EMPATHETIC INNOVATION: HARNESSING DESIGN THINKING FOR SUSTAINABLE AND INCLUSIVE BRAILLE PACKAGING SOLUTIONS AND IMPACT ON SUSTAINABLE DEVELOPMENT GOALS (SDG)

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ABSTRACT
This paper presents an approach to packaging innovation through the integration of Design Thinking with a specific focus on Braille packaging. The problem regarding visually impaired individuals face challenges in accessing important information, particularly on product packaging. Traditional packaging often lacks inclusivity, as it doesn't accommodate the needs of the visually impaired. This presents a barrier to independence and can lead to exclusion from essential goods and services. The objective of this study is to explore the application of design thinking principles to develop sustainable and inclusive Braille packaging solutions. By leveraging empathy and creativity, the aim is to create packaging that not only meets the functional needs of the visually impaired but also aligns with sustainable development goals (SDGs). Through this approach, the study seeks to promote accessibility, independence, and social inclusion for visually impaired individuals while advancing environmental sustainability. Applying Design Thinking's empathetic and user-centric methodologies, by creating packaging solutions that are not only ecologically sound but also accessible to visually impaired consumers. The methodology includes iterative process of prototyping and feedback inherent in Design Thinking allows for the exploration of tactile elements in packaging, with Braille as a central feature. The study resulted in the development of innovative Braille packaging solutions that are not only accessible and user-friendly for visually impaired individuals but also environmentally sustainable. Through the application of design thinking principles, the packaging designs incorporate features such as easy-to-read Braille labels, tactile cues, and eco-friendly materials. Moreover, the adoption of these solutions contributes to several SDGs, including Goal 8 (Decent Work and Economic Growth), Goal 10 (Reduced Inequalities) and Goal 17(Partnerships for the Goals). The findings highlight the potential of empathetic innovation to drive positive social impact and support sustainable development initiatives.

Keywords: Braille accessibility, consumer-centric innovation, design thinking, inclusive design, sustainable packaging

1 INTRODUCTION
The majority of working-age blind people are unemployed (74 percent) and depend on support such as disability income benefits [1]. It is estimated that the lost productivity due to blindness and eye diseases is $8.0 billion per year in the United States. Of the 26 percent of blind people who are employed, the majority of them are braille readers. The correlation is clear braille is an extremely important tool for blind people to become literate, and it is a critical component that supports educational advancement and increases employment prospects. We celebrate World Braille Day every year on January 4th because it's Louis Braille's birthday. He's the inventor of braille. Louis was born in 1809 in France and became blind after a childhood accident. But he quickly mastered his new way of living. According to National Braille Press, research shows that braille literacy directly correlates with academic achievement and employment. Donuts make an ideal choice for Braille packaging to raise awareness about Braille culture because they're a universally loved treat. By integrating Braille into donut packaging, it reaches a broad audience, fostering understanding and inclusivity. It's a simple yet effective way to promote the

significance of Braille in our diverse society. The concept of Braille packaging for donuts involves inclusivity. By incorporating Braille on flavour choices, it allows blind or visually impaired individuals to independently select their preferred donut flavour. This inclusive design promotes accessibility and empowers all customers to make informed choices, enhancing their dining experience. People with the ability to see should be aware of Braille because it is a tactile writing system that enables those who are blind or visually impaired to read and communicate. Understanding Braille promotes inclusivity and accessibility, allowing sighted individuals to assist and interact with the visually impaired community. Knowledge of Braille can lead to more diverse employment opportunities, fostering a more inclusive society.

2 TRIANGULATION STRATEGY

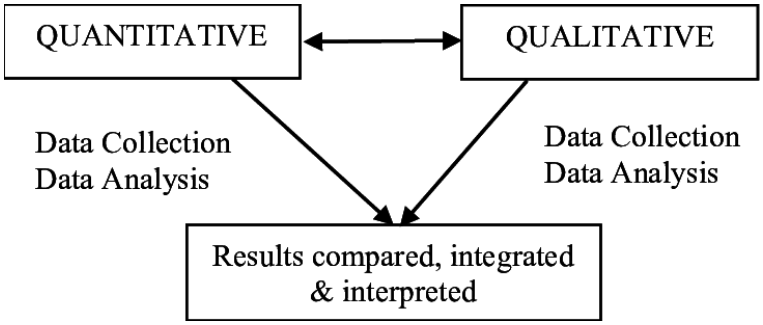

Figure 1. A Visual Diagram of the Mixed-Methods Concurrent Triangulation Strategy

To investigate the integration of Design Thinking into Braille packaging innovation, our methodology was structured in a multi-phase approach. Initially, we conducted a comprehensive literature review to establish a theoretical foundation in the domains of Design Thinking, sustainable packaging, and accessibility standards. Subsequent phases involved qualitative methods, primarily in-depth interviews and focus groups with stakeholders, including design professionals, sustainability experts, and members of the visually impaired community, to gather insights and validate the empathetic design principles [2]. We employed a participatory design framework, inviting visually impaired users to engage in co-creation workshops. These sessions facilitated iterative prototyping, allowing for real-time feedback and refinement of Braille packaging models. Quantitative methods were also utilized, with experiments conducted to measure the usability and environmental impact of the prototypes, comparing them against conventional packaging benchmarks.

Data triangulation ensured validity, with findings cross-verified through multiple data sources. The iterative cycles of prototyping and testing were guided by Design Thinking processes, with a focus on human-centred design, empathy mapping, and rapid prototyping. They begin to realize that the emotional factor in product design is very important in attracting customers to buy and use the product [3]. The research culminated in the development of a scalable model for Braille packaging innovation that emphasizes inclusivity and sustainability, substantiated by empirical evidence and user-centred evaluation.

3 INTEGRATING DESIGN THINKING INTO PACKAGING INNOVATION

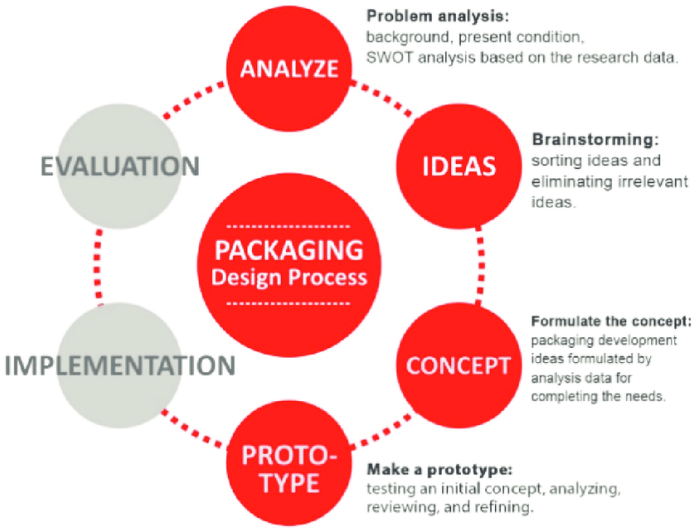

Figure 2. Design thinking methods by Nanda Nini Anggalih (2021)

Integrating design thinking into packaging innovation begins with empathizing to gain deep insights into consumer needs, Understand the consumer's needs, experiences, and motivations. Design involves, among other things, people, products, tools, and organizations [4]. For packaging, this might involve researching how users interact with similar products and what issues they face, such as difficulty opening the package or disposing of it. Followed by defining the specific packaging problems that need addressing. Clearly articulate the problem you are trying to solve. In terms of packaging, this could mean defining specific goals like reducing material use, increasing functionality, or enhancing user experience.

The ideation process then allows for the generation of creative solutions. Generate a wide array of ideas and potential solutions. Brainstorming sessions with diverse teams can lead to creative packaging concepts that are both functional and aesthetically pleasing.

After which prototypes are developed to bring these ideas into the tangible realm. Create scaled-down versions of the product packaging to explore the potential solutions. Prototypes can be used to test the functionality, durability, and user interaction with the packaging. Testing these prototypes with users is crucial to gather feedback and refine the design, leading up to the final implementation where the packaging is prepared for production and distribution. As stated by Nanda Nini Anggalih Packaging design prototypes were developed based on the observation results, including primary and secondary packaging, which can be applied according to the availability of local resources. Share your prototypes with a wider audience to gain feedback [5].

Testing packaging designs with actual users can reveal practical issues and areas for improvement that may not have been initially apparent. Take the final design and prepare it for production. This involves finalizing the design details, selecting materials, and considering the manufacturing process. This approach ensures that the packaging not only meets functional requirements but also resonates with consumers on a practical and emotional level. Therefore, active packaging is the component that takes some action, while intelligent packaging is the component that senses and shares the information. Intelligent and active packaging can, almost inevitably, work in synergy to create what is called a “smart” packaging.

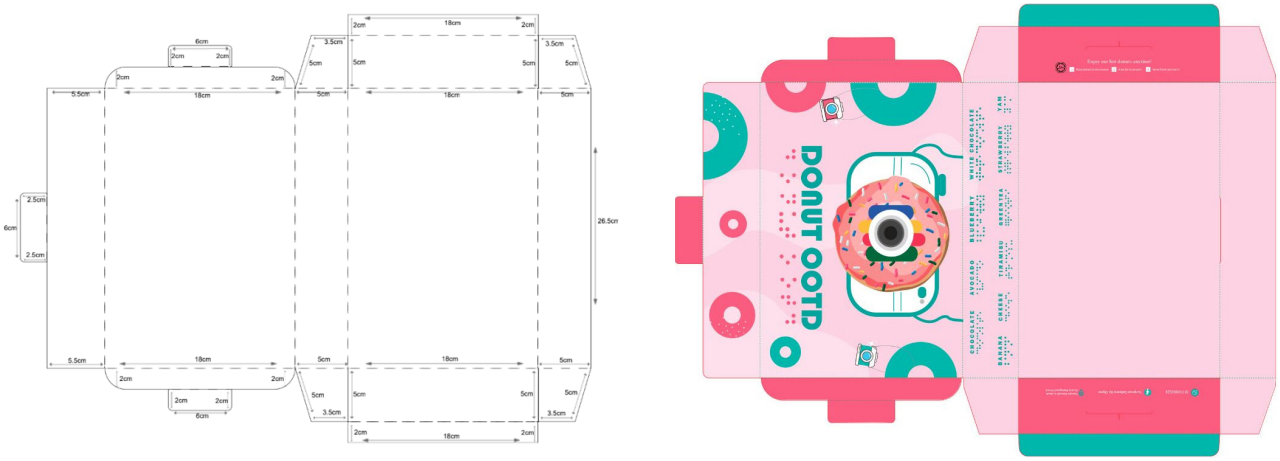

Figure 3. Technical Drawing(left) and Layout Design(right) for Donut packaging with Braille

4 BRAILLE-ENHANCED PACKAGING FOR INCLUSIVITY IN FOOD PRODUCTS

Figure 4. Donut packaging with Braille on flavours

Mastery of braille letters is the basis for incoming knowledge as input from the reading process experienced by children with visual impairments, this process of mastering braille greatly affects the quality of literacy that is owned, not only the quantity that children can read, but also concepts ranging from mastery of letters to awareness of differences. arrangement of words in words and sentences [6], for Arabic, it greatly affects word mastery or phonological as well as the use of numbers and braille codes.

Imagine a donut box, elegantly designed with both visual and tactile elements [7]. Where one sees the words "White Chocolate" or "Tiramisu," another feels the distinct dots spelling out the flavours in braille. This simple yet profound integration of braille into food packaging design can create a ripple effect, encouraging other brands to follow suit and prioritize accessibility [8]. In order to make the product explicit, at the concrete level, we also discovered that the designer continued with the use of hand posture activity in order to get a feeling for the tactility (responsiveness to stimulation of the sense

of touch) [9,10]. The process begins with empathizing with the visually impaired community, understanding their experiences and the barriers they face.
This initiative does not stop at braille; it is about rethinking how we can make everyday experiences more accessible to everyone. By choosing food packaging that incorporates braille, we can use design thinking to create a more inclusive world. It's about offering a touch of insight, one donut box at a time, and ensuring that pleasure in the little things like choosing a donut is an experience shared by all.

5 UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS

By addressing these goals through braille food packaging innovation, stakeholders can contribute to a more inclusive economy that benefits everyone, particularly those with disabilities, while also fostering a culture of sustainable and equitable development. An in-depth sustainability analysis (e.g., environmental or social live circle assessment) could not be performed with the SDG-Check. For an effective sustainability analysis (e.g., with the hotspot analysis) this would be sensible: the selection of the goal and targets does not necessarily have to be the most significant sustainability potential of the innovation. The selection is based on a self-assessment, which can be used as a basis for the further dialogue and should be evaluated by other experts [11]. Goals to be reached, **Goal 8: Decent Work and Economic Growth, Goal 10: Reduced Inequalities and Goal 17: Partnerships for the Goals.**

6 CONCLUDING REMARKS

6.1 The Role of Design Education in Promoting Inclusive and Sustainable Innovations

Braille packaging solutions. Product emotion study is based upon the form's origin, which is also the influence of user emotion and product characteristics. It is important to understand the relationship between basic form and the products character so that the designer can achieve the goals of design and target their user by the product emotion. Design education is intrinsically linked to the approach described in the abstract through its emphasis on Design Thinking and practical applications for real-world problems. Design Thinking's core principles empathy, creativity, and an iterative process are central to design education. Students learn to empathize deeply with users' needs, mirroring the abstract's focus on understanding the challenges faced by visually impaired individuals. The creative problem-solving and ideation skills developed in design education led to innovative solutions, such as the Braille packaging highlighted in the study. Moreover, the iterative process of prototyping and feedback, a fundamental aspect of Design Thinking, is a key part of design education curricula.
In addition to fostering innovation, design education emphasizes inclusivity and accessibility, teaching students to create products that cater to diverse populations.
Practical skills such as prototyping, feedback incorporation, and sustainable material selection are also central to design education. Students are taught to iteratively develop and refine their prototypes, as described in the abstract, ensuring that the final products meet user needs effectively.
and responsibly. The emphasis on using eco-friendly materials in packaging design mirrors the lessons in sustainability that design students learn. Through these practices, students are equipped to balance functionality with environmental impact, creating sustainable and responsible designs.
Moreover, design education instils the value of empathetic innovation, encouraging students to create solutions that have a positive social impact. The study focuses on promoting accessibility, independence, and social inclusion for visually impaired individuals through design aligns with these educational goals. Ethical considerations and the societal implications of design are integral to the curriculum, ensuring that students understand their responsibility to create inclusive and beneficial solutions. Collaborative efforts, emphasized in the abstract through partnerships for achieving SDGs, are also fostered in design education through group projects and interdisciplinary collaborations.
The empathy-driven design process, coupled with a focus on sustainability, not only addresses the immediate needs of a specific user group but also contributes to the broader global agenda of sustainable development. This innovative approach demonstrates the potential for design thinking to be a force for positive change, pushing the boundaries of conventional packaging norms to embrace a more inclusive and environmentally conscious future. the outcome from the analysis of image's scenario will help designers to expand their design thinking and reasoning parameters by reflecting the subtle interaction existed between the users and the products, which identified the user's need and be inspired to create an innovative product design concept. As we move forward, the lessons learned from this exploration can serve as inspiration for future endeavours that seek to harmonize innovation, empathy, and sustainability for the betterment of society and the achievement of the SDGs.

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