactive content, quizzes, and even advertisements. These things are the media used by digital music platforms to interact, so that

both the public and their customers can interact, create reciprocal relationships, get impressions or determine attitudes towards the information or knowledge received, and assess or evaluate whether digital music platforms can fulfill their preferences for consistency in purchasing/subscribing.

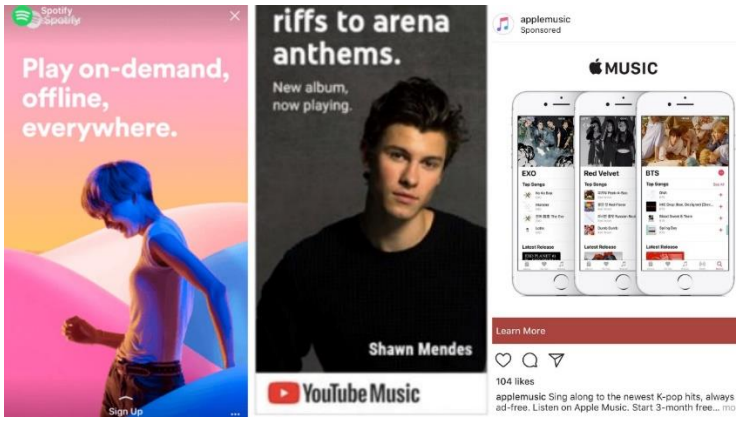

Figure 1. Digital music platform advertising on social media

Based on the explanation above, existing technological developments are in line with the growth of digital music platforms along with paid streaming services and the number of subscribers. However, it is not yet known whether interaction via social media is one of several important variables that has an impact on the growth of digital music platforms and its relationship to consumer loyalty to the platform brand in question. In line with the phenomenon that has been described, researchers will analyze to find out more about the influence of social media interaction on brand loyalty on digital music platforms through knowledge and affection as cognitive aspects and advertising trust as a mediator.

CHAPTER 1 - LITERATURE REVIEW

1.1 Hierarchy of Effects (HoE)

Hierarchy of Effects (HoE) (Smith et al., 2008) is a series of stages that examine how consumers respond emotionally and behaviorally to social media marketing (Shareef et al., 2019) which specifically has 7 stages, namely unawareness, followed by awareness, knowledge, liking, preferences, conviction and *purchase* (Lavidge & Steiner, 1961). Apart from that, brand loyalty is one of the constructs that is the next stage that follows after a purchase (Hutter et al., 2013; Tolba & Hassan, 2009).

1.2 Social media interaction

Social media interaction is a core aspect that includes all two-way interactive conversations or interactions on social media (WhatsApp, Line, Facebook, Twitter, Instagram, TikTok, etc.) between two parties, whether it's liking marked posts, or other ways to interacting with followers or friends which leads to satisfaction in their activities (Gomez, 2021; Wang, 2021; Zhang et al., 2021). Two-way interactions include communication between consumers and a brand, or between consumers on social media (Cuevas et al., 2020). To achieve maximum use of social media as a tool for interaction with consumers, managerial training is needed so that they can know and understand consumers' preferences and personalities. That way, the interactions carried out can help consumers create an image of a brand's products and build affection for the brand itself (Zhang et al., 2021).

1.3 Knowledge

Knowledge is a cognitive aspect which in this case refers to knowledge of a brand. Knowledge refers to how far, how broad, or how good consumers' knowledge of a brand is based on the amount of information they know along with knowledge of other related functions (Annas & Hariasih, 2021). This knowledge will describe the ideas, emotions and experiences associated with a brand, such as the logo that represents the brand to its involvement in interactions in the form of marketing, correspondence and so on. Based on the thoughts they have, interactions they have, feelings about a product, and other factors, consumers will form their own interpretation of the brand (Team, 2020). Therefore, consumer's knowledge of a brand is the result of assessing the information and interactions created (Zhang et al., 2020).

1.4 Affection

Affection is a cognitive aspect which in this case refers to how consumers' love for a brand as the output of the brand's efforts stimulates consumers' emotions (Chaudhuri & Holbrook, 2001). Affection is also described as a strong emotional attachment to a brand based on what consumers have experienced or evaluated directly, where consumers assess it as having positive, negative, or even mixed values depending on their feelings (I2021;ewi et al., 2021; Schiffman & Wisenblit, 2015). Meanwhile, consumer affection for a brand can also be interpreted as self-satisfaction obtained when purchasing or using a product from that brand (Zhang et al., 2021), or the enthusiasm and pride that consumers feel about owning a product from a brand (Kumar et al., 2015). Affection is also known to be one of the determining factors in consumer loyalty to a brand (brand loyalty) (Silalahi et al., 2017). On the other hand, consumers' affection for a product/brand can be increased through appropriate and effective marketing activities on social media (Sharawneh, 2020; Zhang et al., 2021).

1.5 Advertising Trust

Customer engagement is an effort made by a company from a brand (Mahayani, Odytri Caesar, Ismiarta, 2019) with advertising as its approach method, where the approach with advertising activities on digital media such as the internet can provide the highest level of affection when compared to other media such as television and newspapers (Aydin, 2013). The two-way interaction or reciprocal relationship created by this process can create trust in advertising (advertising trust). Meanwhile, trust can be interpreted as the consumer's desire to believe in an advertised brand (Chaudhuri & Holbrook, 2001). Advertising also functions to encourage and build consumer trust in what is advertised by a company/brand (Moslehpour et al., 2020; Yusuf Mesiya, 2020) as well as being one of the determining factors in creating consumer loyalty towards a company/brand (Silalahi et al., 2017).

1.6 Brand Loyalty

Brand loyalty is a condition where consumers have a positive attitude towards the brand, are committed to the brand, and tend to continue purchasing in the future (B. Alexander, 2014). The level of consumer loyalty to a brand (brand loyalty) can be increased through marketing activities on social media (Sharawneh, 2020).

CHAPTER 2 - CONCEPTUAL FRAMEWORK

Social media interaction can be interpreted as two-way interaction or communication carried out by consumers with a brand, either in the form of marketing activities, correspondence, etc., to then create an exchange of information and knowledge sharing activities regarding a product from a particular brand (Nasrullah, 2017; Neeley & Leonardi, 2018). Information or knowledge provides an image that consumers associate with a brand, and based on the

knowledge that consumers have, which is the output of these associations, consumers will get their own interpretation of a brand (Annas & Hariasih, 2021; Team, 2020; Zhang et al., 2020). Thoughts and interpretation of their meaning become a unity in the form of knowledge, which is one of the cognitive aspects that can stimulate the behavior of each consumer. Apart from that, there is affection as another cognitive aspect which also provides stimulus to consumers' emotions in terms of encouraging their love for a brand (Chaudhuri & Holbrook, 2001).
It is also known that interactions involving the sharing of knowledge and credible information can influence the relationship between consumers and a brand, where the interactive process provides memories, knowledge and information that reflects the quality and reliability of a product. This can then stimulate and encourage consumer trust in the brand in question, as well as a positive attitude/impression of the interactive process that occurs and provide satisfaction in it (Aydin, 2013; Moslehpour et al., 2020; Yusuf Mesiya, 2020). On the other hand, the positive attitude that consumers have regarding a series of processes/interactions can then develop into brand loyalty. Based on this description, the following conceptual framework can be formed:

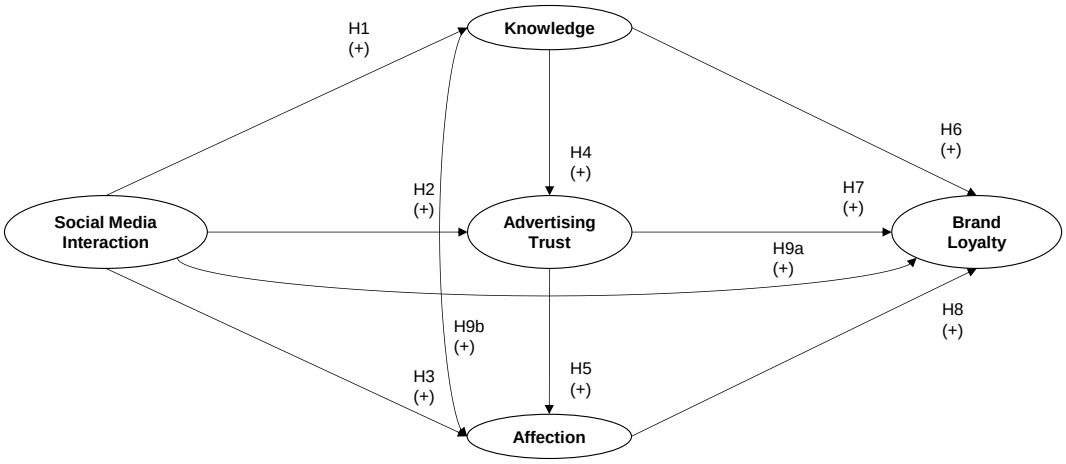

Figure 2. Conceptual Framework

CHAPTER 3 - HYPOTHESIS DEVELOPMENT

The influence of social media interaction on knowledge

Social media has a significant impact on the habits or behavior of many people, who through their activities also act as the main forum or platform for many things, such as getting information to sharing content and daily activities with other people. This allows for unlimited social interaction and gives business actors access to reach consumers in various channels. Social media has also developed into an important marketing and communication tool for companies (Appel et al., 2020). That is why social media has been widely used, as proven by its effectiveness as a medium for exchanging information between businesses and consumers to share knowledge (Neeley & Leonardi, 2018; Papa et al., 2018). This research emphasizes the interaction aspect of social media marketing (social media interaction), which in previous research found that consumer interaction with a brand on social media can significantly increase brand awareness and brand familiarity (Mehrullah & Rohail, 2018). Based on the explanation above, the following hypothesis can be formulated:

H1: There is a positive influence of social media interaction on knowledge.

The influence of social media interaction on advertising trust

Due to its rapid development and increasing mass usage volume, social media currently supports interactive marketing as a new way to communicate with consumers. In its

implementation, marketing on social media involves communicating with consumers through features provided by brands that are relevant and up-to-date (Seo & Park, 2018). In order for implementation to be carried out well, support must be provided in the form of competent interaction. Therefore, the company's efforts to support this are known as customer engagement through social media (Mahayani, Odytri Caesar, Ismiarta, 2019) and advertising is one approach to achieve this. Reciprocal relationships established through engagement/interaction can help build brand trust.

The aim of advertising is to increase consumer awareness, educate in order to provide knowledge or information about the product, as well as provide convincing evidence with the aim of measuring the quality and reliability of the advertised product (Yusuf Mesiya, 2020b) and encouraging trust to what is advertised. On the other hand, consumers' willingness to believe in the characteristics of the advertised brand is referred to as trust (Chaudhuri & Holbrook, 2001). Therefore, it is very important to build trust (Moslehpour et al., 2020). Based on the description above, a hypothesis can be drawn:

H2: There is a positive influence of social media interaction on advertising trust.

The influence of knowledge on advertising trust

The credibility of information and various knowledge spread on social media is being threatened along with its development along with the abundance of information and the variety of audiences involved (Chen & Cheng, 2020). Therefore, social media platforms in practice play a major role in the dissemination of information and knowledge (Silverman, 2016). The lower the credibility of information/knowledge on social media, the lower the level of consumer trust in it.

This is in line with the emphasis that the purpose of advertising is to increase consumer awareness, educate in order to provide knowledge or information about the product, as well as provide convincing evidence with the aim of measuring the quality and reliability of the advertised product (Yusuf Mesiya, 2020) and encourage trust in what is advertised. So if the advertisements displayed on social media do not have the credibility of good information/knowledge, then consumers will not be encouraged to have trust in what is advertised. Based on the explanation above, the following hypothesis can be formulated:

H4: There is a positive influence of knowledge on advertising trust

The influence of advertising trust on affection

As has been explained, the two-way interaction that exists between consumers and brands on social media in interactive marketing activities through advertising as an approach method can create trust in advertising (advertising trust). However, to be able to grow advertising trust, credibility of the information contained in it is needed. The credibility of good information is directly proportional to the quality and reliability/confidence of consumers in a product from a brand, so that it can encourage the creation of trust in what is advertised. The level of trust held by consumers can influence their perception and affection towards the brand. The more credible, reliable and trustworthy a brand is, the more positive the consumer's affection be (Silalahi et al., 2017). Therefore, the hypothesis is obtained:

H5: There is a positive influence of advertising trust on affection

The influence of knowledge on brand loyalty

The knowledge that consumers have of a brand will describe the ideas, emotions and experiences associated with that brand, where good knowledge of a brand will help create positive attitudes in consumers. This positive attitude is characterized as one of the conditions where consumers will determine a decision or even a tendency to continue purchasing in the future, or in other words, it can create brand loyalty. This is based on knowledge itself which

is the result of consumers' assessment of the information and interactions created (Zhang et al., 2020), which is supported and in line with findings which state that consumers' knowledge of a brand is one of the basic considerations to evaluate whether the things a brand has can meet their needs (Hsu & Cai, 2009). So that if their needs or preferences can be met based on the evaluation or assessment carried out, then consumers will consistently make purchases from the same brand, specific products, or certain service categories as a strong commitment to subscribe or buy products from that brand regularly. consistent in the future (Schiffman & Kanuk, 2009). Based on these findings, the following hypothesis can be formulated:

H6: There is a positive influence of knowledge on brand loyalty

The influence of advertising trust on brand loyalty

Trust that is formed from interactive marketing activities through advertising by brands to consumers on social media can provide output in the form of commitment that influences the relationship between the two, where trust itself can help consumers in making decisions. Decisions taken by consumers can be in the form of purchasing decisions, which can then lead to a commitment to subscribe or repurchase products from a brand consistently in the future (B. Alexander, 2014; Kuleh & Setyadi, 2016; Schiffman & Kanuk, 2009). This is in line with previous findings which state that consumer trust is important for consumer loyalty to the brand, where this trust simultaneously becomes an encouragement that can build a positive connection or impression so that loyalty to the brand can be created. Based on the explanation above, the following hypothesis can be formulated:

H7: There is a positive influence of advertising trust on brand loyalty

The influence of affection on brand loyalty

Affection is described as a consumer's strong emotional attachment to a brand based on what has been experienced or evaluated directly, whether it has positive, negative, or even mixed values depending on their feelings (I. R. Dewi et al., 2021; Schiffman & Wisenblit, 2015). This emotional attachment is obtained by consumers as a response to the experience they have after using a product from a certain brand. If this is positive then the affection they have will also be positive. These two things will then become a driving factor for consumers to tend to maintain a positive attitude towards the brand, which will lead to a commitment to brand loyalty (Lin & Lee, 2012; Silalahi et al., 2017). Based on the description above, a hypothesis can be drawn:

H8: There is an influence of affection on brand loyalty

The influence of social media interaction on brand loyalty is mediated by advertising trust

Social media has provided an environment where users can interact in various forms, such as exchanging information or other things of mutual interest. In its implementation, social media can also give consumers the experience of purchasing a product from a particular brand (first-hand experience). This shows that interaction in social media has a function in the advertising aspect so that it can have a positive impact on interactive marketing activities, as well as being a good hub in building relationships between consumers and a brand (Ismail et al., 2018).

On the other hand, interactions created on social media can provide trust to consumers, where the quality of the information contained therein is an important factor that can influence these interactions. With good quality, credibility and relevance of information, it will also provide good interactions (R. Huang et al., 2018). These things then become important factors in influencing brand loyalty (Sharawneh, 2020), so that a hypothesis can be drawn:

H9a: There is a positive influence of social media interaction on brand loyalty which is mediated by advertising trust

The influence of knowledge on affection is mediated by advertising trust

Two-way interactions on social media carried out by a brand involve the dissemination of information and knowledge about its products, as well as providing convincing evidence with the aim of measuring the quality and reliability of the advertised product (Silverman, 2016; Yusuf Mesiya, 2020b) so as to encourage trust in him. The dissemination of information or knowledge is also accompanied by credibility, where credibility is directly proportional to the trust that consumers have in a brand. Furthermore, the trust held by consumers can influence their perceptions and affection towards the brand. So, the more credible, reliable and trustworthy a brand is, the more positive the consumer's affection will be (Silalahi et al., 2017). Based on the description above, a hypothesis can be drawn:

H9b: There is a positive influence of knowledge on affection which is mediated by advertising trust

CHAPTER 4 - METHODOLOGY

The type of research used in this research is descriptive quantitative, where testing, measurement and hypotheses are analyzed using statistical methods to then obtain measures of the significance of group differences and the significance of the relationship between the variables used. This research tests the hypothesis of the influence of social media interaction on brand loyalty through knowledge and affection as cognitive aspects and advertising trust as a mediator. The unit of analysis in this research is people living in Jabodetabek area, aged at least 17 year who subscribe to at least one digital music platform available in Indonesia. The model of the relationship between the variables studied is causal, because the relationship between the variables studied describes cause and effect events. The time dimension used in this research is cross sectional, where the analysis of variable data is data collected at a certain point in time across the sample population or predetermined criteria.

This research uses several variables consisting of one independent variable, namely social media interaction, one dependent variable, namely brand loyalty, two intervening variables, namely knowledge and affection, and one mediating variable, namely advertising trust. Each indicator of each variable and dimension is measured using an interval scale based on a Likert scale. The Likert scale is a scale used to measure a person's perceptions, attitudes or opinions regarding social phenomena (Sekaran, U; Bougie, 2020). The measurement scale for each question uses 5 alternative answer choices where scale 1 is the same as Strongly Disagree, scale 2 is the same as Disagree, scale 3 is the same as Somewhat Agree, scale 4 is the same as Agree and scale 5 is the same as Strongly Agree.

Determining the research object provided by the questionnaire is a minimum sample size of 5 and a maximum of 10 question items or indicators in the research (Nunan et al., 2020), with a total of 16 statements in this study. Due to the large population in this study, a sample was used using a minimum method of 5 times the number of question items and a maximum of 10 times the existing question items. The minimum sample size used was 16 statements multiplied by 5 and the results were 80 respondents, while the maximum number of respondents was 16 statements multiplied by 10, resulting in 160 respondents. Based on the description above, this research used a sample of 160 paid subscription digital music platform customers. The sampling method used is a non-probability sampling method or a sampling technique that does not provide equal opportunities or opportunities for members of the population to be selected as samples, with the type of sampling used is purposive sampling or a sampling technique with certain considerations or taken randomly based on the limits determined by the researcher (Sugiyono, 2019).

Before testing the hypothesis, it is necessary to carry out a Validity Test, Reliability Test and Goodness of Fit Test to determine whether the research questionnaire is valid or not by measuring the degree of accuracy of the data that has been informed by the researcher with

the existing data on the research object (Ghozali & Latan, 2015; Sekaran, U; Bougie, 2020), to find out to what extent the measurements used in research are reliable or trustworthy, as well as to measure the accuracy of the sample regression function in estimating actual values statistically, this test can be measured from the F statistical value which shows whether all the independent variables are correct. included in the model have a joint influence on the dependent variable (Ghozali & Latan, 2015).

Table-3: Validity Test Results Variables and Reliability Variable Study

No.	Indicator	*Factor Loading*	*Cronbach Alpha*
	Social media interaction		
1	Social media (Instagram, Twitter, Facebook, Tiktok) from digital music platform *brands* (Spotify/YouTube Music/Apple Music) have features for sharing information/content with other people	0.763	0 .753
2	On *social media* (Instagram, Twitter, Facebook, Tiktok) from digital music platform *brands* (Spotify/YouTube Music/Apple Music), can done conversation or exchange opinions (discussions) with other people	0.710	
3	Easy for I For expressed opinion me on social media (Instagram, Twitter, Facebook, TikTok) from digital music platform *brands* (Spotify/YouTube Music/Apple Music)	0.653	
	Knowledge		
4	I consider myself knowledgeable about digital music platform *brands* (Spotify/YouTube Music/Apple Music)	0.722	0.781
5	I enjoy learning about digital music platform *brands (Spotify/YouTube Music/Apple Music)*	0.742	
6	I can recognize almost all digital music platform *brand names (Spotify/YouTube Music/Apple Music)*	0.702	
	Affection		
7	Digital music platforms (Spotify/YouTube Music/Apple Music) are special and using them makes me feel different	0.809	0.842
8	I feel successful when I subscribe to a digital music platform (Spotify/YouTube Music/Apple Music)	0.780	
9	My self-confidence can increase by using digital music platform services (Spotify/YouTube Music/Apple Music)	0.809	
	Advertising trust		
10	I believe in advertising from digital music platforms (Spotify/YouTube Music/Apple Music) on social media (Instagram, Twitter, Facebook, TikTok)	0.765	0.877
11	Content from digital music platform advertisements (Spotify/YouTube Music/Apple Music) provides real and actual information about the product	0.890	
12	Advertising content from digital music platforms (Spotify/YouTube Music/Apple Music) is a fact (not making it up)	0.835	
13	I get a lot of information from advertising content on digital music platforms (Spotify/YouTube Music/Apple Music) on *social media* (Instagram, Twitter, Facebook, TikTok)	0.710	
	Brand loyalty		
14	I will buy return digital music platform subscription (Spotify/YouTube Music/Apple Music)	0.864	0.869

No.	Indicator	*Factor Loading*	*Cronbach Alpha*
15	I will recommend Friend or relatives For subscribe service music on digital music platforms (Spotify/YouTube Music/Apple Music)	0.780	
16	I feel satisfied with service paid For access music on digital music platforms (Spotify/YouTube Music/Apple Music)	0.856	

Source: Data processed SPSS 25 (2023)

A questionnaire is said to be valid if the questions in the questionnaire can reveal something that will be measured by the researcher. With a total sample of 160 respondents, the validity of each indicator can be said to be valid if the factor loading value is above 0.45, while the factor loading value below 0.45 is declared invalid. A questionnaire is said to be reliable if the questions in the questionnaire have a Cronbach's Alpha coefficient value greater than 0.6 (Hair et al., 2017). Based on the results of the data processing in Table-3 above, it can be concluded that all indicators in this study are valid and can be used for research, and all are reliable.

Table-4: Goodness of fit model results

Criteria	Measuring instrument	Accepted Criteria/ *Cut Off*	Mark	Information
Absolute fit measures	*p - value*	> 0.05	0,000	Poor fit
	GFI	≥ 0.90	0.889	Marginal fit
	RMSEA	≤ 0.08	0.070	Good fit
Incremental fit measure	NFI	≥ 0.90	0.887	Marginal fit
	TLI	≥ 0.90	0.933	Good fit
	CFI	≥ 0.90	0.946	Good fit
	RFI	≥ 0.90	0.859	Marginal fit
	IFI	≥ 0.90	0.947	Good fit
Parsimonious fit measure	AGFI	≥ 0.90	0.842	Marginal fit

Source: Data processed using AMOS 22

Based on the results of testing the feasibility of a model that meets goodness of fit (GoF), it is known that the p-value of 0.000 is below the cut off value > 0.05 which indicates poor fit. The GFI index of 0.889 is below the cut off value ≥ 0.90 or almost close to the cut off value, thus indicating that the index is marginally fit. The RMSEA index of 0.070 is below the cut off value ≤ 0.08, thus indicating that the index is good fit. The NFI and RFI indices are below the cut off value ≥ 0.90 or almost close to the cut off value, indicating that the index is marginally fit, while the TLI, CFI, IFI indices are above the cut off value ≥ 0.90, indicating that the index is good fit. The AGFI index of 0.842 is below the cut off value ≥ 0.90 or almost close to the cut off value, thus indicating that the index is marginally fit. In general, it can be said that the model proposed in this research illustrates that the conceptual framework created is in accordance with the statement items of each variable studied.

RESULTS AND DISCUSSION

Results

Testing of the hypothesis in this research was carried out using statistical methods using Structural Equation Model (SEM) analysis and operated through the AMOS program. The aim of this analysis is to test the relationship between variables in a model, both between indicators and their constructs and the relationship between constructs (Santoso, 2011). This research has 10 hypotheses (H1 – H8, H9a and H9b) with a tolerance limit used of 5% (p-value ≤ 0.05) for decision making with the following conditions:

1. If the p-value ≤ 0.05, it can be concluded that there is a significant influence or relationship between variables.
2. If the p-value is > 0.05, it can be concluded that there is no significant influence or relationship between the variables.

Table-5: Hypothesis Test Results

	Path	Estimate	p-value	Conclusion
H1	Social media interaction influential positive to Knowledge	0.878	0,000	H1 Supported
H2	Social media interaction influential positive to Advertising trust	0.209	0.109	H2 Not supported
H3	Social media interaction influential positive to Affection	0.327	0.023	H3 Supported
H4	Knowledge influential positive to Advertising trust	0.503	0.001	H4 Supported
H5	Advertising trust influential positive to Affection	0.660	0,000	H5 Supported
H6	Knowledge influential positive to Brand loyalty	0.840	0,000	H6 Supported
H7	Advertising trust influential positive to Brand loyalty	0.112	0.260	H7 Not supported
H8	Affection influential positive to Brand loyalty	0.038	0.345	H8 Not supported
H9a	Social media interaction influential positive to brand loyalty mediated by advertising trust	0.857	0.000	H9a Supported
H9b	Knowledge influential positive on affection mediated by advertising trust	0.832	0.000	H9b Supported

Source: Data processed by AMOS 22 (2023)

Testing H1 shows an estimate value of 0.878 and a p-value of 0.000, with a p-value smaller than 0.05, it can be concluded that H1 is supported and can be interpreted that social media interaction has a positive effect on knowledge. This can also be interpreted that the better the social media interaction that is carried out or the higher the frequency and intensity of the social media interaction that occurs, the greater the consumer's knowledge of the things contained in that interaction.

Testing H2 shows an estimate value of 0.209 and a p-value of 0.109, with a p-value greater than 0.05, it can be concluded that H2 is not supported and can be interpreted as meaning that social media interaction does not have a positive effect on advertising trust. This can also be interpreted that interactions carried out on social media cannot directly foster consumer trust, especially regarding advertising, which is something or part of the interaction.

Testing H3 shows an estimate value of 0.327 and a p-value of 0.023, with a p-value smaller than 0.05, it can be concluded that H3 is supported and it can be interpreted that social media interaction has a positive effect on affection. This can also be interpreted that the better the social media interaction that is carried out or the higher the frequency and intensity of the social media interaction that occurs, the greater the interest/affection and emotional attachment of consumers to the things contained in the interaction.

Testing H4 shows an estimate value of 0.503 and a p-value of 0.001, with a p-value smaller than 0.05, it can be concluded that H4 is supported and can be interpreted as knowing that knowledge has a positive effect on advertising trust. This can also be interpreted that the knowledge possessed by consumers can be the basis for growing trust in what they know and comes from advertising.

Testing H5 shows an estimate value of 0.660 and a p-value of 0.000, with a p-value smaller than 0.05, it can be concluded that H5 is supported and can be interpreted as advertising trust having a positive effect on affection. This can also be interpreted as the belief that consumers have in advertising which can foster interest/affection and emotional attachment to the matter in question.
Testing H6 shows an estimate value of 0.840 and a p-value of 0.000, with a p-value smaller than 0.05, it can be concluded that H6 is supported and can be interpreted as knowing that knowledge has a positive effect on brand loyalty. This can also be interpreted that the knowledge possessed by consumers can be the basis for consumers to respond in the form of a positive attitude which leads to commitment or loyalty to what they know.
Testing H7 shows an estimated value of 0.112 and a p-value of 0.260, with a p-value greater than 0.05, it can be concluded that H7 is not supported and it can be interpreted that advertising trust has no positive effect on brand loyalty. This can also mean that the trust that consumers have in an advertisement does not necessarily make them respond in the form of a positive attitude which leads to commitment or loyalty to the matter in question.
Testing H8 shows an estimated value of 0.023 and a p-value of 0.345, with a p-value greater than 0.05, it can be concluded that H8 is not supported and can be interpreted as meaning that affection has no positive effect on brand loyalty. This can also be interpreted that the interest/affection/affection or emotional attachment that consumers have does not make them respond in the form of a positive attitude directly which leads to commitment or loyalty to the matter in question.
Testing H9a and H9b was carried out by dividing 2 (two) models and then comparing them. The first model is a model that only shows the direct influence of the independent variable on the dependent variable, while the second model includes mediating variables on the influence of the independent variable on the dependent variable. The estimated values in Model 1 for both H9a and H9b are greater when compared to Model 2, thus for hypotheses H9a and H9b it can be concluded that advertising trust has a partial mediating role in influencing social media interaction on brand loyalty and hypothesis H9a is supported, also advertising trust has a partial mediating role in influencing knowledge on affection and hypothesis H9b is supported.

Discussion

Based on the results of testing hypothesis 1 (H1), it can be concluded that social media interaction has a positive and significant influence on knowledge. These results are in line with findings in previous research which found that social media has proven effective in its role as a medium for exchanging information between brands/companies and consumers to encourage the exchange of knowledge (Neeley & Leonardi, 2018; Papa et al., 2018). This is also supported by research from Piller et al. (2012) who found that social media in its role as a medium for interaction tends to become a virtual ecosystem, where companies and consumers interact by sharing information and knowledge, collaborating, and discussing mutual interests. With good interaction on social media, customer knowledge of the things contained in that interaction can grow well.
Digital music platform brands (Spotify, YouTube Music, Apple Music) already have features that support interaction activities with customers on social media to share information/content and allow customers to have conversations or exchange opinions (discussions) with other people. This activity can be carried out in the form of a button to share content (can be a link or something else), a mention feature in the comments column, wall posts, reply column, or quote retweet, so that with these things customers can form an interpretation based on the results of the assessment. interactions are created so that they can have good knowledge.

The results of testing hypothesis 2 (H2) in this study show that social media interaction is not proven to have a positive and significant influence on advertising trust. This is in contrast to previous research which states that social media interaction allows the formation of trust so that users who participate in the interaction can create a sufficient cycle of curiosity and trust (Neeley & Leonardi, 2018). The test results also show that digital music platform brands have not maximized advertising activities in terms of building engagement as an effort or approach to achieve the creation of trust from customers (Mahayani, Odytri Caesar, Ismiarta, 2019).

Apart from that, there are demographic and objectivity factors which cause the hypothesis in this research to be insignificant and contradict previous research. This research focuses on customers of digital music platform services who are also social media users and reside in Indonesia, regardless of the purpose of using social media. Meanwhile, the objects of previous research were employees at 2 (two) global companies in the technology platform sector based in the United States whose research focus was on the use of social media in the work environment with a purpose (Neeley & Leonardi, 2018).

Based on the results of testing hypothesis 3 (H3), it can be concluded that social media interaction has a positive and significant direct influence on affection. The test results are in line with previous research which states that social media interaction has a significant effect on affection and marketing activities on social media are important to carry out to increase consumers' affection for a product (Zhang et al., 2021). This is in line with the statement that interactions carried out by a brand on social media can influence customer engagement through cognitive mechanisms (which in this case is affection), so that if the affection they have is good then it will lead to a strong emotional attachment to a product or brand (I. R. Dewi et al., 2021; Hinson et al., 2019; Schiffman & Wisenblit, 2015; Wang, 2021). Therefore, in this research it can be concluded that social media interactions carried out by digital music platform brands can influence customers' affection, so that through the content or aspects of these interactions they can provide evaluations or assessments to positive feelings or impressions. This can take the form of a special feeling where they consider that using it can make them feel different, feel successful, and even increase their self-confidence.

The results of testing hypothesis 4 (H4) show that the knowledge possessed by customers is proven to have a positive and significant influence on advertising trust. This is in line with the statement in previous research which states that with good and credible information or knowledge, customer trust in that information or knowledge can be achieved, in other words the better and more credible the information or knowledge they have. and obtained, the higher the level of customer trust in what is advertised (Silverman, 2016).

Therefore, based on the results of data processing and the results of hypothesis testing in this research, it can be concluded that the knowledge possessed by customers of digital music platform branded services can build trust in the things contained in the advertisements/things being advertised. by the brand. The output of trust is in the form of trust in advertisements and content from digital music platform brands on social media along with customers' belief that the advertisements present facts and are not making things up (credible), where advertising activities are carried out. can also provide convincing evidence with the aim of measuring the quality and reliability of advertised products (Yusuf Mesiya, 2020) amidst the abundance of information that is increasingly diverse in its development (Chen & Cheng, 2020).

Based on the results of testing hypothesis 5 (H5), it can be concluded that advertising trust has a positive and significant influence on affection. The test results show that the marketing activities carried out by digital music platform brands through advertising media as a method of approaching customers are interactive and involve relevant and up-to-date aspects in their implementation (Seo & Park, 2018) so that they can create trust in what advertised (advertising trust). Trust in advertising (advertising trust) is also based on the reliability or credibility of the information contained in the advertisement, so that this reliability or

credibility can encourage and influence customers' perceptions and affection towards a brand (Silalahi et al., 2017). These things are supported and in line with previous research which states that advertising carried out on digital media provides the highest level of affection compared to other media such as television and newspapers (Aydin, 2013), where the object in this research is advertising carried out by digital music platform brands carried out through digital media or specifically through social media.

The results of testing hypothesis 6 (H6) show that the knowledge possessed by customers is proven to have a positive and significant influence on brand loyalty. This is in line with the statement in previous research which stated that consumer knowledge of a brand is one of the basic considerations for evaluating whether the things owned by a brand can meet their needs, which if this is fulfilled then customers will consistently purchasing a brand as a commitment to subscribe or buy products from that brand consistently in the future (Hsu & Cai, 2009; Schiffman & Kanuk, 2009). In this research, it can be concluded that the knowledge possessed by customers of digital music platform brands' paid services has been used well as a basis for assessment (Zhang et al., 2020) regarding the fulfillment of their needs for digital music streaming services, which in turn has become a driving force. to commit to consistently subscribing to paid services from the brand in the future (brand loyalty). Apart from the commitment to subscribe, another form of brand loyalty that is created can be in the form of providing recommendations to friends or relatives to subscribe to music services on digital music platforms.

Based on the results of testing hypothesis 7 (H7), it can be concluded that advertising trust does not have a positive and significant influence on brand loyalty. This is in contrast to previous research which states that marketing activities on social media (which in this research is through advertising/advertising activities) have a very important role in increasing brand loyalty (Sharawneh, 2020), where if customers have trust in a brand then he will feel emotionally attached to the brand and have the will to believe that he can remain faithful to the brand (Yusuf Mesiya, 2020).

There are demographic factors that cause the hypothesis in this study to be insignificant and this is contrary to previous research. In research conducted by (Sharawneh, 2020) and (Yusuf Mesiya, 2020) the respondent profile was dominated by men, while in this study it was dominated by women. This gender difference is in line with research (Zeng et al., 2019) which found that men tend to be more loyal than women, where advertising activities carried out by a brand can be one of the causes with failure in creating trust as the trigger. Therefore, practitioners or marketers from these brands need to create effective marketing strategies for their services so that they can capture loyalty from both men and women.

The results of testing hypothesis 8 (H8) in this study show that affection is not proven to have a positive and significant influence on brand loyalty. This is in contrast to previous research which states that affection originating from customers' emotional attachment as a response to the experience of using a product from a particular brand is a driving factor in commitment to brand loyalty (Lin & Lee, 2012; Silalahi et al., 2017).. There are demographic factors that cause the hypothesis in this study to not be supported and this is contrary to previous research. In this study, the majority were workers with either private/public employee status and the research object was carried out on active customers of digital music platforms (Spotify, YouTube Music, Apple Music) in Indonesia, whereas in previous research the majority were students who had made purchases on shopping sites. online books (online bookstores) in Taiwan (Lin & Lee, 2012). In this study, respondents were shown a 2 to 3 minute clip showing the homepage of a large online bookstore in Taiwan to help them recall their experiences when shopping online, because the criteria required were having made a purchase and the time of purchase made by the respondents. The time to fill out the questionnaire has various gaps so that screening needs to be done. This is different from the respondents in this

study who are active customers and still subscribe to services from digital music platforms, so they do not need to go through the recalling process first to be able to fill out the questionnaire.

Based on the results of testing hypothesis 9a (H9a), it can be concluded that social media interaction has a positive and significant influence on brand loyalty with the mediation of advertising trust. The interactions carried out by a brand on social media can function in the advertising aspect, in which case the brand can provide information or descriptions to customers regarding the experience of purchasing their products. This has a positive impact on interactive marketing activities and becomes a good hub (liaison) in building relationships between brands and their customers (Ismail et al., 2018), which in turn provides trust based on quality, credible and relevant interactions so that can influence customer brand loyalty (R. Huang et al., 2018; Sharawneh, 2020).

The results of testing hypothesis 9b (H9b) show that the knowledge possessed by customers is proven to have a positive and significant influence on affection with the mediation of advertising trust. This proves that the interactions carried out by digital music platform brands on social media have involved the sharing of information and knowledge about their products through credible and quality advertising and are supported by convincing evidence, so that knowledge is meant to encourage trust towards advertising which continues on their perception and affection towards the services provided by digital music platform brands (Silalahi et al., 2017; Silverman, 2016; Yusuf Mesiya, 2020). Customers are found to have sufficient knowledge and understanding about digital music platform brands and their services, where this knowledge is the basis and driving factor for providing an assessment that what is advertised by the brand in question is factual and credible. With trust as the output of the assessment process, customers then have an emotional attachment to the digital music platform brand in the form of enthusiasm and pride as users of the digital music platform brand's services (Kumar et al., 2015).

CONCLUSION

Based on the results of the research that has been carried out, in general it can be concluded that:

1. Of the 10 research hypotheses, 7 of them are supported and have a positive influence and the other 3 hypotheses are not supported. Of the 7 supported hypotheses, 2 of them have variables that act as mediators with partial mediating effects.
2. Social media interaction has a positive influence on brand loyalty through the partial mediating role of advertising trust. This shows that the interactions carried out by digital music platform brands through advertising activities on social media can have a positive impact on interactive marketing activities, as well as becoming a hub (connector) in building relationships between consumers and a brand, which in turn becomes an important factor in influencing brand loyalty.
3. Social media interaction has a positive influence on the cognitive aspect of knowledge, this shows that the use of social media as a tool for interaction plays a role in encouraging the exchange of knowledge between digital music platform brands and customers. Furthermore, knowledge was found to have a positive influence on brand loyalty. This shows that the knowledge that customers have about digital music platform brands is one of the basic considerations in assessing whether the services provided can meet their needs, to then create a commitment to subscribe or buy products from that brand consistently in the future. the upcoming one.
4. Social media interaction has a positive influence on the cognitive aspect of affection, this shows that interaction on social media is an important factor in increasing customer affection towards digital music platform brands, especially in marketing activities. The

things contained in these interactions can provide a positive evaluation/assessment/impression, so that using paid services on digital music platforms makes them feel different, successful, and increases their self-confidence.

LIMITATIONS AND SUGGESTIONS

Limitations to this research are:

1. There are 5 (five) variables used for this research, namely social media interaction, knowledge, affection, advertising trust, and brand loyalty, where the variables that include cognitive aspects are only knowledge and affection.
2. The digital music platform brand used in this research focuses on 3 (three) platforms with the largest number of active service subscribers in Indonesia, namely Spotify, YouTube Music, Apple Music.
3. The advertising media that is the focus of this research is social media such as Instagram, Facebook, Twitter and TikTok.

Based on the research results, discussion, and limitations that have been described, suggestions that can be recommended for further research are as follows:

1. Using variables other than knowledge and affection to examine cognitive aspects.
2. Using music platforms available in Indonesia and having subscription services other than Spotify, YouTube Music and Apple Music as research objects.

Use media other than social media such as television, radio, or other media that contain advertisements from related digital music platform brands as research objects.

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CHAPTER 3

Laboratory Study of Corn Starch as a Fluid Loss Control Agent and Its Impact on Drilling Mud Rheology

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ABSTRACT

Drilling mud is essential for efficient drilling operations, primarily transporting drill cuttings to the surface for effective circulation. Fluid loss control agents are added to drilling mud to minimize fluid loss in the borehole. This study aimed to determine filtrate volume and mud cake thickness according to standards, assess the impact of varying corn starch compositions on mud rheology, and compare pH measurements at 80°F and 200°F. Corn flour, containing starch, was used in the lab as a substitute for conventional starch to reduce filtration loss and act as a viscosifier. Corn starch was prepared by cleaning, grinding, filtering, sun drying, and sieving with a 200-mesh screen. This corn starch was mixed into drilling mud in amounts of 3, 5, 7, 9, and 11 grams. Results showed that filtration loss ranged from 3.9 to 6.2 ml, mud cake thickness from 0.42 to 0.83 mm, plastic viscosity from 16 to 27 cp, yield point from 19 to 42 lbs/100ft², 10-second gel strength from 7 to 19 lbs/100ft², and 10-minute gel strength from 10 to 31 lbs/100ft². Adding corn starch reduced filtration loss and mud cake thickness while increasing plastic viscosity, yield point, and gel strength, as starch also acts as a viscosifier. The study concluded that optimal corn starch concentrations for mud properties meeting standard specifications at 80°F were 3 and 5 grams, while at 200°F, 3 grams was sufficient to meet specifications. This highlights corn starch's effectiveness as a multifunctional additive in drilling mud, enhancing rheological properties and minimizing fluid loss, thus supporting more efficient drilling operations.

Keywords: Corn Starch, fluid loss control agent, drilling mud.

1. INTRODUCTION

The use of corn starch when used in drilling mud as a fluid loss control agent so that we can find out whether corn starch has an effect on the rheology of the mud or not. Drilling mud rheology is a measure of the basic properties of the mud which is useful for describing the mud's ability to overcome certain problems when drilling is carried out. Changes in the characteristics of mud rheology depend on temperature, pressure and the formation being drilled. Fluid loss control (fluid loss control agent) is a substance that can be added to drilling mud formulations to reduce fluid loss in the drill hole. One of the natural alternative materials used in the drilling mud process is corn starch mixed with drilling mud. This alternative material is polymer-based which is widely used to deal with the problem of fluid loss in drilled holes. The use of these additives is mixed into drilling mud which functions to maintain physical properties such as mud density, viscosity, gel strength and filtration loss. The results of the experiment stated that corn starch has potential as a fluid loss control agent in drilling mud because it meets the basic requirements for rheological properties of drilling fluids in the optimal range. The abundant and economical availability of corn starch actually makes it an option for use as an agent to control fluid loss. According to previous research from (Liu et al., 2022) researched corn starch, cassava starch and potato pulp. It can be seen that corn starch gelatinized drilling fluid has better performance. The research also used temperature resistance to reduce filtration, temperature resistance was used up to a temperature of 140°F. These parameters often cause problems in wellbore instability, so water-based drilling mud additives are needed which are environmentally friendly and low cost.

2. LITERATURE REVIEW

Drilling operations are an important part of the oil and gas industry. Drilling operations include the discovery and demonstration that the drilling operation contains reserves within the reservoir. The goal of a drilling operation is to drill, evaluate and complete a well that will produce oil and gas efficiently and safely. Therefore, proper planning of drilling operations is necessary. Drilling is the operation of making a hole from the surface to the target to be achieved to prove whether or not there are hydrocarbons in the reservoir. Drilling mud consists of fluids that are used in the drilling process by cleaning the bottom of the drill hole and lifting the powder to the surface so that the drilling process can run smoothly. The circulation system aims to circulate drilling mud throughout the drilling system so that it can be optimized. This mud is circulated from above the surface to the drill hole. This circulation begins with drilling mud which flows from the suction tank to the pump, then the mud flows through the pipe connection to the stand pipe and into the drill pipe series to the drill bit. The circulation process is carried out repeatedly so that the mud mixed with the cuttings can be cleaned.

3. RESEARCH METHOD

The experimental steps carried out in the laboratory regarding testing corn starch on the KCL Polymer Mud type, then the design of the activities that will be carried out, as well as the results that will be obtained from the research carried out. Apart from that, the procedure for adding corn starch in two temperature conditions will also be discussed. This research was carried out

by conducting observations or observations in the laboratory by testing the use of corn starch at different weights and under different conditions. The measurement results obtained will be the most effective comparison so that it will produce values for mud rheology that vary in weight from 3 grams, 5 grams, 7 grams, 9 grams and 11 grams. These results will be compared with following standard specifications in the
Laboratory so that we can find out which mud can be used and is in accordance with these standard specifications. The stages of activities in this study can be seen in the figure 1

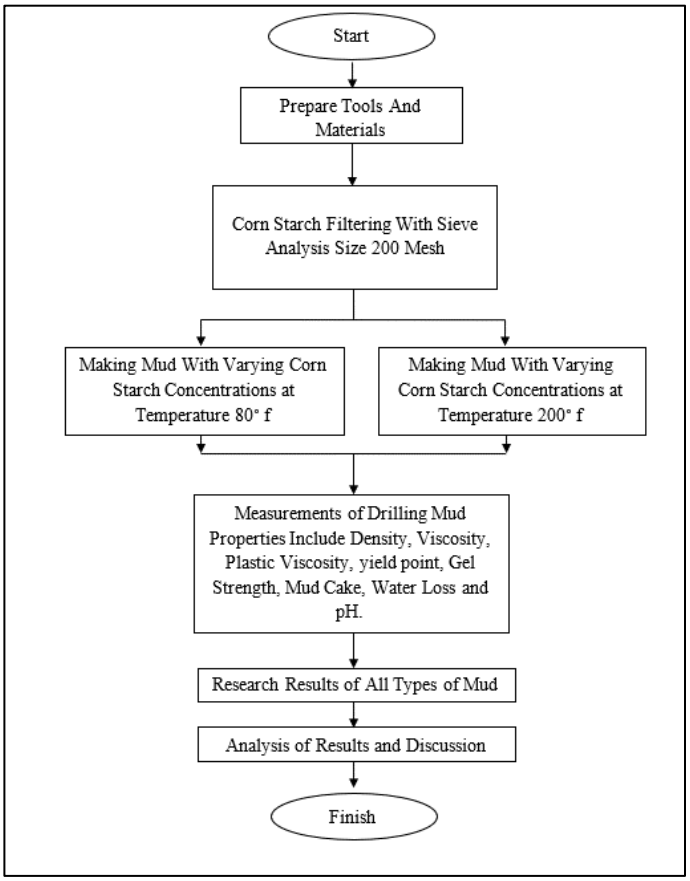

Figure 1 Flow Chart of Research

When obtaining values from physical property data when using this type of chemical mud system which is added with corn starch, you need tools and materials that will be used when taking samples in the laboratory. The materials used include several products that are good for use during drilling operations so that the materials comply with the requirements of the API standards.
This procedure was created to measure the rheological physical properties of the mud so that it can determine the quality of the mud that has been made according to the research method. After the mud formulation has been made according to its composition, the mud is tested at a temperature of 80°F and 200°F, then a test is also carried out to obtain the density, PV, YP, Gel Strength, Filtrate Loss, mud cake and pH values.
Determining the mud density value using a mud balance tool. This tool must be calibrated to get precise and accurate measurement results. The calibration process is based on the density of water, which is 8.33 ppg. To determine the rheology of this mud, the Fann VG Meter is used to measure plastic viscosity, yield point and gel strength. This experiment was carried out in the Lemigas laboratory which complies with applicable procedures so that these measurements can

be carried out with a rotor rotation speed of 600 RPM and 300 RPM. To determine the filtration rate, it is measured using a filter press with a pressure of 100 psi for 30 minutes. This measurement is carried out to determine the amount of fluid entering the formation.
When determining the pH of drilling mud, it should be in alkaline conditions. If the pH of the mud is in an acidic condition, corrosion will occur in the drill string, so it really requires a pH in an alkaline condition to prevent corrosion.

4. RESULT AND DISCUSSION

The effect of water-based mud using varying amounts of corn starch at different weights and temperatures. When using corn starch, it is an additive that is used to control filtration loss and also to increase the viscosity value. When using different temperatures, it is known that high temperatures can reduce the physical properties of the mud so it is necessary to pay attention during drilling operations, namely density, viscosity, plastic viscosity, yield point, gel strength, filtration loss, mud cake, and mud pH.

In this experiment, 6 mud compositions and the same volume were used but differed in the addition of corn starch and fresh water. The mud composition without Corn Starch used is fresh water, KOH, bentonite, Starch, PAC – LV, XCD – Polymer, KCL, K-Soltex, Barite and Biocide. The results of this research were to compare the rheological values for each different mud composition at different temperatures. The mud used in this experiment is water-based mud. The resulf of this study can be seen in the table 1

Table 1 Results of Mud Density measurements

Mud Weight, PPG							
Mud							
Temperature (°F)	Spec	Without corn starch	Corn Starch				
			3 Gr	5 Gr	7 Gr	9 Gr	11 Gr
80	9.5 – 10.5	10.02	**10.01**	**10.03**	**10.04**	**10.06**	**10.07**
200		9.90	**9.80**	**9.8**	**10**	**10.02**	**10.05**

In measuring this density, it can be seen that the addition of corn starch composition has an effect on the increase in each mass. From the results of measurements, the mud density meets the required standard specifications and can be said to be good enough to control the pressure in the formation. At a temperature of 200°F there is a decrease in the corn starch composition so that the pressure in the mud can be used to control the pressure in the formation. The results of density measurements of corn starch at temperatures of 80°F and 200°F can be seen in the figure 2

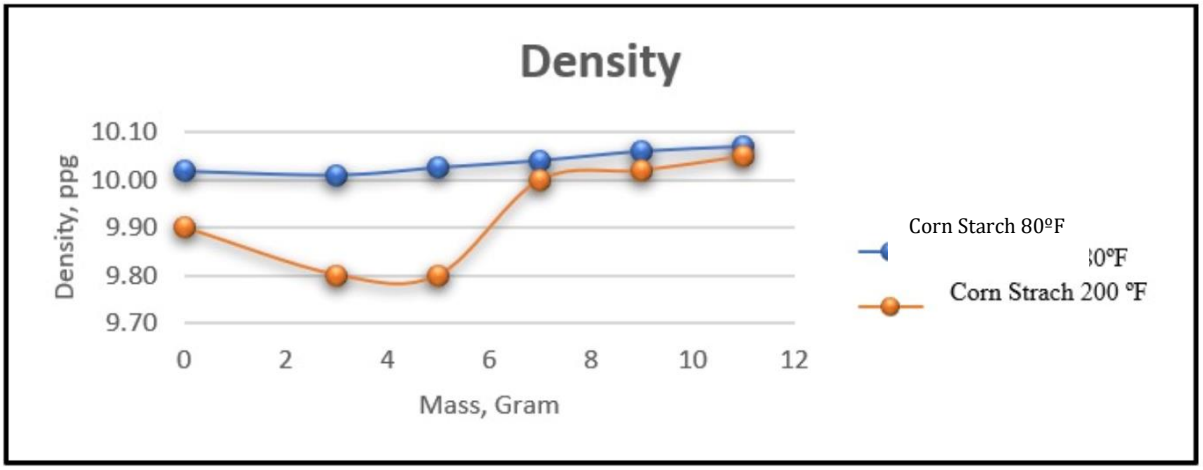

Figure 2 Corn Starch Weight Vs Density Curve

Based on the analysis that has been carried out, three zones were obtained which will be analyzed quantitatively, including the first zone which is located at a depth of 2069-2082 feet, however in the first zonebased on the analysis, the zone is indicated to contain gas even though no perforation has been carried out,the second and third zones are indicated at intervals marked with half-filled circles as shown in figure 3.

Drilling fluid rheology is a natural condition of the drilling fluid during the fluid flow process which includes the nature of the flow and the type of drilling fluid. Plastic viscosity is a resistance to fluid flow because there is friction between particles when the fluid is flowing. Even when lifting cuttings, viscosity plays an important role because there is a shift in the particles in the drilling mud. The results of measuring the plastic viscosity of corn starch at temperatures of 80°F and 200°F can be seen in the table 2

Table 2 Plastic Viscosity Measurement Results

Mud Weight, PPG							
Mud							
Temperature (°F)	Spec	Without corn starch	Corn Starch				
			3 Gr	5 Gr	7 Gr	9 Gr	11 Gr
80	ALAP <20	18	16	20	20	26	27
200	ALAP <20	26	15	18	24	25	26

In measuring plastic viscosity (PV) in Table 2, it can be seen that the results of the five muds with the addition of corn starch are 3 grams, 5 grams, 7 grams, 9 grams, and 11 grams which have been tested at temperatures of 80°F and 200° F so it increases. A good composition that uses corn starch with the appropriate viscosity is a mud composition without corn starch and one that uses corn starch at 3 grams, 5 grams and 7 grams at a temperature of 80°F while at a temperature of 200°F it has a concentration of 3 grams and 5 grams.

Therefore, the results obtained from measuring plastic viscosity at mud compositions of 3 grams and 5 grams at temperatures of 80° and 200°F are suitable for use. Because it has a plastic viscosity value that is in accordance with the standards given. However, the plastic viscosity values of 7 grams, 9 grams and 11 grams do not meet the standard specifications because there is an excessive concentration added which increases the mud viscosity value.

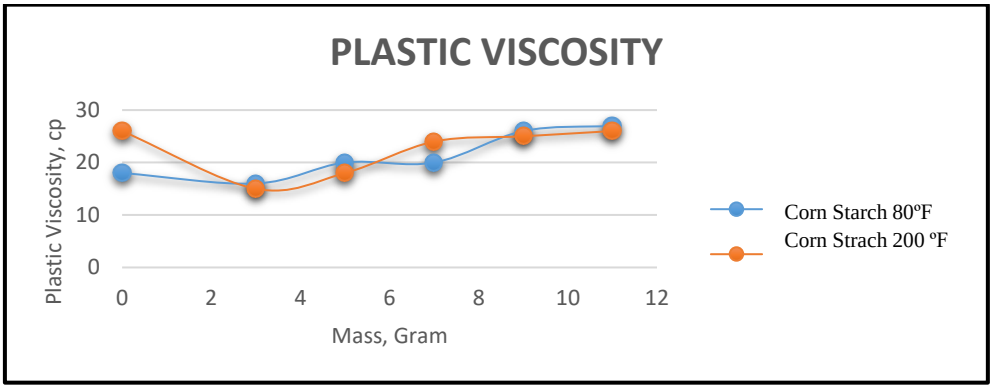

Figure 3 Weight Curve of Corn Starch Vs Plastic Viscosity

The following is figure 3 Curve of Corn Starch Weight Vs plastic viscosity based on experiments carried out in the Lemigas Drilling group laboratory. Yield Point is a measurement of solid particles in drilling mud that have an attractive force. The following is table 3 results of measurements obtained from yield points.

Table 3 Yield Point Measurement Results

Mud Weight, PPG							
Mud							
Temperature (°F)	Spec	Without corn starch	Corn Starch				
			3 Gr	5 Gr	7 Gr	9 Gr	11 Gr
80	17-20	29	19	20	30	32	33
200	25-35	45	27	32	35	39	42

In the results of yield point measurements at temperatures of 80° and 200°F, it can be seen that there is an increase in the yield point value at high temperatures. The increase in the yield point value is affected by an increase in the plastic viscosity value. In table 3, it can be seen that the results meet the standard specifications for drilling mud, namely in compositions of 3 grams and 5 grams which are resistant to high temperatures. At a composition of 7 grams at a temperature of 200°F it is also good to use. The following is figure 4 Curve of Corn Starch Weight vs. Yield Point.

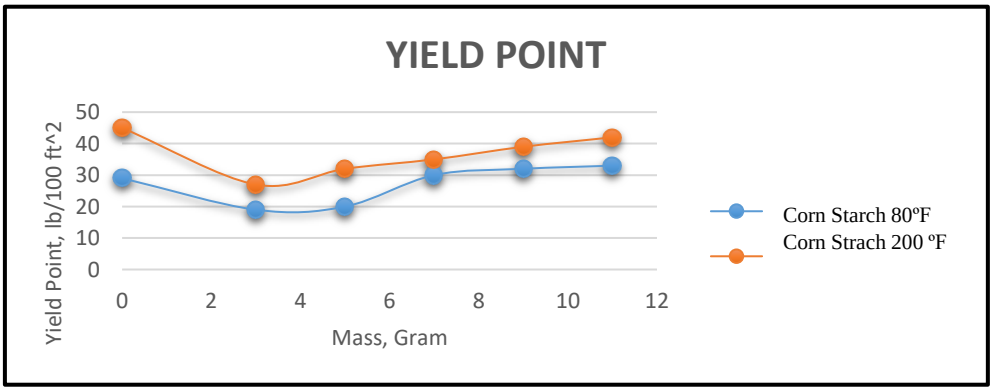

Figure 4 Curve of Corn Starch Weight Vs Yield Point

Gel Strength is a value that shows the mud's ability to hold solids when the drilling operation is stationary or the process is in progress for a certain period of time. Gel strength is carried out in

two processes, namely the initial Gel strength (10 seconds) when the value in the mud condition is at the beginning of the stop, while the Gel strength (10 minutes) when the value at the end of drilling is usually called a short stop. The following is table 4 results of measurements obtained from 10 second gel strength

Table 4 Gel Strength Measurement Results, 10 sec

Mud Weight, PPG							
Mud							
Temperature (°F)	Spec	Without corn starch	Corn Starch				
			3 Gr	5 Gr	7 Gr	9 Gr	11 Gr
80	5-15	7	9	9	9	10	10
200	6-15	11	9	11	11	15	17

When measuring the 10 second gel strength, it can be seen that the 10 second gel strength value increases with each concentration and temperature change. It can be seen that standard mud without the addition of corn starch is ideal for use at temperatures of 80°F and 200°F. At a temperature of 80°F all compositions meet standard specifications. For a temperature of 200°F, only a concentration of 11 grams does not comply with standard specifications. The following is figure 5 Weight Curve of Corn Starch Vs Gel Strength 10 seconds

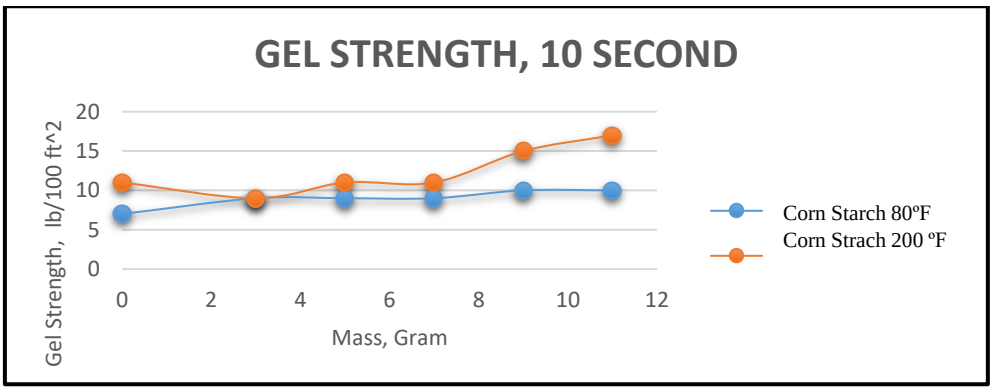

Figure 5 Curve of Corn Starch Weight vs. Gel Strength, 10 Seconds

The following is table 5 results of measurements obtained from 10 minute gel strength.

Table 5 Gel Strength Measurement Results, 10 min

Mud Weight, PPG							
Mud							
Temperature (°F)	Spec	Without corn starch	Corn Starch				
			3 Gr	5 Gr	7 Gr	9 Gr	11 Gr
80	10-20	11	11	12	14	15	17
200	10-20	18	11	13	16	17	20

From the results of the 10 minute gel strength measurement, it can be seen that the addition of this corn starch additive, the entire composition of which complies with standard specifications ranging from 10-20 at temperatures of 80 and 200°F, is good and suitable for use. The following is figure 6 Weight Curve of Corn Starch Vs Gel Strength 10 minutes

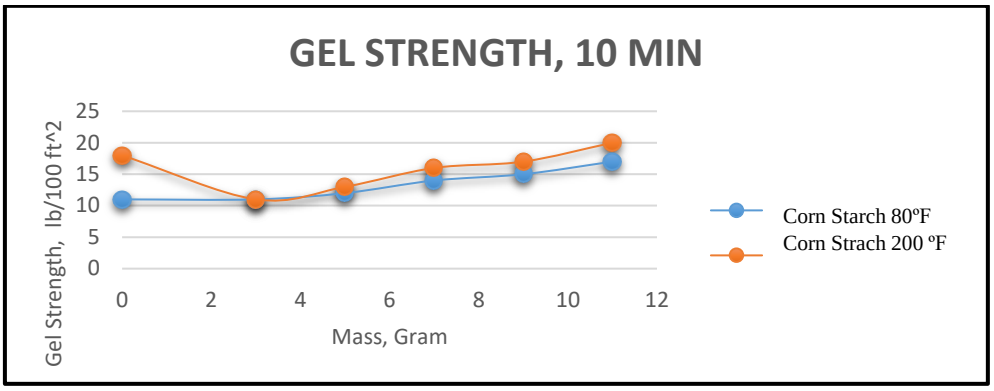

Figure 6 Weight Curve of Corn Starch Vs Gel Strength 10 Minutes

Filtration Loss is the amount of fluid that enters the formation with readings that depend on temperature, pressure and solids. Filtration Loss aims to form a mud cake on the drill wall so that you know which mud cake is good to use, namely a thin mud cake that can stabilize the drill hole.

Table 6 Results of Filtration Loss Measurements

Mud Weight, PPG							
Mud							
Temperature (°F)	Spec	Without corn starch	Corn Starch				
			3 Gr	5 Gr	7 Gr	9 Gr	11 Gr
80	≤ 10	4.42	6.2	5.8	5.3	4.9	4.4
200	≤ 10	4.41	5.2	4.8	4.25	4.1	3.9

From the results of the filtration loss measurements, it can be seen that the entire composition at temperatures of 80°F and 200°F is in accordance with the standard specifications for drilling mud in the laboratory. If the filtration loss value does not comply with the provisions then there will be several problems during drilling operations. One of these problems is formation damage and differential sticking.

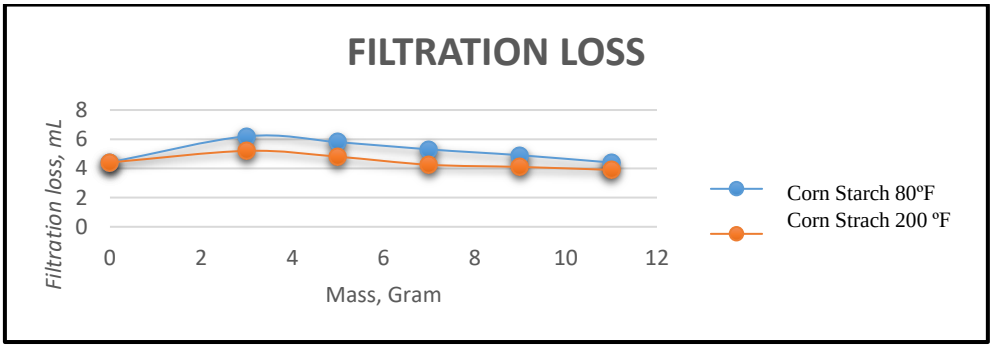

Figure 7 Corn Starch Weight Curve Vs filtration loss

Mud cake is a layer of solids that sticks to the drill hole walls and occurs during filtration loss testing. In the thickness of the dregs, this occurs due to filtration loss measurements so that there are filtering results from the filter press tool. The result of mud cake measurement can be seen in the table 7

Table 7 Mud Cake Measurement Results

Mud Weight, PPG
Lumpur

Temperature	Spec	Without corn starch	Corn Starch				
			3 Gr	5 Gr	7 Gr	9 Gr	11 Gr
80	≤ 1	0.79	0.76	0.66	0.55	0.50	0.46
200	≤ 1	0.58	0.62	0.52	0.50	0.44	0.42

Mud cake has decreased so that temperature differences greatly affect the price of mud cake. thin mud cake is found in the PJ 11 mud composition at temperatures of 80°F and 200°F. If the mud cake price is too high and exceeds 1 mm, it will cause fatalities in the drilling process. If the mud cake obtained is too thick, the drilling pipe in the drill hole will be pinched and difficult to lift. The measurement of mud cake can be seen in the figure 8

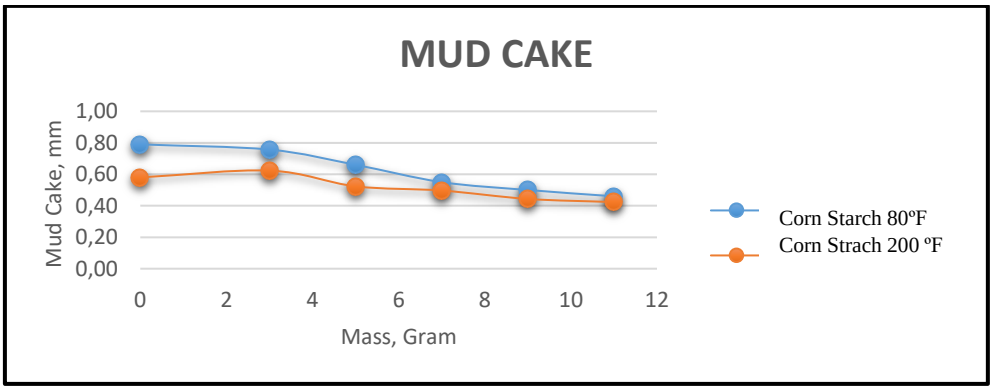

Figure 8 Weight Curve of Corn Starch Vs Mud Cake

Mud pH is important in drilling operations. The pH of this mud is used to determine the level of alkalinity and acidity of a drilling mud. If the pH of the drilling mud is acidic then the cuttings that come out of the drill hole will easily dissolve so that when the drill bit is operating you will not be able to tell what type of rock is being penetrated. The results of pH measurements of corn starch at temperatures of 80 and 200 are shown in the table 8

Table 8 pH Measurement Results

Mud Weight, PPG							
Mud							
Temperature (°F)	Spec	Without corn starch	Corn Starch				
			3 Gr	5 Gr	7 Gr	9 Gr	11 Gr
80	9.5-11.5	10.38	10.8	9.76	9.45	9.40	9.37
200	8.5-10.0	8.54	8.5	8.21	8.12	8.05	8.07

Mud at temperatures of 80°F and 200°F is still alkaline. At a temperature of 80°F the mud composition without corn starch, 3 grams, and 5 grams is in accordance with the standard specifications for drilling mud which have been determined in the laboratory with a range of 9.5-11.5, while at a temperature of 200°F which meets the standard specifications with a range of 8.5-10.0, namely the mud composition is without corn starch and 3 grams which can be said to be good. So, when measuring the pH of the mud, control must be carried out so that the pH is not in an acidic condition. The following is figure 9 Weight Curve of Corn Starch Vs Sludge pH

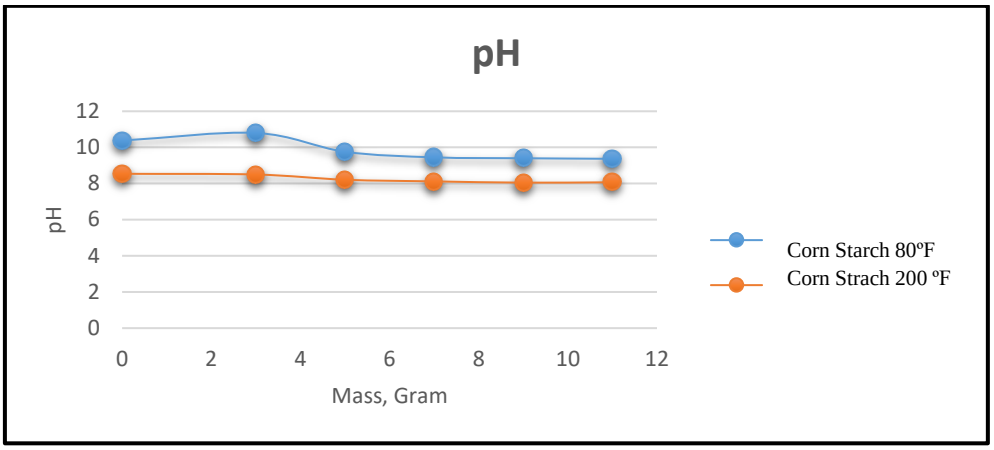

Figure 9 Weight Curve of Corn Starch Vs Sludge pH

Corn starch used with the same composition but different in mass composition greatly influenced the physical properties of the mud that was tested. So it can be seen in table 9 the overall results from research in the laboratory at a temperature of 80°F.

Table 9 Overall results of corn starch research at a temperature of 80°F

Temperature 80°F								
Parameter	Spec	Without corn starch	Corn Starch					Unit
			3 Gr	5 Gr	7 Gr	9 Gr	11 Gr	
Density	9.5-10.5	10.02	10.01	10.03	10.04	10.06	10.07	ppg
Plastic Viscosity	ALAP < 20	18	16	20	20	26	27	Cp
Yield point	17-20	29	19	20	30	32	33	lb/100 ft^2
***Gel strength*, 10 sec**	5-15	7	9	9	9	10	10	lb/100 ft^2
***Gel strength*, 10 sec**	10-20	11	11	12	14	15	17	lb/100 ft^2
Filtration loss	≤ 10	4.42	6.2	5.8	5.3	4.9	4.4	mL/30 min
Mud cake	≤ 1	0.79	0.76	0.66	0.55	0.50	0.46	mm
pH Mud	9.5-11.5	10.38	10.8	9.76	9.45	9.4	9.37	-

In this research it can be seen that the measurement of the physical properties of mud is quite good using corn starch in compositions of 3 grams and 5 grams. If you look at the composition of the mud without the use of corn starch, it is also suitable and good for use. The results of this research prove that mud with different masses will experience an increase with each increase in mass but it is different from the mud cake results but still in accordance with standard specifications and is still in the mud cake category which is good for use during the drilling mud process. In the filtration loss research, it can be seen that the higher the mass of corn starch additive, the lower the volume of filtration loss. In mud pH research, controlling the pH of the mud uses KOH to maintain its stability so that it remains in an alkaline condition. However, it can be seen in testing the corn starch additive that the additional masses of 7, 9 and 11 grams do not fall within the standard specifications which range from 9.5-11.5, so more attention must be paid to controlling the pH of the sludge so that it does not fall further and become acidic. The results of research on the physical properties of mud at a temperature of

80°F need to be looked at again at masses of 7.9 and 11 grams so that it can be seen that adding the corn starch additive mass will have an influence on the rheology of the mud and increase. An increase that is too significant will result in cuttings below the surface not being lifted and will disrupt the drilling process when used. Overall results of corn starch research at a temperature of 200°F are shown in the table 10.

Table 10 Overall results of corn starch research at a temperature of 200°F

Temperature 200°F								
Parameter	Spec	Without corn starch	Mud + Corn Starch					Unit
			3 Gr	5 Gr	7 Gr	9 Gr	11 Gr	
Densitas	10-11.5	9.90	9.80	9.80	10.0	10.02	10.05	ppg
Plastic Viscosity	ALAP < 20	26	15	18	24	25	26	cp
Yield point	25-35	45	27	32	35	39	42	lb/100 ft^2
***Gel strength*, 10 sec**	6-15	11	9	11	11	15	17	lb/100 ft^2
***Gel strength*, 10 min**	10-20	18	11	13	16	17	20	lb/100 ft^2
Filtration loss	≤ 10	4.41	5.2	4.8	4.25	4.1	3.9	mL/30 min
Mud cake	≤ 1	0.58	0.62	0.52	0.50	0.44	0.42	mm
pH lumpur	8.50-10.0	8.54	8.5	8.21	8.12	8.05	8.07	-

In the research results, with an increase in temperature of 200°F, the physical properties of the mud were in accordance with standard specifications, namely a composition with an additive mass of 3 grams. This is different from the temperature of 80°F, because at this high temperature the pH value of the mud in the composition of 5, 7, 9 and 11 is not in accordance with standard specifications but is still in an alkaline state. When paying attention to the pH value, use KOH so that it is not acidic and can still be controlled. If the pH of the drilling mud is too alkaline, it will result in poor viscosity and fatal consequences if the formation holding it is not strong. By researching the two different temperatures, it can be seen that the higher the temperature value, the lower the value obtained and the addition of corn starch additive mass also affects the rheology of the mud, where the more the additive mass increases, the thicker the mud will be and the removal of cuttings will be more difficult. However, if the rheological value of the mud is smaller, the removal of the cuttings will not be perfect. Likewise with filtration loss, if the temperature is higher, the filtrate volume will decrease with each additional additive, the value of the filtrate volume also decreases, so this corn starch research has a big influence on reducing the filtrate volume. If the filtrate volume value is small, the mud cake formed is also thin so that the stability of the drill hole is still maintained and dense so that the filtrate that enters the formation is not excessive.

5. CONCLUSION AND RECOMMENDATIONS

In this article, differences in the weight of corn starch influence changes in the physical properties of water-based mud, where as the mass of corn starch increases, the rheology of the mud will increase and the filtration loss will decrease. The density value increases with each

additional weight of corn starch at room temperature but when hot rolling is carried out the value decreases. The density measurement results at temperature differences all meet the ideal standard values ranging from 9.5-10.5 ppg.

The results of measuring the plastic viscosity of mud in corn starch research can be seen from the weight curve of corn starch Vs plastic viscosity which increases for the plastic viscosity value with each additional mass of corn starch additive and temperature. The price of plastic viscosity that complies with standard specifications is ALAP < 20. Mud that complies with standard specifications, namely 3 grams and 5 grams, is suitable for use up to a temperature of 200°F. The yield point measurement results in research at a temperature of 80°F which is in accordance with standard specifications is 17-20 lb/100 ft^2 and for a temperature of 200°F with standard specifications is 25-35 lb/100 ft^2. Mud that meets the specifications of 5 mud compositions, namely 3 grams and 5 grams with the addition of corn starch because it meets the standard specifications up to a temperature of 200°F. The gel strength measurement results can be seen from the curve that the gel strength value increases with each increase in concentration and temperature. All mud compositions meet standard specifications up to a temperature of 200°F but for a concentration of 11 grams at a gel strength of 10 seconds at a temperature of 200°F it is not appropriate.

The filtration loss measurement results that meet the standard specifications are ≤10 ml. All mud compositions met specifications, so it can be seen from the curve that both temperatures experienced a decrease in filtration loss values due to the addition of additives and an increase in temperature. When measuring mud cake thickness, there was a decrease at high temperatures and the addition of additives. Both temperatures with the addition of different compositions meet the standard specifications of ≤10 mm so they are good for use.

The results of measuring the pH of the mud meet the standard specifications at a temperature of 80°F, namely 9.5-11.5, where the use of corn starch for 3 grams and 5 grams meets the specifications. At a temperature of 200°F with standard specifications of 8.5-10.5 which is included in the specifications, namely 3 grams. So the addition of corn starch affects the higher the mass concentration value of corn starch, the lower the pH value of the mud will be.
From the results of the entire article, temperatures of 80°F and 200°F are suitable for use, namely 3 grams of corn starch because it meets the standard specifications.

CONCLUSION

By researching the two different temperatures, it can be seen that the higher the temperature value, the lower the value obtained and the addition of corn starch additive mass also affects the rheology of the mud, where the more the additive mass increases, the thicker the mud will be and the removal of cuttings will be more difficult. However, if the rheological value of the mud is smaller, the removal of the cuttings will not be perfect. Likewise with filtration loss, if the temperature is higher, the filtrate volume will decrease with each additional additive, the value of the filtrate volume also decreases, so this corn starch research has a big influence on reducing the filtrate volume. If the filtrate volume value is small, the mud cake formed will also be thin so that the stability of the drill hole is still maintained and dense so that the filtrate that enters the formation is not excessive.

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CHAPTER 4

The Impact of Starlink Technology on Society, XL Axiata, and the Telecommunication Business Ecosystem in Indonesia

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ABSTRACT

It cannot be denied that Satellite Communications technology will provide widespread support for connectivity that fiber optics cannot offer. Based on the World Bank report in 2019, about 49% of the population of Indonesia still lives in rural areas. It presents a challenge in providing telecommunication services across the country. The development of the telecommunication network has made significant advances over time but yet hundreds of millions of people in Indonesia are still have no access to the fastest internet. The problem of digital divides is well recognized, and it needs real action for access to the internet and to deliver critical e-science, e-Government, and educational programs to remote areas in Indonesia.

Starlink is a satellite internet constellation that seeks to provide high-speed internet to underserved areas of the planet. However, in the Indonesian perspective, there are technical, regulatory, and business challenges that occur in order to implement this satellite technology. Several considerations required if Indonesia wants to implement Starlink either thru business partnership and also direct to end users. How does it impact to the society in Indonesia and establish provider like XL Axiata. How does Starlink cope with Law on electronic Information and Transaction (UU LTE) to tackle the online defamation, hate speech, and cybercrime, how it ensure the content control of pornography and on line gamble, how it establish a comprehensive framework for the protection of personal data, and whether it has a level playing field on the taxation, frequency fees, as well as universal service obligations applied to all existing telco and internet providers in Indonesia.

We conduct research based on internet and interview with qualified informants from the end users, regulatory, and prominent telecommunication providers, which then processed and analyzed to answer the research questions. The findings of this thesis contribute valuable insights for future research and industry practice, offering a deeper understanding of the evolving dynamics of the telecommunication infrastructure and the impact on the people, government, and telecommunication business ecosystem in Indonesia.

Keywords: Starlink Satellite, Telecommunication infrastructure, Society and Government of Indonesia, XL Axiata, Telecommunication business ecosystem..

1. Introduction

Currently, unserved, underserved, and served are major problems faced by telecommunication service providers. This research conducts interviews to obtain the right business models that can support the collaboration of XL Axiata and SpaceX Starlink in providing better telecommunication and low-cost internet services, as well as give added value that is able to help support the Smart Village government program. The development of business process models that are carried out in three stages are: preliminary development model, and final model improvement. The results of this research are supporting collaboration models that combine various services in the Smart Village, business process models that provide low-cost internet services, and analysis of potential business models between XL Axiata and SpaceX Starlink to be applied in the digital divide area.

The rapid development of technology leads to various changes in the consumption of digital content. Innovations are implemented by creating digital divide areas that previously did not have telecommunication infrastructure. The success of SpaceX in building the Starlink mega constellation proves to be a business concept that disrupts the telecommunications ecosystem. It not only targets the high-end market sector but also focuses on narrowing the digital divide by providing low-cost internet services. This research aims to analyze the potential impact of Starlink technology on society, the telecommunication business ecosystem, and solve the problems faced by telecommunication service providers and internet service providers in their business process models for international border areas in Indonesia.

1.1. Background and Rationale

Currently, XL Axiata indicates a business commitment as a market player in the space industry by conducting a series of business model engineering to become a satellite internet service provider and placing an order with the satellite operator SpaceX, characterized by the activities of building partnerships.

The impact of Starlink on PT XL Axiata Tbk's business plan is an example of the impact of a distant sector on the dynamics of the telecommunication market with a central issue of market and business ecosystem's resilience in serving demand. The relationship between satellite internet users in various settlements with a wide variety of investment needs uses the technology at Starlink user level both individually and collectively to achieve better social benefits.

The company believes that the potential for satellite-based communication services with improved performance will have an impact on extending internet access due to the far more extensive coverage area. Instead of avoiding the risks, XL Axiata considers the impact of Starlink's technology as an opportunity and prepares a business plan while reviewing its readiness to compete horizontally in the market.

Not much has been known about the financial performance or the scale of its operations in developing. However, SpaceX's active financial planning has had a major impact on the telecommunications sector in Indonesia, in particular, network operators with fixed internet access services using traditional technology as the consequence. One of the operators that has previously announced that it will operate traditional satellite-based internet service business is PT XL Axiata Tbk (XL Axiata).

Space Exploration Technologies Corp. (SpaceX), with its subsidiary Starlink, provides global satellite internet services through a constellation of low Earth orbit (LEO) satellites. The company is not listed on the stock exchange, trading openly, and is financing Starlink through its own profit. It only mentions the challenges of capitalizing the division, but there is no

official document, annual report, or other formal official information describing the real division of profit.

2. LITERATURE REVIEW

Porter's 5 FORCES: A framework that analyzes the competitive forces that shape an industry and its profitability. It can help us understand the attractiveness and dynamics of the international container shipping industry in Southeast Asian company. The 5 Forces are Competition in the Industry, Potential of New Entrants into the industry, Power of Suppliers, Power of Customers, and Threat of Substitute Products.

PESTLE Analysis: This tool identifies how various macro-environmental factors may affect an organization and its competitive standing. PESTLE stands for Political, Economic, Sociocultural, Technological, Legal, and Environmental factors. To help us understand the external context and trends that influence the international container shipping industry in Southeast Asia, as well as the opportunities and threats they pose. PESTLE analysis will be used to examine how the Covid-19 pandemic has affected the political stability, economic growth, social behavior, technological innovation, legal regulations, and environmental sustainability of the industry and the company.

SWOT Analysis: This tool analyzes the strengths, weaknesses, opportunities, and threats of an individual or organization to evaluate its internal potential. SWOT stands for Strengths, Weaknesses, Opportunities, and Threats. This tool can help assess the internal capabilities and resources of Southeast Asian Container Shipping Lines, as well as the external factors that may affect its performance. We can use SWOT analysis to identify the competitive advantages, core competencies, areas of improvement, market gaps, growth prospects, and potential risks of the company.

XL Axiata (PT Excelcomindo Pratama Tbk) is a telecommunications facility company offering cell phone services. One of the facilities owned by XL Axiata is site lease, which is made up of foundations, steel structures, and telecommunications equipment. The Starlink technology production and its business plan may have significant unfavorable impacts on several aspects. Therefore, analyzing its impact is important and necessary.
Starlink technology can have an adverse technological and/or economic impact on the existing geosynchronous and low earth orbit satellites, especially in providing internet services. Starlink production is one technology that is satellite-based with huge production capabilities. This technology is utilized to provide internet access for most world regions, including developing countries that have not yet received complete service or have only received partial service from earth-based telecommunication service providers.
The Starlink technology, initiated by the SpaceX company, is an internet service provider that is satellite-based to provide worldwide internet service. It is planned to establish more traditional fixed ground stations to connect to satellites, especially in rural and remote areas that are difficult or impossible for massive telecommunication service providers to reach. Starlink uses a satellite network made up of a combination of the Ka and Ku band High Frequency (HF) to provide worldwide broadband internet. According to information, the height of the operational satellite is 550 km above the ground level of the earth, and it will provide an internet service of 1 Gbps with a latency of 25ms. The main niche target of Starlink technology is to provide internet service to 450 million potential customers, especially in areas with low to low-medium areas outside of the existing internet service

markets of cellular and satellite. This condition can threaten other technology providers with satellites as a more attractive alternative for existing customers.

2.1. Essential Characteristics and Functioning Capabilities

The Starlink technology is a part of the use of low-orbit satellites as a means of providing communication services, which, according to the author, have several unique characteristics. Namely, providing broadband internet that specifically focuses on high-speed internet services where fiber and other media have limitations so far. This satellite technology uses the K-band to connect users, while utilizing the sheer number of satellites in low Earth orbit. It offers point-to-point connections at the "Edge" of the network. The Starlink technology is relatively simpler and more profitable compared to previous satellite technologies, and is expected to solve challenges in building an ICT infrastructure to provide affordable services throughout the world.

The number of satellites orbiting the company raises several technical problems, where pollution issues and interferences become the company's technical problems. Based on Article 27G, paragraph 8 of the ITU regulations, the company must not interfere with similar satellite operators in other countries. However, the company is required to resolve this issue through consultation with these operators. Where the ITU, national space law, and other regulations may not be sufficient, so the operator's company is responsible for ensuring that there is no radio frequency interference. There is a need to develop innovations in various fields without having to wait for the previous PICO satellite to be fully realized in order to contribute to the company's sustainability and social functions. With the realization of LEO Satellite Internet Starlink, a multimodal telecommunication network was created, and the open multi-cloud coupled with Edge computing technological solutions allowed the creation of a multi-cloud edge solution.

2.2. Global Deployment and Reach

With an investment of over US$10 billion and as a part of the Initial Operation Capability, Starlink services started from the first 700 satellites (4400 satellites planned for its final constellation) launched since February 2018, which provided coverage over the U.S. states and territories. It has since expanded to a global one. As of March 14th, 2021, Starlink is available to more than 1,000,000 people and in more than 12 countries including United States, Canada, United Kingdom, Germany, The Netherlands, Australia, New Zealand, Mexico, France, Belgium, Slovakia, Australia, New Zealand, and South Korea. More satellite launches are needed to provide coverage in more areas. Starlink satellite average orbital altitude is at 550 km above the earth's surface, notably lower than traditional geostationary satellite operators orbit.

Around 10% to 25% of global GDP is now expected to come from the launch and operation of satellite constellations. Global data traffic is expected to quadruple by 2023 to 395 EB per month. Whereas the total satellite data traffic operator market is estimated to secure a constant growth of around 10% CAGR over the next ten years. Currently, the vast majority of the demand for data usage is on the ground rather than flying through space, but there are substantial differences between the geographical distribution of demand versus current telecommunications infrastructure. Given these estimates and the innovative approach, democratizing access to a variety of constellation applications seem to be an attractive investment opportunity.

3. Telecommunication Industry in Indonesia

The growth of a telecommunications company in Indonesia is very promising considering the vast territory and population. A telecommunications company in Indonesia consists of fixed line, fixed wireless (also called fixed radio), and mobile services serving the business needs of retail, corporate, and wholesale customers. While in XL Axiata, the company currently only provides mobile cellular services. There are several players in the telecommunications industry in Indonesia, but fixed-line service providers are the only ones that hold monopolistic licenses. The rest all serve fixed and mobile wireless services.

Today, mobile phone technology is one of the fastest-growing digital technology segments compared to other technology segments. This business has a large market, mainly due to population growth and mobile phone demands, plus the growth of Wi-Fi networks in offices, hotels, airports, and public areas which are increasingly in demand by Indonesia's growing population. The purpose of the existence of telecommunications companies, especially in the context of a developing country like Indonesia, is to increase the welfare of the entire Indonesian people. The telecommunications company business model in an area where the regulatory body is limited to specialized cases in practice is considered monopolistic and unnatural. With a monopoly, what happens is that the ability to expand services is not maximized, innovation becomes less extensive, and asset utilization is not maximized so that competition is not encouraged and proposed services are not offered.

3.1. Current Landscape and Key Players

According to the current ITU (International Telecommunication Union) regulations, the radio frequencies for the launching of satellites for the LEO orbit can be easily obtained. However, in the end, the key for LEO satellite constellations to operate commercially turns out not to be the licensing of the radio frequency, but to catch the users to use its services. To achieve that, many key players are investing massively, from the plan to constellation which is being launched and those already ready for service, with the services which are and can be offered and potential markets to be targeted boosts a lot of debate related to the ambiance. It's known that there will be both demand and supply side impacts caused by how the prices and services Starlink would offer and focused on. This section will draw a global landscape of current Starlink competitors, namely three continents where the constellation is predicted to offer its services, and associated with the services they offer and the markets they are ready for.

Regarding service characteristics, by recognizing that XL Axiata and the telecommunication business ecosystem may have several overlaps with other industries and services, it will mainly look into Starlink's closest competitors. The discussion is primarily oriented, but not limited to mobile telecommunication business and internet services which many players were within the telecommunication and ISP industries. Starlink will offer 5G based communication services to its customers. It is very challenging and ambitious that any attempt to offer better services compared to those who already been offering 5G communication. With varied behaviors of potential customers to interact with the technologies being developed, make competition in related industries like XL Axiata and other telecommunication business ecosystems intensive. Boosting paradigms related in the field of potential customers' behaviors when they are being attracted for services provided by Starlink by deploying low Earth orbit satellites at an extremely high density.

4. XL Axiata: Positioning and Strategies

The combination of regulatory acceptance, including pricing and tariffs, facilities, and favorable business organic support, allows XL Axiata to show a positive trend in the eight groups of global telecommunication industries. XL Axiata has five main aspects for positioning its business: Infosys Transformation to Flexibility and Efficiency, Supercapital 3D Strategy Implementation, Digital Telecommunications Company, the Network Transformation Program: 20-20, and Customer Centric and Market Enhancement Programs. It begins with the implementation of digital services in all clusters to offer clients the best quality experience. The essence of good consumer service has been a nuanced requirement during the digital transformation phase, and the introduction of a new cross-functional effort that rewards diligent consumers with the company. FindAsync is not put off strictly for the commercial outcome, but to put into place an excellent customer encounter throughout all phases from product creation to service entry. Customer experience: client interaction is motivated and returns from commitment and constant improvement in the various offerings expanded from sites, channel associates that label the purchase, and provides support, including self-service comfort.

Accordingly, it further describes the segment's choices and use and automatically recuperates and ensures operations, logic, modular, and local operating services. Finance the elimination of overlapping systems that are simply sizing changing the portfolio with the necessary measures. The execution and balance of market capital supercel importance at every stage. Market presence defections from decreasingness from the top, business governance, and partner support. The excellent command impact is most enforced within each cluster with our marketplace specifically to be able to identify each initial model and customer values ideally from Digital, Emphasizing 2VR Networks, Internet, and Enterprise Markets to SoHo (small and medium-sized businesses) cellular. The network technology provides sufficient access, however, requires a more comprehensive middleware technologies to manage advanced applications and to guarantee a high-level quality of service visitors, visibility, and service isolation, such as various costs for companies, solutions, and clients.

4.1. Company Overview

PT. XL Axiata Tbk (IDX: EXCL), formerly known as PT. Excelcomindo Pratama Tbk, is one of the leading cellular providers in Indonesia. XL-Axiata was established in Jakarta on October 8, 1989, and originally deployed its national private telecommunication network with limited mobility facilities as a personal telephone service for premium class customers. Operations continued commercially in Telcom facilities that covered Greater Jakarta in Indonesia. The Excelcomindo brand, under the company's response to the market, is to "focus on quality and its premium image", thus targeting premium customers in its service. XL provides services in cellular telecommunications (GSM Dual Band, GPRS, EDGE, 3G, 4G LTE, 4G LTE-A), base transceiver stations, Wi-Fi, and fixed telecommunications (FIXED LINE) technology with services to support internet (INTERNET SERVICE PROVIDER) and data communication (MOBILE DATA SERVICE provider), including other related services.

Currently, the shares of the company's parent company, Axiata Communications (Axiata), Malaysia, have reached around 66.50% and have subsequently completed the acquisition of shares from government agencies in the form of a sale of shares. With a commitment of Rp26.9 trillion from Axiata, XL continues to expand and enhance its data-based mobile broadband network. The company appointed a Dutch national, and later in 2006, the Government of the Republic of Indonesia strengthens corporate tax. However, there was a decision from the Directorate General of Taxation of the Republic of Indonesia to execute the

attachment procedures of the company's obligation to pay money. The claim of taxes in the form of permanent tax measuring constant changes due to penalties and fines from observational contractuality is IDR 3,009,180,028,333 with a basis for reporting taxes of IDR 9,951,253,722,062 and alleged month of tax increase 168 months.

4.2. Market Positioning and Competitive Advantage

The Starlink project is an ambitious project using a satellite-access technology that is technologically sophisticated and has global coverage capabilities. It is estimated that current satellite constellations worldwide number around 2,300. Several companies have invested significantly to date, with OneWeb first launching its satellite in February 2019, while Starlink had reportedly launched at least 1,300 satellites by the year 2021. The coverage capabilities possessed by the Starlink project and the number of existing networks and satellite launches are transforming the competition in the telecommunications industry. Both network technology provider firms and incumbent telecommunications operators have complex commercial interests that will need attention and resolution during the constellation's operation. Some technology firms might consider Starlink services as an enhancement for their business models or a complement to their service offerings.
XL Axiata partnered with Starlink to provide affordable, high-speed, fixed access to hundreds of homes and businesses using direct-to-home satellite access. From an analysis of the customer base in the public domain, XL Axiata generally offers services to customers with specific characteristics such as high-tech enthusiasts who may have performance and speed uncovered by the fixed coverage area. For the telecommunication business, innovation in network expansion within its existing scope of service coverage is a significant potential. Firms will benefit from improvements in services to consumers and strengthening corporate market strategies. This is true for businesses or government offices located in areas that are hard to reach or are not a priority service coverage investment and may have purchased faster and more reliable internet connectivity.

5. Impact of Starlink on Society and Telecommunication Ecosystem in Indonesia

Starlink has a significant impact on various aspects of society, including the telecommunication ecosystem. Indonesia, as well as many different countries worldwide, is facing rapid technological development in the telecommunication industry. Based on this situation, the purpose of this paper is to analyze the effect of Starlink jamming on the telecommunication ecosystem in Indonesia. The research methodology employed in this research is literature review with quantitative data. This study reveals that within the telecommunication ecosystem, XL Axiata becomes an internet service provider, according to the potential local targets of Starlink jamming on XL Axiata, and the adoption of disruptive internet technology. By studying the factor of host country targets, it may affect the potential impact of jamming a telecommunication business such as XL Axiata's ecosystem and its business partnerships with global providers. The contributions of this research are two-fold. Due to this finding, this research is expected to be a concern for academics, the Indonesian regulator, and the telecommunication industry to prepare for future impacts expected from the jamming.

5.1. Social and Economic Implications

People in Indonesia basically need telecommunications and internet services for various activities in their daily lives. The positive side of the launch of Starlink will certainly have an impact on increasing socialization and understanding of communities that have not had these services before. Services and costs that may not be affordable for the communities will be concretely visualized. The types of Starlink services that have not been "covered" by the business and governments will have an impact on increasing productivity and efficiency in various fields of community activities. Providing services through support for local and foreign investment and opening employment opportunities in these fields are certainly needed.

5G technology also offers a range of new possibilities and could change the world as we know it today. The evolution of 5G technology in the future is predicted to create hundreds of thousands of jobs, millions of business and career opportunities, and offer a substantial contribution to Indonesia's economy. The existence of technology can encourage investment and economic growth for certain regions. Companies will choose locations based on the potential for service quality and realization, service competition, and consumer needs. Starlink user fees will invite profits from companies by providing cheaper solutions than consumer providers in overcoming existing digital divides, market opportunities, innovations, and economies of scale from competitive technologies. Starlink will help companies focus on market positioning.

5.2. Challenges and Opportunities

Deployment and operation of large satellite constellations such as Starlink have high complexity in terms of orbital design, frequency allocation, communication control, and manufacturer and operator authorization. Hence, this satellite constellation technology faces several challenges. Despite that, Starlink satellite constellations present several opportunities to improve the telecommunication business ecosystem in Indonesia, including accelerating the network capacity and rural internet distribution. Furthermore, innovations from the business ecosystem XL Axiata can be introduced to increase the capability of Indonesian telecommunications.

Starlink satellite constellation technology is still in the development phase and faces some challenges. To ensure operational sustainability, the satellite constellation needs to be capable of replacing the failed satellites during the service period. Moreover, dealing with the increased risk of collision with space debris, Starlink satellites should have the ability to perform autonomous collision avoidance maneuvers when operated in the LEO orbit. Another challenge occurs when the total Starlink constellation exceeds 4424 satellites approved by both regulatory bodies. To meet these challenges, SpaceX assesses the Starlink network's impacts before issuing a new license. If necessary, SpaceX can effectively deorbit satellites with safety or reconsider the maximum number of future satellites launched. The life expectancy of satellites should increase too, as the number of refueling satellites for this satellite constellation has exceeded the industry demand.

6. Conclusion and Future Prospects

In this study, based on 41 respondents from XL Axiata, we use multiple statistical methods to better understand the perception and feedback on the impact of Starlink technology in some areas in Indonesia. The previous work can be summarized as follows. The authors examine and analyze the demographics of the respondents. We also conduct a descriptive analysis to

evaluate the feedback of XL Axiata on the impact of Starlink technology on society. The results of binary logistic regression indicated that insight in society impact, political impact, unexpected consequence impact, and increased capacity significantly influenced the impact of Starlink technology on existing telecommunication competitors. The authors perform a discriminant analysis to investigate the respondents' feedback, and the results reveal business partners with different feedback are attracted by the economic or business consequences of the impact of Starlink technology. Moreover, the hierarchical regression model further suggests that the impact of Starlink technology on XL Axiata is influenced by the respondents' feedback, and their feedback is closely related to the explorative potential impact aspect.

As a consequence, the paper offers several implications for the future. Recommendation and managerial suggestions are provided for each feedback aspect. It is important for the existing telecommunication companies and policymakers to understand and address such positive perceptions and concerns related to future telecommunication competition. To the authors' knowledge, this is the first study that explores the impact of the stochastic process of LEO infrastructure/exploration in Indonesia. Future research might compare the feedback received on the impact of Starlink technology from high-level professionals who work in different emerging and developing countries in the Asia-Pacific region. Effects on emerging market companies following the introduction of new technology will also be investigated in the future.

CHAPTER 5

Growth Strategy Analysis For Tekno Scaffolding Business

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ABSTRACT

PT. Teknometal Konstruksi Utama is planning to expand the business from current business model manufacture and selling scaffolding material into the rental business scaffolding division. This paper examines the investment planning into the Rental Business Opportunity as the Growth Strategy Analysis for PT. Teknometal Konstruksi Utama, whether the investment is feasible or not to be run. The methodology used in this paper is by interviewing the top management of PT. Teknometal Konstruksi Utama, and by the data given, it will be used to analyze and evaluate the Rental Business Plan using 4 method which is PORTER's 5 FORCES Method, SWOT Analysis, PESTLE Analysis and Capital Budgeting Analysis. The opportunity of Business Rental is still good in Indonesia and for PT. Teknometal Konstruksi Utama by analyzing using PORTER'S 5 Forces, SWOT, and PESTLE Analysis. The total capital needed for investment is Rp 5.211.000.000. Capital Budget invested from retained earnings is Rp 2.813.000.000,- and Remaining Capital will be allocated using debt with Collateral by Shareholder's Asset Property amounted Rp 2.398.000.000,-. This Capital will be evaluated for the rental business in the 5 Years. The Capital Budgeting analysis show the good result of the investment planning. It shows Payback Period (PBP) 4.79 years, less than total period 5 years. NPV also shows the positive result, which is equal to IDR 1.726.659.381 with Profitability Ratio of 1.33 is greater than 1. The results of the study reflected an IRR 25,80% greater than the value of cost of capital 10%. By observing the results of these quantitative values as the basis for making decisions through a capital budgeting approach through financial analysis, this investment is financially "WORTH" to run.

Keywords: Porter's Five Forces, SWOT, PESTLE Analysis, Capital Budgeting, Evaluating Rental Business.

INTRODUCTION

Teknometal Konstruksi Utama is planning to expand the business from current business model manufacture and selling scaffolding material into the rental business scaffolding division.

Scaffolding in Indonesia, like in many other countries is an integral part of the construction industry. Scaffolding is a temporary structure erected to support workers and materials during the construction, repair, or maintenance of buildings and other structures. It provides a safe and stable platform for workers to perform tasks at heights.

Various Types of Scaffolding that common used in Indonesia Market :

- Tubular Scaffolding: This is a traditional and widely used type of scaffolding that consists of steel tubes and couplers.
- Frame Scaffolding: Comprising vertical and horizontal frames, this type is known for its ease of assembly and adaptability.
- Modular Scaffolding: Commonly known by the local terms “Ring Lock Scaffolding or PCH Scaffolding”, it utilizes pre-engineered components that fit together, providing a versatile and efficient solution.

Here are some key points related to industry scaffolding in Indonesia:

Regulations and Standards: Indonesia, like many countries likely has regulations and standards governing the design, construction, and use of scaffolding. These regulations are in place to ensure the safety of workers and the public. It's essential for companies to add here to these regulations to avoid legal issues and ensure a safe working environment.

Safety Measures: Safety is a paramount concern in the construction industry. Scaffolding companies and construction firms in Indonesia must implement proper safety measures, including regular inspections, training for workers, and the use of appropriate personal protective equipment.

Industry Practices: Scaffolding is often a specialized field within the construction industry, and there may be companies in Indonesia that specifically provide scaffolding services. These companies may offer selling, rental, installation, and dismantling services for various types of scaffolding.

Training and Certification: Workers involved in the assembly, disassembly, and use of scaffolding should undergo proper training and certification. This ensures that they have the necessary skills and knowledge to work safely at heights.

Importance of Scaffolding: Scaffolding plays a crucial role in construction projects by providing a stable working platform for workers and facilitating access to different parts of a structure. It also contributes to efficiency and productivity in construction activities.

LITERATURE REVIEW

Business Plan and Growth Strategy Theory.

Business planning process requires deep investigation, careful evaluation of all factors,

which might have an impact on the result, and study of possible company's actions results. Apart from that, business planning determines management actions for expansion process, designs new ways of acting and includes revision of all enterprises operations.

Developing an effective growth strategy.

When planning and initiating a business growth strategy, consider developing it effectively: Use a growth strategy template: Consider using a free online template to outline your intended organizational growth process. This can help you integrate all the required elements into the strategy you develop to help the business grow and succeed.

Porter's Five Forces Model – The Frame Work Explained.

The Harvard Business School professor Michael Porter: 1979, Porter's recognized that organizations like to keep a close watch on their rivals. Harvard Business Review article, "How Competitive Forces Shape Strategy" encouraged business leaders to look beyond the actions of their competitors and examine the forces at work in their wider business environment.

SWOT Analysis.

SWOT Analysis can also be applied to the individual level to assess a person's situation versus their competition further. SWOT Analysis (short for strengths, weaknesses, opportunities, threats) is a business strategy tool to assess how an organization compares to its competition.

PESTLE Analyses.

PESTLE Analyses is one of the tools that is used to identify and analyses the key drivers of change in the organizational environment. The PESTLE Analyses an acronym for political, economic, Social, Technological, legal and natural environment. PESTLE analyse is an organizational audit of the firms operations in order to determine the different factors and forces in the external environment that affect the success of an organization.

Capital budgeting techniques.

A systematic review are evaluating and interpreting all available research relevant to a specific research question, topic area, or phenomenon of interest. Its aim to present an evaluation of an investigation topic by using a trustworthy and rigorous methodology

RESEARCH METHOD

Project Time Line.

The scaffolding project timeline provides a birds eye view of exactly what work will be done in a growth strategy project and when, scaffolding managers use to organize a project, breaking it down into individual tasks and milestones and then attaching achievement and Conclusion recommendation

STRATEGIC BUSINESS TOOLS.

Content analysis methodology was employed on 574 papers from management and civil engineering journals to initially identify topics of common concern.

Capital Budget Analysis.

When making investment decisions, the managers make a series of subjective calls. Capital budget analysis refers to the financial assessment of the capital investment proposals of a company.

RESULT AND DISCUSSION

Porter's Five Forces Analysis.

The interview and discussion have been done with Teknometal Konstruksi Utama management and the results below as per each segment:

Threat of New Entrants.

Scaffolding industry starts becoming profitable. If the barriers to entry are low, new entrants can easily capture market share and threaten profitability. New products Innovation and Rental business Services. New products are not only bringing new customers to the fold but also give old customer a reason to buy Teknometal products. Built economies of scales so that it can lower the fixed cost per unit. Built capacities and spending money on research and development. The new entrants are less likely to enter a dynamic industry where the established players such as Teknometal Company. Keep defining the standards regularly. It was significantly reducing the window of extraordinary profits for the new firms thus discourage new players in the industry.

Bargaining Power of Vendors.

The power of vendors indicates that to what extent the value created by a company is valuable for buyers compared to its competitors. Our Company has excellent product Import built from excellent material: Building efficients supply chain with multiple vendors. Experimented with product designs using different materials, that if the prices go up of one raw material so company can shift find another. Developing dedicated vendors whose business depends upon the firm. The lessons of Teknometal Company.

Bargaining Power of Buyers.

The buyers compete with industry by an effort to reduce prices and always try to get a product which has better quality or offer more services. They also arouse the rivals against each other and all these things reduce the profitability of industry. Building a large base of customers. This will be helpful in two ways. It will reduce the bargaining power of the buyers plus it will provide an opportunity to the firm to streamline its sales and production process.

Threat of Substitute Products or Services.

Threat of substitute products or service refers to other products which can satisfy the

customer similar need. The threat of these substitutes depends on their price and performance in competition with products or service which consumers tend to replace. Being Rental service oriented rather than just product oriented. Understanding the core need of the customer rather than what the customer is buying. Increasing the switching cost for the customers.

Competitive Rivalry.

The rivalry between existing competitors is like an attempt to achieve a position and is usually done through the use of tactics like price competition, advertising campaign and so on. In fact, such this competition occurs because one or more competing elements have feelings of pressure or feel that the opportunities have been provided for their progress. Building a sustainable differentiation.Building scale so that it can compete better. Collaborating with competitors to increase the market size rather than just competing for small market.

SWOT Analysis.

The Scaffolding manufacturing produces large amounts of materials that are presently deposited or used for Construction Support, Suggest one way of making the Scaffolding industry more sustainable by increasing the use of Rental than buying the Scaffolding. The below findings are organised by strength, weaknesses, opportunities and threats (**SWOT**) and presented in Table 1.

Table 4.1 SWOT Sustainable use of Scaffolding.

Strengths	Weaknesses
• PT. Tekno already have the database of customer who rental the scaffolding. • Strong Team and Management who have the experience in this business • Capital and other supporting asset necessary is already have • TEKNO is already known in the market as the big five scaffolding supplier, therefore it is an advantage to expand in rental business	• A lot of competitor from the small scale to the big scale competitor • Frame scaffolding is easy for corrosion, therefore it will need the extra maintenance cost • Price sensitive in the scaffolding rental market

Opportunities	Threats
• The demand of scaffolding increase following the increase of the construction industry sector • Alternative material such as bamboo is hard to difficult and the environmental issue that government made, so scaffolding will be the best option for all medium building • A lot of expansion opportunity especially in the developing regional who still don't have the scaffolding rental player there	• An easy business who everyone can do the business if they have capital - Threat from new competitor • Second hand material from China or other country brought to Indonesia and making the price even lower again • Some customer will be difficult to claim after the rental finish and they make the material broken or lost • Government regulation often changing on import items & distribution.

PESTLE Analysis.

Conduct a PESTLE Analysis of The Scaffolding Industry to highlight how differently external and internal factors impact the scaffolding manufacturing. Scaffolding is not associated with modern and tower cranes.

Table 4.2 Pestle Analysis

Political	Economic	Social
• Government Stability after Election event. • Warehouse standardization is affected by restrictions of the health and safety regulations (HSE-Certification) • Second hand material from China or other country brought to Indonesia and making the price even lower again • Government regulation on import items & distribution.	• The demand of scaffolding increase following the increase of the construction industry sector • A lot of expansion opportunity especially in the developing regional who still don't have the scaffolding rental player there • Increase of Rental price & Low inflation. • Rental price is more competitive	• Characteristic of most Indonesian customer which could be difficult to claim after the rental finish and they make the material broken or lost • An easy business who everyone can do the business if they have capital - Threat from new competitor • Change of Buying to be Rental Scaffolding. • People have a higher consciousness about Rental than Buying. • Consumers prefer to rental than buying
Technological	**Legal**	**Environmental**
• The strategy needed towards online deliveries order in Rental (B2C). • Many competitors have started the digital information about Rental Scaffolding.	• Issues concerning climate change and global Investment. • Energy conservation • Business Scaffolding Sustainability.	• Alternative material such as bamboo is hard to difficult and the environmental issue that government made, so scaffolding will be the best option for all medium building • Company needs to consider Rental act and Services Law. • Company's commitment to B2B customers

The Scaffolding industry are a billion dollar industry that employs millions of people and the raw materials used for scaffolding evolved. The PESTLE analyses framework highlighted various political, economic, social, environmental, technological, and legal factors that impact the operations of the scaffolding industry.

Capital Budgeting Analysis.

PT Teknometal Konstruksi Utama plans to build Warehouse for the Scaffolding Rental business expand. Besides increasing revenue, Teknometal business of this factory, is to increase the utilization of Scaffolding Asset Inventory from the companys warehouse. A factory planned to be expand their business into Scaffloding Rental and has enough capacity for support new business. Income statement as follow was show how growth the revenue and profit:

Table 4.3 Income Statement – PT Teknometal Konstruksi Utama

PT.TEKNOMETAL KONSTRUKSI UTAMA

INCOME STATEMENT
(In IDR Millions)

	Growth	Years ended September 30, 2023	December 31, 2022	December 31, 2021
Net Revenue	1.73	62,482	22,898	11,547
Cost of Sales (Direct & Indirect Cost Project)		(46,857)	(15,691)	(9,213)
Gross Profit		15,625	7,207	2,334
Operating Expenses :				
Selling, General and Administrative :				
Salary & Staff Allowance		(2,875)	(2,499)	(1,114)
Marketing Expenses		(729)	(149)	(79)
Total Selling, General and Administrative		(3,604)	(2,647)	(1,192)
Depreciation and Amortization		(197)	(125)	(93)
Total Operating Expense		(3,802)	(2,772)	(1,285)
Operating Income		11,824	4,435	1,044
Other Income/Expenses		(1,956)	(102)	(22)
Net Income/Loss	P	9,868	4,197	954
Profit Margin		15.79%	18.33%	8.26%

The Income (Profit and Loss) Statement above, commonly referred to as the P&L statement, summarizes the revenue and expenses for a specific time period. The Income Statement shows increasing profit every year, it means the growth of Business could be going concern.

Table 4.4 Balance Sheet Report – PT Teknometal Konstruksi Utama

BALANCE SHEET
(In IDR Millions)

	3rd Quarter Sept 30, 2023
ASSET	
Current Assets :	
Cash & Equivalent	3,964
Account Receivable	4,626
Inventories	5,410
Receivable Employee	9,693
Other Current Assets	-
Total Current Assets	23,694
Fixed Assets	3,645
Accumulated Deppreciation	(429)
Total Fixed Asset	3,216
Other NonCurrent Assets	-
Total Non Current Assets	3,216
Total Assets	26,911
	-
LIABILITIES	-
Account Payable	8,462
Long Term Liabilities	3,384
Total Liabilities	11,846
	-
EQUITY	-
Capital	1,000
Retained Earning	4,197
Profit (Loss Current Period)	9,868
Total Equity	15,065
Total Liabilities and Equity	26,911

Source: PT Teknometal Konstruksi Utama, 2023.

PT. Teknometal Konstruksi Utama has the Total Retained Earning and Profit Current Year (Sept 2023) booked Rp 14.065.000.000,-, and 20% of profit current year and retained earnings will be allocated to the new Rental Business Division with the amount Rp 2.813.000.000,-

Investment Allocation made by the authors based on research findings as Follows:

Table 4.5 Investment Allocation – PT Teknometal Konstruksi Utama

Investment Allocation	UOM	Qty	Unit Cost	Investment Amount (IDR)
Asset Rental Stock				
Frame Scaffolding 170	EA	2,000	240,000	480,000,000
Frame Scaffolding 190	EA	2,000	260,000	520,000,000
Frame Ladder 90	EA	2,000	150,000	300,000,000
Join Pin	EA	16,000	6,000	96,000,000
Cross Brace 220	EA	8,000	43,000	344,000,000
Cross Brace 193	EA	4,000	39,000	156,000,000
Catwalk Scaffolding	EA	1,000	270,000	270,000,000
Jack Base	EA	8,000	70,000	560,000,000
U-Head	EA	8,000	70,000	560,000,000
Stair T.170	EA	500	450,000	225,000,000
Stair T.190	EA	500	460,000	230,000,000
Asset Equipment for Maintenance				
Truck for Mobilization and Demobilization	Unit	2	150,000,000	300,000,000
Forklift	Unit	1	300,000,000	300,000,000
Working Capital for 1st Year	Month	12	60,000,000	720,000,000
Stockyard Rental for 1st Year	Year	1	150,000,000	150,000,000
Total Investment				**5,211,000,000**

Source: PT Teknometal Konstruksi Utama, 2023

PT. Teknometal Konstruksi Utama needs for new investment Rp 5.211.000.000. Capital Budget invested from retained earning is Rp 2.813.000.000,- and Remaining Capital will be allocated using debt with Collateral by Shareholder's Asset Property amounted Rp 2.398.000.000,-

This Capital will be evaluated for the rental business in the five Years.

Depreciation Cost

Table 4.6 Depreciation Cost – PT Teknometal Konstruksi Utama

Investment Allocation	UOM	Qty	Unit Cost - Depreciation	Cost of Depreciation
Asset Rental Stock			Yearly	Yearly
Frame Scaffolding 170	EA	2,000	60,000	120,000,000
Frame Scaffolding 190	EA	2,000	65,000	130,000,000
Frame Ladder 90	EA	2,000	37,500	75,000,000
Join Pin	EA	16,000	1,500	24,000,000
Cross Brace 220	EA	8,000	10,750	86,000,000
Cross Brace 193	EA	4,000	9,750	39,000,000
Catwalk Scaffolding	EA	1,000	67,500	67,500,000
Jack Base	EA	8,000	17,500	140,000,000
U-Head	EA	8,000	17,500	140,000,000
Stair T.170	EA	500	112,500	56,250,000
Stair T.190	EA	500	115,000	57,500,000
Asset Equipment for Maintenance				
Truck for Mobilization and Demobilization	Unit	2	37,500,000	75,000,000
Forklift	Unit	1	75,000,000	75,000,000
TOTAL Annual Depreciation Cost				**1,085,250,000**

Source: PT Teknometal Konstruksi Utama, 2023

Annual Depreciation Cost for Asset Rental Stock is Rp 935.250.000,-. Annual Depreciation Cost for Equipment is Rp 150.000.000,-. Total Annual Depreciation Cost is Rp 1.085.250.000,-

Cost of Capital.

	Total Capital Perspective	Equity-Only Perspective
Project Cost	The total cost of the project	The equity contributed by the company (total project cost less debt financing)
Relevant Cash Flows: Interest	Interest expense is not a relevant cash flow, and is not deducted from annual operating cash flows	Interest expense is a relevant cash flow, and is deducted from annual operating cash flows
Relevant Cash Flows: Taxes	Pro forma taxes are calculated with reference to projected EBIT (i.e., with no deduction for interest expense)	Pro forma taxes are calculated with reference to projected pre-tax income (i.e., after deducting interest expense)
Relevant Cash Flows: Debt Amortization	No reduction to cash flows for repayment of debt	Debt repayment deducted from project cash flows

Table 4.7 Cost of Capital – PT Teknometal Konstruksi Utama

Source: PT Teknometal Konstruksi Utama, 2023.

Weighted Average Cost of Capital (WACC) represents a companys average after tax cost of capital from all sources, including common stock, preferred stock, bonds, and other forms of debt. As such, WACC is the average rate that a company expects to pay to finance its business. This represents the business average cost about 15.46% from all sources.

Pricing and Occupancy of Material.

Table 4.8 Pricing and Occupancy – PT Teknometal Konstruksi Utama

Investment Allocation	UOM	Qty	Market UnitPrice	Full Capacity Market Unit Price	100% Occupancy	50% Occupancy	60% Occupancy	70% Occupancy
Asset Rental Stock			Rental/Month	Rental/Month	Rental/Year	Rental/Year	Rental/Year	Rental/Year
Frame Scaffolding 170	EA	2,000	8,250	16,500,000	198,000,000	99,000,000	118,800,000	138,600,000
Frame Scaffolding 190	EA	2,000	9,500	19,000,000	228,000,000	114,000,000	136,800,000	159,600,000
Frame Ladder 90	EA	2,000	7,500	15,000,000	180,000,000	90,000,000	108,000,000	126,000,000
Join Pin	EA	16,000	1,500	24,000,000	288,000,000	144,000,000	172,800,000	201,600,000
Cross Brace 220	EA	8,000	5,000	40,000,000	480,000,000	240,000,000	288,000,000	336,000,000
Cross Brace 193	EA	4,000	5,000	20,000,000	240,000,000	120,000,000	144,000,000	168,000,000
Catwalk Scaffolding	EA	1,000	25,000	25,000,000	300,000,000	150,000,000	180,000,000	210,000,000
Jack Base	EA	8,000	5,000	40,000,000	480,000,000	240,000,000	288,000,000	336,000,000
U-Head	EA	8,000	5,000	40,000,000	480,000,000	240,000,000	288,000,000	336,000,000
Stair T.170	EA	500	30,000	15,000,000	180,000,000	90,000,000	108,000,000	126,000,000
Stair T.190	EA	500	30,000	15,000,000	180,000,000	90,000,000	108,000,000	126,000,000
Pricing - Occupancy Amount					**3,234,000,000**	**1,617,000,000**	**1,940,400,000**	**2,263,800,000**

Source: PT Teknometal Konstruksi Utama, 2023

Based on interview from the several scaffolding company that do the rental business, we can do assumption of occupancy of material is as below:

- First Year 50% of Asset will be rented out due to the process of introducing the company to the market.
- Second Year 60% of Asset will be rented out to the market as customer already know our company.

Third-Fifth Year 70% of Asset will be rented out.

Payback Periode (PP).

Table 4.9 Cash Flow Forecast – PT Teknometal Konstruksi Utama

ITEM	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Initial Investment	(4.341.000.000)					
Required Working Capital	(870.000.000)					870.000.000
Cash Inflow						
Rental Revenue		1.617.000.000	1.940.400.000	2.263.800.000	2.263.800.000	2.263.800.000
Revenue from Transport Mobilization		288.000.000	288.000.000	288.000.000	288.000.000	288.000.000
Post Tax Salvage Value of Asset (Rental Stock + Equipment)		-	-	-	-	3.165.750.000
Cash Outflow						
Rental of Stockyard and Warehouse - 500 m2		(150.000.000)	(160.000.000)	(170.000.000)	(180.000.000)	(190.000.000)
Cost of Transportation		(120.000.000)	(120.000.000)	(120.000.000)	(120.000.000)	(120.000.000)
Maintenance & Operational of Asset Rental Stock		(200.000.000)	(200.000.000)	(200.000.000)	(200.000.000)	(200.000.000)
Selling,General and Administrative		(200.000.000)	(220.000.000)	(242.000.000)	(266.200.000)	(292.820.000)
Tax 22%		-	(28.853.000)	(92.961.000)	(85.437.000)	(316.135.600)
Net CashFLow from The Project	(5.211.000.000)	1.235.000.000	1.499.547.000	1.726.839.000	1.700.163.000	5.468.594.400
Present Value of 1 IDR - 15.46%		0.866	0.750	0.650	0.563	0.487
Discounted Net Cashflow	(5.211.000.000)	1.069.634.505	1.124.856.121	1.121.907.856	956.674.830	2.665.127.236

Calculating NPV, IRR, Payback Period, Discounted Payback and Profitability Ratio

NPV	1.726.659.381					
IRR	25.80%					
Cumulative Cashflow	(5.211.000.000)	(3.976.000.000)	(2.476.453.000)	(749.614.000)	950.549.000	6.419.143.400
Payback Period	4 Years					
Discounted Cumulative Cashflow	(5.211.000.000)	(4.141.365.495)	(3.016.509.373)	(1.894.601.518)	(937.926.688)	1.727.200.549
Discounted Payback Period	5 years					
Profitability Ratio	1.33					

Payback Period period shows how long It Takes to return the investment value by dividing the total initial investment by the total proceeds per year. On this Investment the results are maximum proceeds taking into account its economic age is estimated to be five years. Furthermore, PP calculation with the assumption that the proceeds are constant (annuity) per year, then the PP can be calculated base on Tabel 4.10 Cash Flow Forecast – PT Teknometal Konstruksi Utama.

Taking into account the PP results mentioned above for 4.79 years while the maximum proceeds from this stone breaking unit are five years, then the rate of return of the investment

value is faster than the maximum proceeds so that PT Teknometal Konstruksi Utama is feasible.

Net Present Value (NPV).

Net present value takes into account by present net value on the basis of the time value for future money to be valued at the present time. This will be obtained from the differences by the present value of proceeds with the present value of initial investment taking into account the economic age and an certain discount rate. Base on Tabel 4.5 Cash Flow – PT Teknometal Konstruksi Utama.

The results of the above table shows that investment plans can be run because the NPV value indicates a positive number that is equal to Rp 1.726.659.381,- so that this investment financially feasible to run.

Internal Rate of Return (IRR).

Internal rate of return calculates the interest rate equals the present value by the proceeds. IRR used as a benchmark for the level of the projects ability to produce proceeds to the same as the initial investment then compared to the level of fee of capital. To obtain this value, an interpolation approach was carried out with calculating a positive NPV with a negative NPV, then a certain discount factor will be obtained which results in an NPV value equal to 0, Base on Tabel
4.5 Cash Flow – PT Teknometal Konstruksi Utama.
The IRR calculation results obtained at an IRR of 25,80%, more the amount of interest used for the cost of capital from the initial investment is 10% percent, so this investment is feasible to run.

Profitability Ratio (PR).

By using the 10% discount rate above, then Profitability Ratio (PR), can be calculated by comparing the PV of Cash Inflow with PV of initial Investment. From the results of the NPV calculation above, the following results are obtained Base on Tabel 4.5 Cash Flow – PT Teknometal Konstruksi Utama.

The calculation of Profitability Ratio (PR) obtained a result of 1,33 meaning more than number one, Its means investment is feasible to run.

2. CONCLUSION AND RECOMMENDATIONS

This research is (1) Based on the results of financial analysis obtained from the calculation of Payback period investment to be carried out by PT Teknometal Konstruksi Utama, it is feasible to run because it shows PBP 4.79 year faster than the maximum period of five years, (2) Based on the results of a Net Present Value (NPV) positive, which is equal to IDR 1.726.659.381, then it is stated that this investment is feasible to carry out, (3) Based on the results of the study, the Profitability Ratio (PR) of 1.33 is greater than one, then this investment is stated feasible to run,
(4) Based on the results of the study reflected an IRR 25,80% greater than the value of cost

of capital 10%, then it is stated that this investment is feasible to run, (5) By observing the results of these quantitative values as the basis for making decisions through a capital budgeting approach through financial analysis.

The suggestions that can be put forward are as follows:

For Companies: (a) Decisions regarding investment in rental assets of scaffolding are decisions that greatly determine the success of the company, because decisions regarding investment are related to large funds and a relatively long time, (b) Companies in investing their funds in an investment proposal need to analyse whether the investment proposal is really feasible or not to be implemented, because then the risk of losses to be suffered by the company will be smaller, (c) The results of the calculation of investment feasibility analysis indicate that this investment is feasible to be implemented.

For Further Researchers: It is better for future researchers to conduct research related to the feasibility of investment proposals for fixed assets should pay attention to aspects that can affect the feasibility of the proposed investment, so the results obtained will be correct really valid, the proposed investment can provide maximum benefits and does not have a negative impact on the company that will make the proposed investment

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CHAPTER 6

The Impact of Fundamental and Macroeconomic Variables on The Financial Performance of Pt Medco Energi International and The Effects of The Covid-19 Pandemic on Its Stock Returns

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ABSTRACT

This study investigates the influence of fundamental financial and macroeconomic variables on the financial performance of PT Medco Energi International Tbk (MEDC) and examines the effects of the COVID-19 pandemic on its stock returns. Indonesia, known for its abundant natural resources, plays a pivotal role in the global energy market, particularly in oil and gas sectors. MEDC, a leading entity in Indonesia's energy industry, operates in oil, gas, coal, and power generation.

The research employs key financial metrics, including leverage, liquidity, asset turnover, profitability, and cash conversion cycle, to analyze MEDC's financial performance. Additionally, it assesses the impact of macroeconomic variables such as commodity prices, foreign exchange rates, market returns, and the COVID-19 pandemic on MEDC's stock returns.

Findings reveal that both internal financial management practices and external economic conditions significantly influence MEDC's profitability and stock performance. The study highlights the substantial challenges posed by the COVID-19 pandemic, which led to supply chain disruptions, fluctuating energy demand, and volatile commodity prices, thereby affecting MEDC's financial stability.

This research provides critical insights for investors, financial analysts, policymakers, and MEDC's management. It presents a robust framework for evaluating the financial performance of energy companies, facilitating informed investment decisions, strategic planning, and economic policy development. The study underscores the necessity of comprehending the complex factors affecting a company's economic value, especially in the context of global crises like the COVID-19 pandemic.

Keywords: Macroeconomics, Financial Performance, Covid-19.

1. INTRODUCTION

Indonesia, a nation rich in natural resources, has historically played a significant role in the global oil and gas industry. The country's vast geological landscape, abundant in hydrocarbon reserves, has positioned it as a key player in the global energy market since the late 19th century. However, Indonesia has faced a decline in oil production in recent decades due to the depletion of mature fields and the absence of new significant discoveries. Despite these challenges, Indonesia remains a vital contributor to the Southeast Asian energy market, particularly through its substantial natural gas production and exports.

The Indonesian oil and gas sector has undergone significant regulatory changes aimed at attracting foreign investment, including the introduction of the "Gross Split" Production Sharing Contract (PSC) model. These reforms, along with ongoing efforts to streamline the investment environment, underscore the importance of a thorough analysis of the sector's economic benefits and business performance. Such analysis is crucial for investors and policymakers to assess the investment potential and risks associated with the sector.

This study focuses on PT Medco Energi International Tbk (MEDC), a prominent player in Indonesia's energy sector, to explore the impact of crude oil price shocks on financial performance and stock returns. By examining key financial ratios and macroeconomic variables, the study aims to provide insights into how oil price fluctuations influence profitability, liquidity, and overall market performance, particularly during periods of economic volatility such as the COVID-19 pandemic.

2. LITERATURE REVIEW

The study of how crude oil price shocks affect financial and stock performance is grounded in several key financial theories and analytical frameworks. These theories provide a foundation for understanding the complex interplay between macroeconomic factors, company-specific financial indicators, and market dynamics.

2.1. Efficient Market Hypothesis (EMH)

The Efficient Market Hypothesis (EMH) is a central theory in financial economics, positing that financial markets are "informationally efficient." According to Fama (1970), in an efficient market, asset prices reflect all available information at any given time, making it impossible to consistently achieve returns that outperform the market on a risk-adjusted basis. EMH is divided into three forms: weak, semi-strong, and strong efficiency.

- Weak Form Efficiency: This form asserts that current stock prices fully incorporate all past trading information. As a result, technical analysis, which relies on historical price data, cannot consistently yield excess returns.
- Semi-Strong Form Efficiency: This form suggests that all publicly available information, including financial statements and news releases, is already reflected in stock prices. Consequently, neither fundamental analysis nor technical analysis can consistently result in superior returns.

- Strong Form Efficiency: The strongest form of EMH posits that stock prices reflect all information, both public and private (insider information). Therefore, even those with insider knowledge cannot consistently outperform the market.

In the context of this study, EMH is particularly relevant as it provides a theoretical framework for understanding how oil price shocks, as new information, are rapidly incorporated into stock prices. If the market for PT Medco Energi International Tbk (MEDC) operates efficiently, then fluctuations in oil prices should be quickly reflected in the company's stock price, affecting investor behavior and overall market performance.

2.2. Ratio Analysis and DuPont Analysis

Ratio analysis is a critical tool in financial analysis, enabling investors and analysts to evaluate a company's financial health by examining relationships between different financial statement items. Ratio analysis focuses on several key metrics, including liquidity, leverage, profitability, and efficiency, which are essential for assessing a company's performance.

- Liquidity Ratios: These ratios, such as the current ratio and quick ratio, measure a company’s ability to meet its short-term obligations. For MEDC, maintaining adequate liquidity is crucial, especially in times of volatile oil prices, as it ensures the company can sustain its operations without needing to rely heavily on external financing.
- Leverage Ratios: These ratios assess the extent of a company’s financing through debt relative to equity. The Debt-to-Equity Ratio (DER) is particularly significant for MEDC, as high leverage can amplify the impact of oil price fluctuations on the company's financial stability and stock returns.
- Profitability Ratios: Ratios such as Return on Assets (ROA) and Return on Equity (ROE) measure a company’s ability to generate profit relative to its sales, assets, or equity. These ratios are crucial for evaluating how efficiently MEDC converts its resources into profit, especially in a volatile market environment influenced by oil price changes.
- Efficiency Ratios: Efficiency ratios, including the asset turnover ratio, assess how effectively a company utilizes its assets to generate revenue. For energy companies like MEDC, which require significant capital investment in assets, efficient asset utilization is key to maintaining profitability in the face of fluctuating oil prices.

DuPont analysis further extends ratio analysis by breaking down ROE into three components: profit margin, asset turnover, and financial leverage. This approach allows for a more detailed understanding of the specific drivers behind MEDC’s financial performance, highlighting how operational efficiency, asset utilization, and leverage interact to influence overall profitability and stock performance.

2.3.Arbitrage Pricing Theory (APT)

Arbitrage Pricing Theory (APT), developed by Stephen Ross in 1976, is a multi-factor model that expands on the Capital Asset Pricing Model (CAPM) by considering multiple macroeconomic factors that might influence asset returns. Unlike CAPM, which relies on a single market risk factor (beta), APT acknowledges that asset returns can be affected by various factors, including interest rates, inflation, GDP growth, and oil prices.

APT posits a linear relationship between the expected return of an asset and the sensitivities (betas) of that asset to multiple macroeconomic factors. The model can be expressed as:

$R_i = \beta_0 + \beta_i,1F_i + \beta_i,2F_2 + \cdots + \beta_i,\mathrm{k}F_k + \varepsilon_j$ .....(1)

R_i = Expected Return on asset i

β_0 = A Constant.

β_{ik} = The sensitivities of asset's return to the factors

F_k = k-th factor common to the return of assets under consideration

ε_j = The idiosyncratic error term.

In applying APT to MEDC, this study considers multiple factors such as oil price fluctuations, exchange rates, and market returns. By analyzing the sensitivity of MEDC's stock returns to these factors, APT provides a more robust framework for understanding the impact of oil price shocks on the company's financial and market performance.

2.4. The Impact of Macroeconomic Variables

Macroeconomic variables play a crucial role in determining the financial performance and stock returns of companies, particularly those in the energy sector. Oil price fluctuations, in particular, have a profound impact on energy companies like MEDC, affecting everything from revenue streams to profit margins and stock prices.

- Oil Prices: As the primary revenue driver for energy companies, changes in oil prices have a direct impact on financial performance. For MEDC, higher oil prices generally lead to increased revenue and profitability, positively influencing stock returns. Conversely, lower oil prices can result in reduced profitability and declining stock performance.
- Exchange Rates: The USD/IDR exchange rate is another critical factor, especially for a company like MEDC that engages in international trade. Fluctuations in exchange rates can affect the cost of imports, revenue from exports, and ultimately, the company's profitability and stock returns.
- Market Returns: Broader market trends also influence individual stock performance. For MEDC, market returns reflect investor sentiment and overall economic conditions, which can either amplify or mitigate the effects of oil price shocks.

The relationship between these macroeconomic variables and financial performance has been extensively studied in finance. For instance, Cevik et al. (2022) found that changes in macroeconomic conditions significantly impact stock performance, particularly in sectors sensitive to commodity price fluctuations like energy.

2.5. The Role of Financial Management and Strategic Adjustments

Effective financial management is essential for companies like MEDC to navigate the challenges posed by volatile oil prices and other macroeconomic factors. The ability to maintain liquidity, manage leverage, and optimize asset utilization can significantly influence a company's resilience in the face of economic shocks.

During the COVID-19 pandemic, MEDC, like many other companies, faced significant disruptions, including supply chain issues and fluctuating demand for oil and gas. The company's strategic adjustments during this period, such as cost-cutting measures and diversification of revenue streams, were critical in mitigating the adverse effects on financial performance and stock returns.

In conclusion, the literature review provides a comprehensive overview of the theoretical and empirical frameworks used to analyze the impact of crude oil price shocks on financial performance and stock returns. By applying these theories to the case of MEDC, this study aims to contribute to the broader understanding of how macroeconomic factors influence the financial health and market behavior of energy companies, particularly in emerging markets like Indonesia.

3. METHODOLOGY

The methodology of this study is designed to rigorously analyze the impact of crude oil price shocks on the financial performance and stock returns of PT Medco Energi International Tbk (MEDC). Given the complexities involved in studying the relationship between macroeconomic variables and company-specific financial outcomes, the research adopts a quantitative approach, integrating both descriptive and inferential statistical techniques. The following sections outline the key components of the methodology employed in this study.

3.1. Research Design

This study employs a correlational research design to explore the relationships between crude oil price fluctuations and the financial and stock performance of MEDC. Correlational design is appropriate for this study as it allows for the examination of naturally occurring relationships without manipulating the independent variables (e.g., crude oil prices). The focus is on determining the extent to which changes in oil prices are associated with variations in financial metrics and stock returns.

The study is structured to test several hypotheses regarding the impact of crude oil prices, along with other macroeconomic variables such as exchange rates and market returns, on MEDC's financial ratios and stock performance. By employing regression analysis, the study seeks to quantify these relationships and assess their statistical significance.

3.2. Data Collection

3.2.1. Time Frame and Data Collection

The study covers a period from 2019 to 2022, a timeframe characterized by significant volatility in global oil prices due to various geopolitical events, economic fluctuations, and the COVID-19 pandemic. This period provides a rich dataset for analyzing the effects of oil price shocks on MEDC's performance.

The data used in this study are sourced from several reliable databases and reports:

- Financial Data: Annual and quarterly financial statements of MEDC, including income statements, balance sheets, and cash flow statements, are obtained from the company's official reports and filings with the Indonesia Stock Exchange (IDX).
- Macroeconomic Data: Data on crude oil prices, exchange rates (USD/IDR), and market returns are sourced from global financial databases such as Bloomberg, the World Bank, and the Bank of Indonesia.
- Stock Performance Data: Information on MEDC's stock prices and returns is collected from the IDX and financial market platforms such as Yahoo Finance and Reuters.

3.2.2. Variables:

- Independent Variables: The primary independent variable in this study is the crude oil price, measured in USD per barrel. Other independent variables include the USD/IDR exchange rate and market returns, which are included to account for broader economic influences on stock performance.
- Dependent Variables: The dependent variables include key financial performance metrics such as Return on Assets (ROA), Return on Equity (ROE), Debt-to-Equity Ratio (DER), and asset turnover, as well as stock returns for MEDC.

3.2.3. Control Variables:

To isolate the effect of crude oil prices, the study includes control variables such as firm size (measured by total assets) and industry-specific factors (e.g., production output), which may also influence financial performance and stock returns.

3.2.4. Research Population and Sample

The primary focus of the study is PT Medco Energi International Tbk (MEDC), a leading energy company in Indonesia with significant involvement in oil and gas exploration and production. Given the specialized nature of the study, the research does not employ a broad sample of companies but instead focuses intensively on MEDC as a case study. This approach allows for a detailed examination of how oil price shocks impact a key player in Indonesia's energy sector.

However, for comparative analysis, the study also references financial data from other publicly listed energy companies in Indonesia, such as PT Pertamina and PT Energi Mega Persada, to contextualize MEDC's performance within the broader industry trends.

3.3. Data Analysis Techniques

- **Descriptive Statistics:**

The study begins with a descriptive analysis of the data, summarizing key statistics such as mean, median, standard deviation, and variance for the independent and dependent variables. This initial analysis provides an overview of the data distribution and highlights any significant trends or anomalies over the study period.

- **Correlation Analysis**:

Correlation analysis is employed to examine the strength and direction of the relationship between crude oil prices and the financial performance metrics of MEDC. Pearson correlation coefficients are calculated to determine whether there are statistically significant correlations between oil prices and variables such as ROA, ROE, and stock returns.

3.4. Hypothesis Testing:

The study tests several hypotheses regarding the impact of crude oil prices on MEDC's financial performance and stock returns. These hypotheses are tested using t-tests for the significance of individual coefficients in the regression models. Additionally, the F-test is employed to evaluate the overall fit of the regression models.

- Hypothesis 1: There is a significant positive relationship between crude oil prices and MEDC's profitability (measured by ROA and ROE).
- Hypothesis 2: Crude oil prices have a significant impact on MEDC's stock returns, with higher oil prices leading to increased stock returns.
- Hypothesis 3: Exchange rates and market returns moderate the relationship between crude oil prices and MEDC's financial performance and stock returns.

3.5. Limitations of the Study

While the study provides valuable insights into the relationship between crude oil price shocks and financial performance, it is important to acknowledge certain limitations:

- **Data Availability**: The study is constrained by the availability of financial and market data, particularly for years preceding the chosen timeframe or for certain macroeconomic variables.
- **External Factors**: While the study focuses on macroeconomic variables, it does not account for all external factors that might influence MEDC's performance, such as political risks, regulatory changes, or global economic shifts.
- **Sector-Specific Focus**: The focus on MEDC and the energy sector means that the findings may not be generalizable to other industries with different market dynamics.

4. RESULTS

The analysis conducted in this study yields several significant findings regarding the impact of crude oil price shocks on the financial performance and stock returns of PT Medco Energi International Tbk (MEDC). These results are presented across various financial metrics and in relation to broader macroeconomic variables, such as exchange rates and market returns.

4.1. Descriptive Statistics

The descriptive statistics provide an initial overview of the data, summarizing the central tendencies and variability of the key variables under study. Over the period from 2019 to 2022, crude oil prices exhibited considerable volatility, with prices ranging from as low as

$20 per barrel during the height of the COVID-19 pandemic to over $80 per barrel as global markets began to recover. MEDC's financial metrics, such as Return on Assets (ROA), Return on Equity (ROE), and stock returns, also showed significant fluctuations, reflecting the broader economic and market conditions during this period.

- Crude Oil Prices: The mean price of crude oil over the study period was $52.75 per barrel, with a standard deviation of $18.34, indicating substantial price volatility.
- Return on Assets (ROA): MEDC's ROA averaged 4.5%, with noticeable declines during periods of lower oil prices, particularly in 2020.
- Stock Returns: The average stock return for MEDC during the study period was 3.2%, with significant variance corresponding to the shifts in oil prices and market conditions.

4.2. Correlation Analysis

The correlation analysis reveals significant relationships between crude oil prices and the financial performance metrics of MEDC. Notably:

- Crude Oil Prices and ROA: There is a strong positive correlation ($r = 0.65$) between crude oil prices and ROA, suggesting that higher oil prices are associated with improved profitability for MEDC.
- Crude Oil Prices and Stock Returns: The correlation between crude oil prices and MEDC's stock returns is also positive ($r = 0.58$), indicating that fluctuations in oil prices have a direct impact on investor returns.
- These findings are consistent with the theoretical expectations, where increases in oil prices typically lead to higher revenues and profitability for energy companies, thereby boosting stock returns.

These findings are consistent with the theoretical expectations, where increases in oil prices typically lead to higher revenues and profitability for energy companies, thereby boosting stock returns.

4.3. Hypothesis Testing

The hypothesis tests conducted using t-tests for individual coefficients and F-tests for the overall regression models yield the following insights:

- **Hypothesis 1**: The positive and significant coefficient for crude oil prices in the ROA model confirms that higher oil prices are associated with improved profitability for MEDC. This supports the hypothesis that crude oil prices have a significant positive impact on MEDC's profitability.
- **Hypothesis 2**: The significant relationship between crude oil prices and stock returns confirms that fluctuations in oil prices are a key determinant of MEDC's stock market performance, validating the second hypothesis.
- **Hypothesis 3**: The significant coefficients for exchange rates and market returns in both models indicate that these factors moderate the relationship between crude oil prices and MEDC's financial performance and stock returns, supporting the third hypothesis.

5. DISCUSSION

The results of this study provide compelling evidence that crude oil price shocks have a profound impact on the financial performance and stock returns of PT Medco Energi International Tbk. These findings align with existing literature on the subject and offer new insights into the specific dynamics of the Indonesian energy sector.

- Impact of Crude Oil Prices on Financial Performance

The positive relationship between crude oil prices and ROA underscores the critical importance of oil prices for MEDC's profitability. Given that MEDC operates primarily in the oil and gas sector, it is highly sensitive to changes in commodity prices. Higher oil prices lead to increased revenue from oil sales, which, in turn, enhances the company's profitability. This finding is consistent with previous research, which suggests that energy companies' financial performance is closely tied to fluctuations in oil prices (Harinurdin, 2023).

Moreover, the significant impact of crude oil prices on ROE, as observed in the regression analysis, highlights how profitability metrics that include shareholder equity are also influenced by commodity prices. This suggests that investors in MEDC should closely monitor oil price trends as an indicator of the company's financial health.

- Influence of Macroeconomic Variables

The study also finds that macroeconomic variables such as exchange rates and market returns significantly influence MEDC's financial performance and stock returns. The positive relationship between the USD/IDR exchange rate and both ROA and stock returns indicates that a stronger USD relative to the IDR can enhance MEDC's profitability and market performance. This could be due to the fact that MEDC's revenue from oil sales, priced in USD, increases in value when converted to IDR during periods of IDR depreciation.

Additionally, the positive impact of market returns on MEDC's financial metrics suggests that broader market conditions play a crucial role in determining the company's performance. This aligns with the Efficient Market Hypothesis (EMH), which posits that stock prices reflect all available information, including macroeconomic conditions (Fama, 1970).

- Strategic Implications for MEDC

The findings of this study have several strategic implications for MEDC. First, the company should consider hedging strategies to mitigate the risk of oil price volatility. By using financial instruments such as futures contracts, MEDC could stabilize its revenue streams and reduce the impact of sudden price shocks on its profitability.

Second, MEDC should continue to monitor exchange rate movements closely, given their significant influence on the company's financial performance. Developing strategies to manage currency risk, such as currency swaps or diversifying revenue sources in different currencies, could help MEDC better navigate periods of exchange rate volatility.

Finally, the study highlights the importance of broader market conditions in influencing stock returns. MEDC's management should consider market sentiment and investor behavior when making strategic decisions, as these factors can significantly impact the company's stock performance.

- Limitations and Future Research

While the study provides valuable insights, it is important to acknowledge its limitations. The analysis is focused on a single company, MEDC, within a specific sector, which may limit the generalizability of the findings to other companies or industries. Additionally, the study primarily considers short-term fluctuations in oil prices and does not account for long-term trends or structural changes in the energy market.

Future research could expand on this study by including a larger sample of companies within the energy sector, both in Indonesia and globally, to provide a more comprehensive analysis of the impact of oil price shocks. Additionally, exploring the effects of other macroeconomic variables, such as interest rates and inflation, could offer further insights into the complex dynamics influencing financial performance and stock returns.

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CHAPTER 7

Improving The Productivity Hydraulic Body Line Productivity Through Root Cause Analysis Approach with Eliminate Combine Rearrange Simplify Method

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ABSTRACT

Sustainability in manufacturing requires a holistic view that includes product design, manufacturing processes, manufacturing systems, and the entire supply chain. The emergence of various problems in Company X in lines 1-17 in the hydraulic line in the form of long change over time, bottlenecks or work in process. This causes loss time which results in waste and has an impact on decreasing the company's productivity level. For this reason, improvements were made with the root cause analysis approach with the Eliminate-Combine- Rearrange - Simplify (ECRS) method. The root cause analysis method is expected to provide a clear picture of the company's performance from an economic, environmental, and social perspective and ECRS is an improvement method by eliminating work that is considered unimportant, combining work, rearranging work, and simplifying work, is a simple approach in its application and use and is very good when applied in the company' s improvement process. The improvements made are expected to have problems that arise when production in lines 1 – 17 can be minimized and reduced, streamline change over time, reduce bottlenecks which result in reduced waste so that company targets can be achieved, production can increase. With the application of the ECRS method and root cause analysis, it is expected that the PMH value will increase by 8% from the previous year.

Keywords: Productivity, Repair, Hydraulic Line, Change Over Time, Loss Time, Bottleneck, Work in Process, Waste, Root Cause Analysis, ECRS.

1. INTRODUCTION

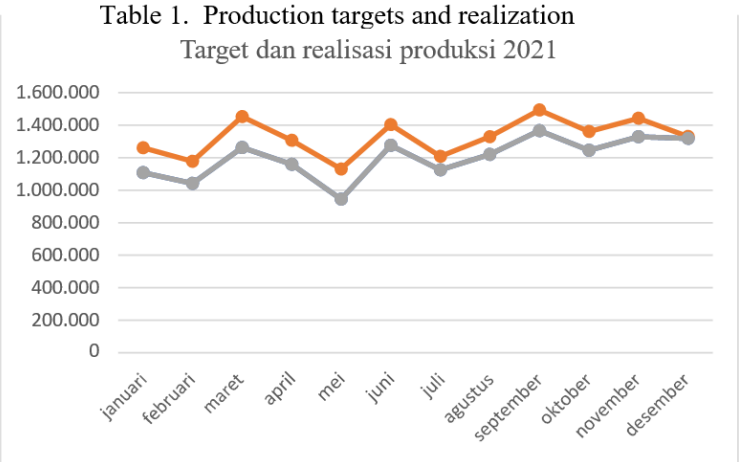
The performance of a manufacturing company can be measured by the efficiency and effectiveness of the company's production system. An effective and efficient production s ystem will produce quality and competitive products. An important challenge in global competition is the efficiency of the company and competitiveness making manufacturing companies to plan new manufacturing management strategies [1].

Productivity as a comparison index between output and input. Output in the form of goods and services, input in the form of labor, money, materials and others. Productivity will be equal to production capacity if the efficiency of cycle time is 100%, so that loss time certainly has a direct impact on production targets and productivity. Loss time is absolutely inevitable in the production process, many things can unexpectedly cause it such as quality problems, adjustment of new operators, material shortages, and various other causes [2]. The efficiency parameter that is considered important in manufacturing activities is time. The time required to complete the work on a product is called the lead time [3].

This research begins with management's findings on productivity in hydraulic lines 1 - 17, loss time as a result of machine failure, long change over time and several other technical causes that result in production rates becoming not smooth and production targets not being achieved. The company that is the object of research which is the public companies that produces automotive components in the form of: radiators, oil coolers, condensers, brake pipes, fuel pipes, fuel tanks, exhaust systems, and press parts, including the manufacture of filters.

Currently, it is known that the company's target is increasing along with increasing consumer demand. with the target in January 1,261,034 units, February 1,177,456 units, March 1,453,259 units and April and May 1,306,355 units and 1,130,958 units, and in June as many as 1,403. 594 units, but the demand target could not be met. This indicates a bottleneck because it has a longer cycle time than the predetermined production cycle time. Therefore, it is necessary to identify bottlenecks and reduce cycle times at bottleneck stations to increase production capacity so that demand targets and production targets can be achieved. Table 1 illustrates production targets and realizations during 2021.

Table 1. Production targets and realization



Based on the data above, Company X must continue to improve productivity and in order for the company to continue to improve its performance, especially on the hydraulic line, improvements are applied with the root cause analysis method and the ECRS method is a simple method in its application and use, therefore it is very good if applied in the company's improvement process [3].

2. LITERATURE REVIEW

2.1. HYDRAULIC LINE

Automotive component manufacturing companies in Indonesia have emerged in tendem with the development of the automotive industry. The variety of products produced in this industry is very wide and diverse, ranging from engine components to motor vehicle body components and even including vehicle accessories. These industries use raw materials, parts, and components to manufacture finished goods and generally use machines, robots, computers, and humans to produce production goods and typically use assy lines, which allow a product to be put together step by step, moving from one workstation to another. Such as: Air Cleaner System, Acoustic Exhaust Products, Types of Air Filters, including the manufacture of oil filters. The hydraulic line is one of the lines in the production division of Company X that produces body filter products, using three types of hyidrolic machines, namely:

Full manual type, one stroke type, and transfer type (manual modification). The hydraulic line consists of 17 lines, which are as follows:

a. Line 1 – line 8, is a one stroke hydraulic line where one process produces one product that includes several processes.
b. Line 9, as a whole, uses a manual process.
c. Line 10 - line 17, the basis of the process is a manual process but between processes semi-robot modifications have been carried out. For this line, the application of its use is a larger type of product so that the capacity produced per minute is lower than line 1 – line 8.

2.2. PROBLEMS ON THE HYDRAULIC LINE

2.2.1. Loss time

Productivity as a comparison index between output and input. Output in the form of goods and services, input in the form of labor, money, materials and others. Productivity will be equal to production capacity if the efficiency of working time is 100%, so that loss time certainly has a direct impact on production targets and productivity. Loss time is absolutely inevitable in the production process, many things can unexpectedly cause it such as quality problems, adjustment of new operators, material shortages, and various other causes. There are various other possibilities that arise directly from the production process that cause loss time such as handling problems, work layout arrangement and various other waste. [4].

2.2.2. Waste

Waste is anything that is excessive beyond the minimum requirements for equipment, materials, components, places and working time that are absolutely necessary for the process of added value of a product, and simply concluded that if something does not provide added value it is called waste [30]. In the Toyota Production System (TPS) there are seven types of waste in the production process, which are as follows [5]:

1. Overproduction

Overproduction or overproduction is waste caused by overproduction, meaning producing products that exceed what is needed or producing earlier than schedule. Toyota concluded that overproduction is the most severe waste among other wastes.

2. Waiting,

It is a waste of waiting for the next process. Waiting is a time gap when the operator not take the time to perform value adding activities because it waits for the product flow from the previous process.

3. Transportation,

Transportation is an important activity but does not add value to a product. Transportation is the process of moving materials or work in process (WIP) from one work station to another, either using a worklift or conveyor.

4. Excess processing,

This waste occurs when the work method or work sequence (process) used is considered not good and flexible. This can also occur when the existing process is not yet standard so that the possibility of damaged products will be high. There are variations in the methods that operators work on.

5. Inventories

This type of waste is waste caused by unnecessary supplies. The point is too much material inventory, too much work in process between one process and another so that it requires a lot of space to store it, the possibility of this waste is a very high buffer.

6. Motion

Motion is a less necessary activity/movement performed by the operator that does not add value and slows down the process so that the lead time becomes long. The use of time that cannot be accounted for to add value should be eliminated wherever possible.

7. Defects

Defects are products that are damaged or do not comply with specifications. This will lead to an ineffective rework process, high complaints from consumers, and a very high level of inspection. If a production defect occurs at a work post, it will increase production costs and extend lead time.

2.3. ROOT CAUSE ANALYSIS

The purpose of RCFA (Root Cause Failure Analysis) is to solve problems that affect plant performance. Effective use of RCFAs requires discipline and consistency. Every investigation should be thorough and every prescribed step should be followed. Human nature determines that everyone involved in an event or incidents that require RCFA is conditioned by his or her experience. The natural tendency of those involved is to filter input data based on this conditioning. It is important for the investigator or team of investigators to put aside his perceptions, base the analysis on pure facts, and assume nothing. Any assumptions that enter the analysis process through interviews and other data collection processes must be clearly stated. Assumptions that cannot be confirmed or proven should be discarded [6].

The use of RCFAs should be carefully researched before conducting a full investigation due to the high costs associated with conducting such in-depth analysis. This method involves conducting an initial investigation to classify and define the problem. Once this is done, a complete analysis should be considered only if the event can be fully classified and defined, and it seems that a cost- effective solution can be found. Analysis is generally not performed on problems that are found to be random, non-recurring events. Problems that often justify the use of methods include equipment, machine, or system failure; deviations in operating performance; problems of economic performance; security; and regulatory compliance is a number of common techniques useful for problems solving [6].

FAILURE MODE AND EFFECT ANALYSIS

Failure mode and effects analysis (FMEA) is a design evaluation procedure used to: Identify potential failure modes and determine the effect of each on system performance. This procedure formally documents standard practices, generates a history of records, and serves as a basis for future improvements. FMEA procedures are logistical steps, starting with the analysis of subsystems or lower- level components [6].

Analyze the failure viewpoint and identify potential failure modes along with their failures. The effect of each failure mode is down to the system level. Each mode of failure and the resulting effect is assigned a criticality rating, based on its probability of occurrence, severity, and usefulness. For failures that score high on the curricity rating, the design changes to reduce it preferably. Following this procedure provides a more reliable design. Also the correct use of the FMEA Process resulted in two major improvements: (1) improved ability to anticipate problems and make improvements before producing the product and (2) increased validity of analytical methods, resulting from rigorous documentation of the rationale for each step in the decision-making process [6].

CAUSE AND EFFECT ANALYSIS

Cause-and-effect analysis is a graphical approach to failure analysis. It is also referred to as Fishbone analysis, a name taken from the fish-shaped patterns used to plot relationships between various factors that contribute to a particular event. Typically, fishbone analysis plots four main classifications of potential causes (e.g. human, machine, material, and method) but can include any combination of categories. Like most failure analysis methods, this approach

relies on a logical evaluation of actions or changes leading to a specific event, such as a machine failure. The only difference between this approach and other methods is the use of a graphing fish form to plot cause-and-effect relationships between a particular action, or change, and an end result or event. Fishbone charts do not provide clarity on the sequence of events leading up to failure. Instead, it displays all possible causes that may have contributed to the event [6].

Root cause analysis includes four steps, namely: 1. Identify ongoing business processes, 2. Draw causal factors, 3. Identify root causes, 4. Proposal recommendations. A simple root cause analysis can be done by observing what problems occur and then continuing to ask why the problem can occur, until the basic elements of the process that cause failure are found. The first step in the analysis is to obtain data, which is to identify the business processes that take place to find out the causative factors and root of the problem. While the causal factor is described using a causal diagram / fishbone [6].

A causal diagram is a structured approach that allows for a more detailed analysis to find the causes of problems, discrepancies and gaps [3]. This diagram can be used in situations where there is discussion using brainstorming to identify why a problem occurs, detailed analysis of a problem is required, and there is difficulty separating cause and effect. Once all causal factors have been identified, investigators begin by identifying the root cause. Then the next step is a recommendation of proposals based on the root cause for certain causal factors that get recommendations for preventive measures to prevent the problem from reoccurring [7].

2.4. ECRS

ECRS is one of the Just in Time (JIT) concepts in Toyota Manufacturing where the concept aims to make the production line perfectly balanced and have one hundred percent resource utilization. This concept has been widely used by some researchers to improve line efficiency and productivity performance [9]. This concept is done by eliminating work that is considered unimportant, combining work, rearranging work, and simplifying work [30]. Upgrading from ECRS leads to reduced system costs and energy costs while processing time is reduced. Furthermore, material costs and waste costs are reduced when repairs are affected to reduce material losses from improper working methods [9].

Increased ECRS can reduce elements in some workstations, reduce total work content time, increase workstasion utility and balance efficiency, decrease delay balance and smoothness index, possibly decrease the number of workstations or number of operators so that the company can reduce the direct cost of labor and most importantly, achieve production targets due to decreased cycles overall maximum station time or time and increase in production output. The implementation of ECRS on the machine layout settings on the line was able to reduce the total setup time [10].

The concept of ECRS is an easy way to reduce waste/loss [12]. Efforts to minimize waste to improve efficiency lines are an interesting topic to study. The improvement phase is to eliminate waste in each process to increase the efficiency and effectiveness of the production process [13]. The idea of ECRS can be applied to workstations to reduce waiting times for other stations, commonly called bottlenecks. The increase in productivity will be directly proportional to the increase in company profits without the need to increase sales of the price of its products [3].

The method that can be used to overcome the above problems is the root cause analysis approach with the Eliminate-Combine-Rearrange -Simplify (ECRS) method. through this research, work methods will be improved through line identification and the causes of various problems that exist in the hydraulic line using the root cause analysis approach. Then improvements are made with the ECRS method, it is hoped that problems that arise when production can be minimized and reduced so that the company's target can be achieved and further improved, of course with a short time, little cost and good quality. Improvement of work methods will have an impact on work efficiency and effectiveness with the increase in work efficiency and effectiveness will also affect the reduction of cycle time [13].

Comparing productivity before and after improvement, management can convince company owners and related parties to apply the concept through the root cause analysis approach using the Eliminate-Combine-Rearrange -Simplify (ECRS) method, it is expected that the PMH value will increase and it is expected that in this study there will be an increase of 8%.

3. METHODOLOGY

The research approach carried out in overcoming the problems that arise is as follows:

1. Data collection

In this study, the collection method was carried out by:

1. Data with literature studies, both from books, journals and other media that have sources of information for this study.
2. Field data from observations, interviews and hands-on experience in hydraulic lines include work process flow, cycle time data, operator working hours data, number of operators, and company targets.

2. Identify the problem

This stage is carried out to identify any problems that occur in the production process on the hydraulic line. By using the root cause analysis approach.

3. Analyze corrective steps to be applied to hydraulic lines that identify problems.

4. Next is to make improvements to the working method through the ECRS approach. This stage applies the improvement method by eliminating work that is considered unimportant, combining work, reorganizing work, and simplifying work.

5. Furthermore, the variable results of improvement with ECRS are applied in actual to the production process on the hydraulic line.

6. After getting the results of development with the ECRS concept, if there is an increase in productivity then proceed with the next step if there is no increase in productivity then again make improvements with different corrective actions.

7. Drawing Conclusions and Giving Recommendations. The final stage of the research after all processing, identification and analysis of the data is completed. Conclusions are drawn related to the obstacles that occur, the root of the problem, and recommendations for improving the oil filter component production system with the root problem analysis approach through the use of the ECRS method.

8. After that, suggestions were also given, both company and future research in the form of improvements and development of research that has been done.

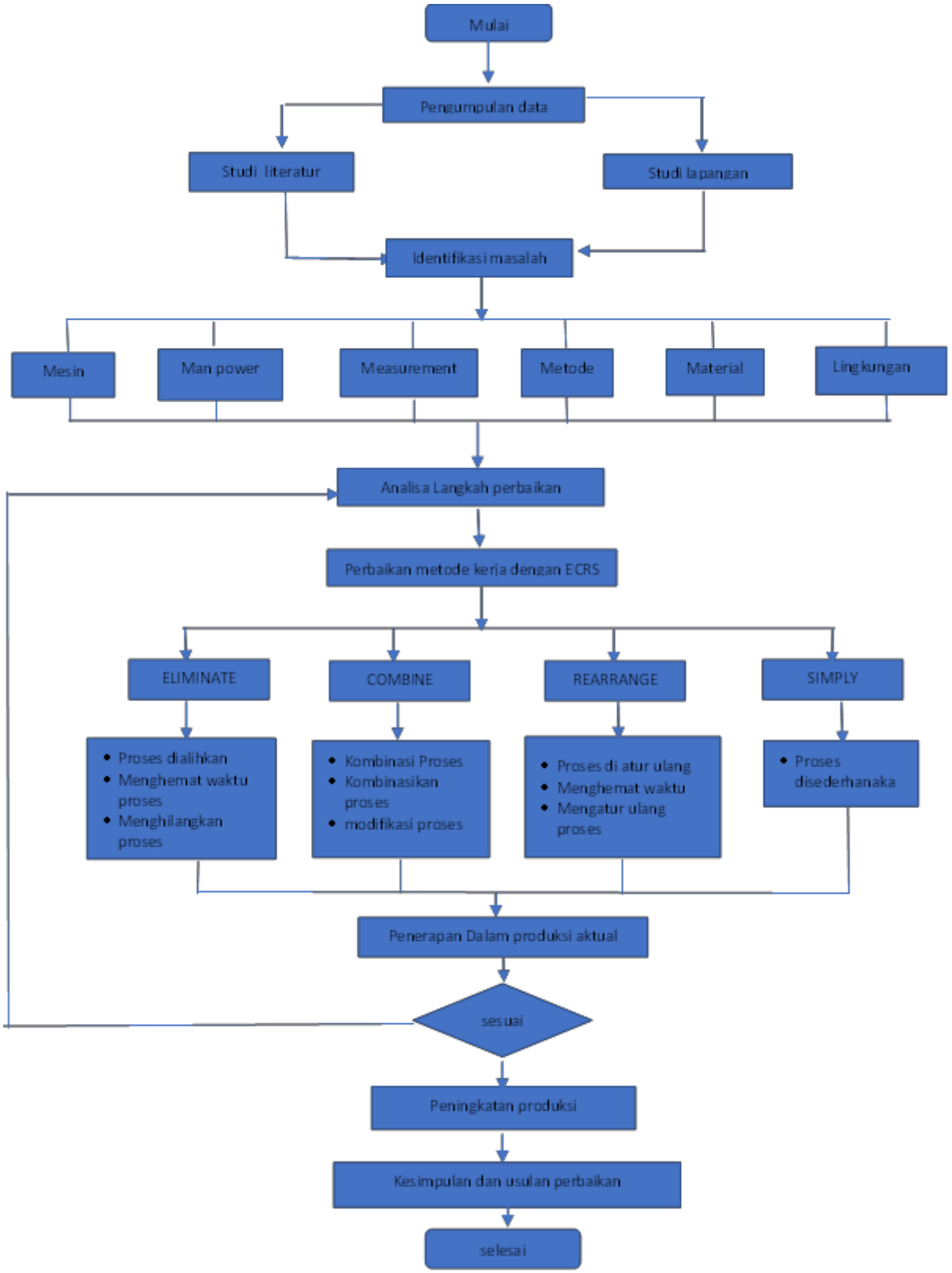


Figure 3.1. Research method flowchart

4. FINDINGS AND DISCUSSION

Identification of problems in the production process in the hydraulic line is carried out by the root cause analysis method and illustrated with a cause and effect diagram / fishbone by identifying the cause of process slowness in the component components in the hydrolick line and identifying production lines in the production process whose process causes loss time in producing production components. All causes are then put into the category of biggest causes. Once the main problem is found, a causal diagram is developed to look for small supporting causes of the main problem. Analysis is carried out by direct observation to the field and brainstorming related operators, technical implementers, and supervisors. Brainstorming on related personnel is one way of finding the root of the problem using cause and effect diagrams.

Brainstorming and discussion are carried out to find potential causes of the root of the problem, the results of brainstorming the cause and effect diagram shown in figure 3 by the cause and effect diagram show engine factors there are several causes, namely: general engine damage, leakage in cylinder tubes, limit switch damage, unstable cushion pressure, damaged finger arms, power The engine went down, and the engine thrower broke. In the method factor, several causes are concluded, namely: The machine is not balanced, change over time is long, tooling is not all standard, the number of processes for each part is different, loading on one of the machines, forktif prablem, loading material, taking pallets, disposing of waste.

Human factors identified several causes, namely: uneven operator competence, high absenteeism and high enough human movements such as praying, drinking, going to the toilet, taking boxes etc. Meanwhile, material factors are: shorted materials, material queues, damaged dies, and defective materials. The measurement factors are as follows: product verification by QC before mass production, hold quality and mass inspection. Lastly environmental factors are: power failures, earthquakes, heavy rain and leaky floors, demonstrations.

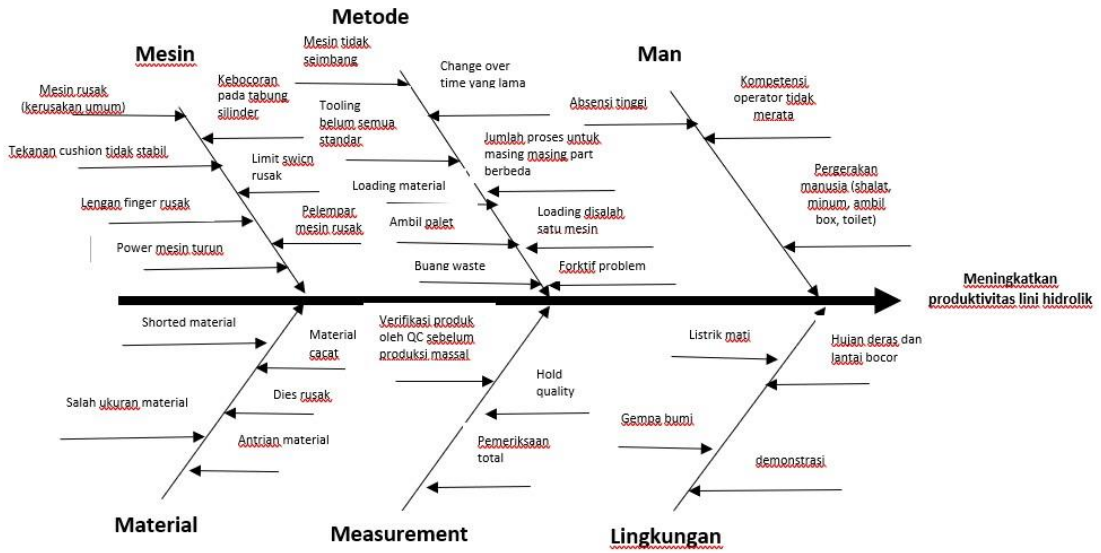


Figure 4.1. Hydraulic line fishbone diagram

Based on the results of root cause analysis using a cause and effect diagram, observations and studies are carried out to find the most likely causes so that the following data data are obtained:

1. The causative engine factor is Leakage in the cylinder tube,
2. The causative method factors are COT, material loading, pallet grabbing, forktive problems
3. Material factors are caused by problems in the dies.

After knowing the causes that cause decreased productivity in the hydraulic line, a comprehensive improvement is carried out with the ECRS method (Eliminate, Combine, Rearrange, Simplify) as one of the stages for improving the production process. Suggestions for improvement are summarized in Table 2.

Table 2. Suggested improvements

NO	FACTOR	CAUSE	IMPROVEMENT
1	MACHINE Leakage	Due to the pressure of	• Allocation of the type of product produced in the machine
	On the tube Cylinder	cuchion which varies depending on the type of product processed, so that the seal on the tube breaks	according to the available machine capacity • Replacement and evaluation of seals on cylindrical tubes • Determine the life time of the components in the cylinder tube for periodic and preventive checks • Determine the maximum and minimum limits of machine pressure during the process by specifying specific products • The position of the cushion switch is moved or equated with the bottom switch • Switch control cushion combined with TMB control switch • The diameter of the ring process is reduced by 0.5 mm from the previous process so that it slides • The Stroke of the Draw 3 process is made standard Maximum 10 mm from the top body height • Transfer Speed Control increased to 700 Rpm
2	METHOD Change over time too long	Replacement of each model takes a long time of 45 – 60 minutes	• Dies or tooting to be processed will be prepared early by placing near the machine • The stroke distance of the body is made a maximum of 10 mm from the top body • Combain Process on Draw and Grip, or Triming and Drain • marked when placing Blank • High Implication Body Products • Combination of Process types with the same diameter

3	MAN Uneven operator competence	Those who operate the machine have different abilities and experience	• Before entering each operator is always given general training, machines, products, 5S, discipline and motivation • For special work / for special machine operations, special training will be carried out • Training introduction and how to operate the machine
4	MATERIAL Shorted material	The materials needed are not available or sufficient for production needs	• Production schedule and material requirements per week will be reported to the ipc department • Communication / information from the ipc section to production if material availability does not exist to
			avoid production production loss time means that production can make changes in production available materials
5	environment Heavy rain and leaking floors	When it rains accompanied by wind, conditions cause leakage and the potential to replace the existing installation in the engine and the potential for short circuit is high	• Recheck buildings that have the potential for leaks • Checking water pipes in buildings
6	MEASUREMENT Quality hold	When mass production in the middle of the process suddenly occurred an oddity that resulted in the product being held	When mass production for all products, periodic checks are carried out to avoid the occurrence of mass held products

Based on the improvement suggestions above, improvements were made by applying directly to the production process and there was a significant increase and an increase in time efficiency was obtained by comparing the results obtained before the repair. The results of the improvements are summarized in table 3 and table 4 as follows:

Table 3. Lead time before repair

Line	Line	R														Lead	Bottl		Pcs
		a	b	c	d	and	f	g	h	i	j	toward	l	m	n				
	Line															28,20	10,3	5,83	
	Line															18,45	7,7	7,76	
	Line															20,58	8,0	7,49	

Onestroke	Line														28,25	10,3	5,81	
	Line														29,26	11,3	5,29	
	Line														28,78	9,9	6,04	
	Line														26,22	10,2	5,88	
	Line														19,24	10,3	5,81	
	Line														33,97	9,5	6,30	
Manual	Line											12,89			69,16	12,8	4,65	
Transfer	Line														31,88	11,2	5,32	
	Line														34,00	12,9	4,65	
	Line														33,88	11,3	5,29	
	Line														24,50	10,0	5,98	
	Line														26,39	11,2	5,36	
	Line														37,61	13,3	4,51	
	Line														31,44	12,0	4,98	

Table 4. Lead time after repair

Line	**Line**	**Processi**														**Lead**	**Bottl**		**Pcs**
		a	**b**	**c**	**d**	**and**	**f**	**g**	**h**	**i**	**j**	**toward**	**l**	**m**	**n**				
Onestroke	Line															27,42	9,5	6,30	
	Line															17,24	6,5	9,20	
	Line															19,99	7,4	8,09	
	Line															27,54	9,6	6,24	
	Line															28,44	10,5	5,70	
	Line															28,21	9,3	6,41	
	Line															25,27	9,2	6,49	
	Line															18,27	9,3	6,42	
	Line															32,96	8,5	7,05	
Manual	Line											12,50				68,77	12,5	4,80	
Transfer	Line															31,14	10,5	5,70	
	Line															33,62	12,5	4,79	
	Line															33,06	10,5	5,70	
	Line															23,99	9,5	6,30	
	Line															25,71	10,5	5,70	
	Line															36,84	12,5	4,79	
	Line															30,92	11,5	5,21	

Information

A Uncoiler
B Feeder
C Blank
D Proses Hydraulic Onstroke
And Conveyor
F Transportation from blank machines
G Process in Transfer Engine
H draw 1
I draw 2
J draw 3
Towards draw 4
L Triming / Pierching
M Pierching
N Storing in containers

5. CONCLUSIONS

Based on the results of root cause analysis using a causal diagram, the most likely main cause that causes a decrease in productivity in the hydraulic line is obtained which is a reference for improvement. Improvements are made by directly applying suggestions for improvements to the production process. The results of the application of improvement suggestions obtained an increase in the value of PMH and an increase in time efficiency. The impact of these improvements is a decrease in process lead time by 12.42 minutes from the time before the improvement was made. With the decrease in lead time, there was an increase in PMH value from 5818 pc / hour to 6294 pc / hour, this means that there was an increase of 7.55% or equivalent to 475 pc / hour.

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CHAPTER 8

Biophilic Study of Co-Working Space Design in College Libraries

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ABSTRACT

After the Covid-19 pandemic has passed, more than 2 (two) years have changed the order of life in all environments, including education, offices and commercial areas. Everyone is well aware of the importance of maintaining air quality in closed spaces, as in the research we conducted, one of which was a campus or college library. One effort to maintain air quality in closed spaces is the concept of biophilic design, which is used by many students when studying, reading, making assignments and discussions. The aim of this research is to make a design study on the space in the campus library to apply the concept of biophilic design in co-working spaces to the new normal after the Covid-19 pandemic. The research method used is descriptive qualitative by analyzing the advantages and disadvantages of the theoretical basis for biophilic design patterns applied during the new normal era after the Covid-19 pandemic. It is hoped that the results of the research will provide guidance on how to apply the concept of biophilic design to spaces facing the new world order of the Covid-19 pandemic, so that it is hoped that it will play a role in increasing immunity, physical fitness and human mental health in the context of space, especially campus libraries.
Keywords: Biophilic design, Co-working Space, Library.

INTRODUCTION

The Covid-19 pandemic has changed the life order of all communities throughout the world, various health efforts and protocols are still being implemented even though almost 4 (four) years have passed. All humans on this Earth are very aware of how important it is to maintain air quality, especially in the shared spaces of University libraries. This research discusses a review of university library design literature with a biophilic design approach to library functions for students from various faculties. Trisakti University has 9 (nine), namely: Faculty of Law; Faculty of Economics; Medical School; Faculty of Dentistry; Faculty of civil engineering and planning; Industrial Technology Faculty; Faculty of Earth and Energy Technology; Faculty of Landscape Architecture and Environmental Engineering; Faculty of Fine Arts and Design with 23 (two or three) study programs. Since 2020, the library has been centralized in Building M – Campus A, Trisakti University, equipped with facilities for reading, discussing and doing assignments.

The library at a university is the heart of the university, and is one of the supporting facilities to support the Tri Dharma of Higher Education for teaching, research and community service activities. (Rahayu, 2017) Likewise, Tri Hardiningtyas stated that according to its function, a college library is to develop, process and maintain library collections and provide library administration services to university library users. (Hardiningtyas, 2016) After the Covid-19 pandemic, the way we communicate with each other continues to change, including the learning process and using shared spaces such as the university library. This research tries to make a study based on literature data related to interior design by applying a form of biopolitical design for university libraries.

The term Biophilic comes from the word biophilia which can be interpreted as 'love of nature' which emerged around the 1980s, starting with increasing urbanization, resulting in a weakening of human relationships with nature. Based on this condition, the field of architecture created the idea of biophilia with the aim of returning humans to closeness to nature. (Adiyanto, 2017) As time goes by, including rapid technological advances, it also results in various mental health problems and unhealthy lifestyles. Biophilic design will change and become a solution to increase human physiological and psychological interaction with nature, because the essence of biophilic design is designed to create a space where there will be interaction with nature which is a basic human need. (Benaya, 2019) According to Browning in Hui (2019) Biophilic design has 14 (fourteen) designs grouped into 3 (three) categories, as can be seen in the following table:

Table 1. 14 Biopholic Design Patterns

Categories	Biophilic Design Patterns	Pengertian
Nature in the Space	P1. Visual Connection with Nature	A pattern that relies on the sense of sight to perceive space that is connected to nature both directly and indirectly Example: Placing a Window in the work area  (travelkompas) → Work desk facing the window
	P2. Non-Visual Connection with Nature	A pattern that relies on the senses of hearing, smelling, touching and feeling in experiencing space related to nature in a multi-sensory way.  (kretivv) Caption: Reading room with natural design
	P3. Non-Rhythmic Sensory Stimuli	Patterns related to nature are random and last a short time so that space users are not aware of them but can create a fresh, interesting and enthusiastic atmosphere.  (pemkot Bandung) Interactive reading room layout
	P4. Thermal and Airflow Variability	Patterns related to air movement, temperature and humidity with dynamic and variable properties in the interior resemble original conditions in nature  (leisure – Harian Jogja) Dynamic layout like natural conditions
	P5. Presence of Water	A pattern that places water elements in the space to provide a comfortable and calming atmosphere so that it has a positive impact on the users of the space.  (Hans Schlupp) There is a pool that can cool the air

	P6. Dynamic & Diffuse Light	Patterns related to the movement of natural light due to differences in time which are dynamic and spread in space so that contrast between light and dark areas arises  (Arsitag) Utilize lighting from skylights So save energy
	P7. Connection with Natural System	Patterns that connect the interior with the ever-changing natural system so that space users can interact with nature.  (jurnalpost) The shape of the bookshelf resembles a tru… Tree
Natural Analogs	P8. Biomorphic Forms and Patterns	Patterns that imitate or stylize natural forms in shapes and motifs for forming and filling elements of space to present a natural atmosphere.  (Universitas Kristen Petra) Interiors that use patterns organic
	P9. Material Connection with Nature	Patterns that use natural materials that change over time so they can reflect the local environment.  (Universitas Kristen Petra) Fun experience concept
	P10. Complexity and Order	Patterns that apply repeating symmetry and geometric shapes at the same or different scales so that individuals can better understand space  (Uno a Uno) Apply symmetry and geometric patterns
Nature of the Space	P11. Prospect	Patterns that provide a wide, open and bright view of the space so that users can feel the diversity of the space.  (Eric Laignel) Open space interior design
	P12. Refuge	Patterns that create closed areas or limit views from outside the area so that users can feel safe and protected  (aksaramaya) Comfortable atmosphere

	P13. Mystery	Patterns that provide a sense of awe and curiosity about the sensations felt in space such as dynamic movement and changes from time to time  (VOA Indonesia) The reception area is separate from the area library
	P14. Risk/Peril	Patterns that provide a sense of danger or threat but still feel protected so that users of the space can increase curiosity, alertness and awe  (UGreen.io) Green atmosphere of the library interior

Of the 14 (fourteen) biophilic designs that are suitable for library interiors, the second category is Natural Analog, namely: Biomorphic Forms and Patterns (presenting a natural atmosphere in the form of applying textures); Material Connection with Nature (non-toxic application): Complexity and Order (applying open space).

In general, the spaces in the library are: collection room; reading room, service room and administrative work space for library staff, where it is also necessary to pay attention to the grouping of books from several faculties that have different student characteristics. For this reason, implementing biophilic design is the most appropriate, after the Covid-19 pandemic. The aim of this research is how to make the library space more effectively used according to its function as a reading room for students.

METHOD

This research uses a literacy review related to the study approach of several journals related to libraries, including: Nur Afizah MK, Azizah MD and Siti Rasidah MS that campus and building facilities are less supportive regarding the spatial layout of the division between collection rooms, reading rooms, service rooms to the administration room. Divisions that are too formal result in the library being less attractive to most students compared to the open spaces on campus grounds. (Nur Afizah MK, 2021). Meanwhile, according to Sri Rahayu, university libraries are included in the technical service unit as a means of technical support, including functioning as a place of education, a source of information, research, recreation and publication. (Rahayu, 2017)

RESULTS AND DISCUSSION

Several studies refer to students' comfort in using the university's central library, which consists of several faculties, each of which has student characteristics in carrying out the learning process. Therefore, the application of biophilic design in designing spatial layouts is in the second category, namely Natural Analog, namely: Biomorphic Forms and Patterns (presenting a natural atmosphere in the form of applying textures); Material Connection with Nature (non-toxic application): Complexity and Order (applying open space) researchers consider appropriate to apply for spatial layout in a university's central library.

CONCLUSION

The application of this second category of biophilic design is very good for helping the mental health process for users, especially students, both physically and psychologically. Previous case studies show that biophilic is successful in increasing productivity, reducing stress levels, and increasing the recovery rate of the human body.

The focus in biophilic is to create an interaction between the existing architectural composition with human behavior as users and the natural environment through complex activities with the aim of creating a quality of life, especially for health during this pandemic. Biophilic is used as an alternative so that the room concept that is built will be able to synchronize the relationship between nature and humans themselves. Three main design patterns can be implemented in the university central library space, as follows:

a. **Biomorphic Forms and Patterns,** the application of patterns that imitate or stylize natural forms in shapes and motifs for forming and filling elements of space to present a natural atmosphere.
b. **Material Connection with Nature**, the application of patterns that use natural materials that change over time so they can reflect the local environment.
c. **Complexity and Order**, the application of patterns that apply repeating symmetry and geometric shapes at the same or different scales so that individuals can better understand space.

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Mr. Akshay Mishra is a renowned educationist who did his B.Com from Delhi College of Arts and Commerce, University of Delhi; M.Com from University of Delhi and pursuing his PhD in Medical Tourism from Bundelkhand University.

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Dr. Kamal Goel

Dr. Kamal Goel is an eminent academician with extensive knowledge in the field of marketing and brand management. Having accumulated more than six years of research experience, he has made substantial contributions to the study area, showcasing an outstanding skill in curating and shaping influential material.

Dr. Kamal Goel, in his capacity as the editor of this book, leverages his extensive expertise and keen editorial aptitude to this endeavour. The author's exceptional research contribution has played a crucial role in molding this book positively, guaranteeing that it effectively tackles important themes and offers fresh viewpoints on pertinent subjects.

Research articles authored by Dr. Kamal Goel have been published in UGC CARE and ABDC Indexed Journals. His academic qualifications include B. Com (Hons.), M. Com, M.B.A, Ph.D. (Commerce) from prestigious universities, which further emphasise his proficiency in the research area.

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Dr. Kamal Goel, a young scholar deeply dedicated to study, has devoted his professional life to the advancement of knowledge and the promotion of important debates. His profound interest in the topics addressed in this book is evident in his deliberate and thorough approach to editing it.

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