

A DO-IT-YOURSELF (DIY) EFFORT TOWARDS GREEN INNOVATION AND SUSTAINABILITY IMPACT: A CASE OF D'BAG

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Abstract: *Recycling benefits both the environment and the economy by converting waste into valuable products, thereby safeguarding ecological health. D'Bag is an innovative tote bag crafted from discarded hardcover files and surplus fabric, showcasing creativity while being both attractive and functional. This initiative stems from the understanding that the accumulation of waste leads to a disposal crisis. This study aimed to explore the fate of broken hardcover files, gauge interest in DIY recycling projects, and raise public awareness about the significance of recycling in fostering a sustainable mindset. The research also introduces the DIY product D'Bag. An online questionnaire was created and distributed, employing convenience sampling to gather data via Google Forms, with 294 respondents participating through their mobile devices. The study focused on a small sample of potential users, including students and lecturers from the Business Technology Management department. Furthermore, this paper outlines the innovative process of transforming broken files and other inexpensive materials into D'Bag. A design-based research framework consisting of four phases was utilized in the development of this DIY innovation. The findings revealed that 42.9% of respondents engage in recycling, while 39% retain their files without any intention to recycle. Upon presenting the innovative DIY product known as D'Bag, 69.7% of participants expressed that they found it highly intriguing, while 86.7% indicated a willingness to undertake a similar DIY project. Clearly, imaginative individuals inspire fresh concepts and foster enjoyable new*

pastimes. D'Bag serves as a prime example of a DIY initiative designed to demonstrate how items typically regarded as waste can be transformed into something valuable. It is advisable for everyone to dedicate time to engage in DIY activities, particularly with damaged hardcover files found in their homes or offices.

Keywords: Broken files, DIY Innovation, Sustainable Impact, D'Bag

Introduction

In 2020, Malaysia was positioned 68th among 180 nations in the Environmental Performance Index (EPI), an improvement from its 75th place in 2018. The EPI evaluates countries based on their performance in key environmental concerns across two main policy domains: safeguarding human health and preserving ecosystems. As Malaysia approaches 2025, it is encountering significant challenges in addressing environmental matters, which are exacerbated by the rising population (Mohd Hasnu N, Muhammad I, 2022). This is because the amount of waste being generated are increasing. The vast majority of 79% was thrown away and only 9% was recycled and 12% incinerated. It is expected to generate four times more waste over the next 30 years. If these trends continue 26 billion metric tons of waste will be produced by 2050. Almost half of which will be dumped in landfills. As such, the management of these wastes is one of the major environmental concerns worldwide (Ramakrishna et.al, 2020).

Recycling is widely recognized as an effective method for reducing pollution, conserving energy, and preserving natural resources. It involves the collection and processing of materials that would otherwise be discarded as waste, transforming them into new products. Governments and environmental organizations globally have invested considerable resources in promoting recycling practices and encouraging public participation in recycling initiatives (Ma, B. et al., 2019). The failure to recycle paper and other materials resulted in an estimated loss of RM291 million in 2023. Specifically, paper waste alone had the potential to generate over RM47 million if properly recycled (Malay Mail, 2023).

Cardboard and paper materials constitute a significant portion of recyclable waste in Malaysia. However, due to inefficient recycling practices, valuable resources worth millions of ringgits are lost annually. In 2021, paper and plastic materials made up about 17% of waste sent to landfills, equivalent to a value of RM205 million in the recycling industry (Astro Awani, 2022).

The 3R concept, which stands for Reduce, Reuse, and Recycle, has been a longstanding practice in Malaysia for solid waste management (SWM). This model serves as an alternative to direct landfill disposal by managing the waste generated. Research conducted by Moh & Abd Manaf (2014) indicates that the 3R approach is essential for prolonging the lifespan of landfills in Malaysia, particularly when compared to the expensive method of incineration (Ali & Yusof, 2018). The 3R concept—Reduce, Reuse, and Recycle—is an important framework in Malaysia's environmental management and waste reduction strategies. It is part of the country's broader goals for sustainable development, especially under initiatives such as the National Strategic Plan for Solid Waste Management and the Malaysia Roadmap Towards Zero Single-Use Plastics 2018–2030 (Greenpeace Malaysia, 2019). Furthermore, Bamberg, Ajzen, & Schmidt (2003) suggest that the Theory of Planned Behaviour (TPB) model may be

influenced by cognitive shifts in intentions and behaviours as new information is integrated. Additionally, findings indicated that differentiated waste collection and disposal could achieve greater acceptance if associated with elite or prestigious behaviours, thereby reinforcing pro-environmental identities. Ultimately, the 3R approach aims to enhance and sustain the overall waste management system (Agamuthu et al., 2011). This is supported by The Triple Bottom Line (TBL) framework, proposed by Elkington (1994), emphasizes sustainability by balancing three key dimensions: People, Planet, and Profit. This model provides a holistic approach for evaluating the impacts of sustainability practices, including the 3R concept—Reduce, Reuse, and Recycle.

Irregular or inconvenient recycling collection schedules significantly hinder recycling behaviors. A study in Seremban highlighted that inconsistent collection times or locations made it difficult for residents to recycle regularly. Establishing well-structured and consistent recycling collection systems aligned with people's routines is essential to overcome this obstacle (Rodzi et al., 2023). Paper constitutes a significant portion of Malaysia's municipal solid waste. In 2023, over 57,000 tonnes of paper were discarded monthly, occupying approximately 456,000 cubic meters of landfill space. This is equivalent to the loss of about 680,000 marketable-sized trees annually (Astro Awani, 2021).

In Malaysia, municipal solid waste (MSW) management remains an ongoing environmental and policy challenge. Among paper-based materials, one particular item that is conspicuously absent from both public discourse and formal recycling frameworks is the broken hardcover file. These files, typically composed of laminated cardboard, metal fasteners, and plastic covers or coatings, represent a composite material that does not fit neatly into existing single-stream recycling systems. Therefore, it is considered a neglected waste stream. Unlike aluminum cans or clean white paper, these items are bulky, non-uniform, and labor-intensive to dismantle for material separation (Moh & Manaf, 2014). In addition, Malaysia's existing waste separation infrastructure, particularly at the household level, is underdeveloped and lacks the granularity to deal with niche or composite materials (Yusop & Othman, 2019). Although the Solid Waste and Public Cleansing Management Act 2007 (Act 672) mandates waste separation at source in certain jurisdictions, enforcement is inconsistent, and public awareness of what qualifies as recyclable remains limited (MHLG, 2016). This situation leads to a disproportionate focus on mainstream recyclable materials, while marginal streams like broken files are overlooked and typically landfilled.

Meanwhile, academic and policy literature on waste management in Malaysia largely overlooks office and institutional waste types that are neither hazardous nor high in economic return. Research on paper waste tends to focus on newspaper, cardboard, or packaging waste (Agamuthu & Dennis, 2011), with little attention paid to the diverse and underexplored categories of post-consumer stationery waste. This constitutes a notable research gap, particularly given the rising interest in circular economy principles and low-tech reuse strategies. In sum, broken hardcover files fall into a “blind spot” in Malaysia’s waste management system, and something has to be done on this matter dan a DIY D’bag is one of it. Addressing this gap not only supports the country’s goals under the National Solid Waste

Management Policy (2016) and Circular Economy Roadmap (2025–2035) but also opens new opportunities for behavioral change, educational innovation, and design-based reuse at the grassroots level.

The purpose of this study was to find out what could be done with broken hardcover files; to determine the interest in do-it-yourself (DIY) elements; and to create awareness among the public on the importance of recycling towards green attitude.

Literature Review

Despite efforts, Malaysia's recycling rate remains modest. As of 2021, the national recycling rate stood at approximately 31.52%, with paper making up about 17% of landfill waste. This indicates a significant gap in recycling practices (Astro Awani, 2021). The following points will be discussed in this literature review.

Recycle

The Solid Waste and Public Cleansing Management Act 2007 (Act 672) defines recycling as the process of collecting and separating solid waste to create new products. According to the National Solid Waste Management Department (2021), recycling involves a cyclical process that begins with waste sorting, followed by directing the sorted materials to organizations or manufacturing facilities. The objective is to reprocess waste into new products. Additionally, recycling provides significant advantages for the environment by reducing the consumption of natural resources, generating financial savings, and offering social benefits. Consumers play a crucial role in completing the recycling cycle by purchasing products made from recycled materials. The United States Environmental Protection Agency (2020) has identified various terms associated with products that contain recycled content. Table 1 below states the terms used.

Table 1: Recycling terms on product that have recycled content

Terms	Meaning
Recycled-content product	Has recycled materials that collected from a recycling program or from waste recovered during the normal manufacturing process.
Post-consumer content	Is like recycled content but the material comes only from recyclables gathered from consumers or businesses via recycling program.
Recyclable product	Products that can be collected, processed and manufactured into new products after they have been used. These products do not necessarily contain recycled materials.

Source: United States Environmental Protection Agency, 2020

Recyclable materials can be categorized into four primary groups: paper (including items such as newspapers, magazines, cardboard, and paperboard), plastic (such as bottles and containers), metal (including tin, aluminium, and steel cans), and glass (such as bottles and containers). Additionally, other recyclable materials that fit within these categories include food waste,

electronic waste, medical waste, and solid waste, among others. Despite various campaigns and programs initiated by government agencies and non-governmental organizations (NGOs) to raise awareness about recycling, there remains significant room for improvement in the recycling habits of the community. Research conducted by Zhang, Gong, and Jiang (2021) explored the concept of nostalgia and its potential influence on consumers' decisions regarding recycling behaviour. The study's findings indicated that businesses should consider incorporating nostalgic elements into product packaging to encourage recycling among consumers. Furthermore, during recycling events, organizers could enhance participation by playing music that evokes nostalgic feelings, thereby motivating individuals to engage in recycling activities.

Manufacturers, businesses, community, and individual must work together to ensure that the recycling matters could be successfully implemented. We are in the same system, and everyone must take responsibility to protect the environment.

Do-it-yourself (DIY)

DIY retail products, according to (Dabija & Bejan, 2018) have a high market price. There are two factors to consider: (1) some retail chains collaborate with local producers, and the added value of the sold goods benefits local communities; and (2) various specific norms and standards must be followed during production in terms of pollution, PM emissions in the air, and producing goods that are not harmful to the environment or the community. This is because most of DIY items are produced from natural materials such as wood or wood derivatives, merchants will have started or been actively engaged in social responsibility initiatives. Among the actions performed are the reforestation of cleared lands, the cleaning up of green and other places, the assistance of communities via specialized social and/or environmental preservation programs, and so on.

Furthermore, the studies done by (Fox, 2014) stated that DIY practices are a source of "prosumption" development, whereby the definition is local production with local materials by local people, innovation, and entrepreneurship by local populations in regions lacking industrial manufacturing infrastructure, because they are based on customization, integration, and involvement of users in the production processes, as well as entrepreneurship. According to prior study by (Dupont et al., 2020), the convergence of ideas and technologies, as well as the interconnection of digital and physical environments, offer the potential for a transition to a new type of hybrid production that combines the scale and efficiency of high-volume manufacturing with the benefits that small local producers (SMEs and SMIs) bring to local economies. Supporting this hybrid production strategy and spreading DIY ideas among local producers, however, necessitates the creation of new production modes and tactics in a setting where processes "are less open, less dispersed, and less minimal than the new Do-It-Yourself processes." Therefore, many performers, particularly small producers, lose out on the possibilities for growth and creativity provided by DIY.

The Do-It-Yourself (DIY) movement began with product design and expanded to materials design. DIY materials provide new experiences, encourage sustainability and self-sufficiency,

and help to spread development knowledge. On the other hand, they symbolize local identity because they are built with local raw materials, processes, and resources, lowering costs, encouraging recycling, and connecting with the origin community. Studies conducted by (Alarcón Castro, 2020) shows that the identification of waste and its application in new DIY materials opens possibilities for self-production of materials and the customization of objects of everyday life. In rural settings, it promotes the valuation of local resources and motivates the ties of individuals with their immediate surroundings. This research is testing using fifteen children from primary rural schools and the results shows that the materials and can propose possible applications in their contexts.

Green Attitude

Various research on green attitudes used interchangeable terms such as environmental attitudes, ecological attitudes, environmentally friendly attitudes, and sustainable attitudes in which all of them is conceptualized based on individual's evaluative judgement on the environment. Green attitude is explained in two contexts: attitudes toward environment and attitudes toward pro-environmental behaviour (Coskun, 2018).

The rising demand for eco-friendly products today suggests a heightened positive perception of environmentally responsible behaviour among consumers. In comparison to other consumers, those who identify as green consumers are more inclined to demonstrate environmentally conscious actions. Numerous studies have shown that a significant factor influencing consumers' green purchasing behaviour is their attitude (Dhir et al., 2021; Zhang and Dong, 2020).

Based on tri-component attitude model, Dunlap and Van Liere (1978) distinguish attitude into three components: affective, cognitive, and behavioural. How does these three components correspond with each other are summarized and explained on Table 2.

Table 2: Attitude Components

Components	Definition	Example
Cognitive	Based on cognition of the attitude object as to its desirable outcomes	Belief in making a difference to environmental outcomes through behaviour.
Affective	Based on emotional reaction to the attitude object	Feeling virtuous when engaging in environmentally friendly behaviours.
Behavioral	Based on the tendency to act in favour of the attitude object	Choosing to buy a hybrid car.

Source: Schiffman & Kanuk (2007)

Although Malaysia's Solid Waste Act (2007) mandates separation at source, actual recycling outcomes remain weak—just 3–5% of recyclables were processed in 2005. This gap reveals not only enforcement issues but also public disengagement, as noted by Yusop & Othman (2019). Moreover, the exclusion of niche materials like hardcover files from mainstream

recycling programs suggests that current policy is biased toward high-yield materials, undermining the broader goals of the circular economy.

Divergence Between Policy Ambition and Practical Outcomes

Although Malaysia's national recycling rate has surged—from 15.7% in 2015 to 35.38% by 2023, with a notable increase in 2022 hitting 33.17% (Business Today, 2024). The country still risks falling short of its 40% target by 2025. This growth, while commendable, remains insufficient, underscoring a recurring pattern: stronger legislative frameworks have yet to translate into widespread behavioural and infrastructural adaptation (The Star, 2023).

Economic Losses Missed Recycling Opportunities

In 2023 alone, Malaysia lost an estimated RM291 million from recyclable materials that were instead discarded—reflecting the economic implications of suboptimal recycling practice. This figure spotlights not just environmental waste but tangible economic opportunity costs, particularly in commonly recyclable categories: paper, plastics, metal, and Tetra Pak. Strategic Innovation: From Vision to Action (The Star, 2023). Policy evolution is gaining momentum. In 2024, the government launched the Solid Waste Circular Economy Blueprint (2025–2035), introducing instruments such as Extended Producer Responsibility (EPR), Pay-As-You-Throw, and Zero Waste to Landfill Certification, all aimed at systemic change. Complementing this, the rollout of a Multi-Stakeholder Circular Economy Council, pilot recycling projects in urban centres and local recycling infrastructure in Selangor were announced to support tangible outcomes (Swinburne University of Technology, 2023).

Persistent Gaps and Structural Challenges

Despite optimistic policy signals, Malaysia still grapples with fragmented enforcement, variable public engagement, and uneven infrastructure access. Notably, source segregation remains implemented only in some states under Act 672, hampering cohesive uptake (The Malaysian Insight, 2022). In Selangor, volumes of daily MSW exceed state collection capacities, with recycling rates lagging behind ambitious targets (The Star, 2023).

DIY Idea: D'BAG, its Innovative Design and Development

In conjunction with this paper, an idea has been brought up to create do-it-yourself (DIY) bags from cardboard files that is no longer being used to file documents and papers to the public. This effort is done to publicly encourage other people not to throw away their files but instead recycle it for other purposes.

Do-it-yourself (DIY) activities encompass a variety of undertakings from home improvement to self-service, from crafts to art making, and from design work to digital technologies (Williams 2013). Despite the substantial growth in DIY activities, very few social scientists have studied the psychology behind DIY. Wolf & McQuitty (2013) have come out with a consumer behaviour model to explain motivations and outcomes associated with DIY and stated that motivations and identity factors drive the participation in DIY and reported a link between physical DIY involvement and higher order outcome values, with implications to life goals (Wolf & McQuitty 2013). Other investigators have reported forms of knowledge sharing,

open-source contributions, learning, and creativity as the core motivational forces underlying DIY involvement, rather than profit and social capital (Pöllänen, 2015).

The emergence of positive behaviour (Bakker & Schaufeli, 2008; Luthans, 2002 as in Ouweneel, 2013) has paved the way for individual interventions that are aimed at enhancing themselves. The question is, however, how exactly can this be accomplished? Simple as this question might seem at first glance, the answer is far from self-evident.

This DIY innovation is called D’Bag. The idea is to bring out an innovation concept idea to reality based on the problem discussed above. D’Bag mainly targets any individual who have unused cardboard files and to educate them to be creative about these files rather than just throwing them away. Thus, D’Bag is the first to introduce the most economical way to being creative with the concept of recycling.

Materials and Method

This paper intended to create awareness among all teachers, students, and office workers on the importance of recycling and do-it-yourself efforts on their old and unused cardboard files. Therefore, an innovation idea of bags from cardboard files and other recycle materials called D’Bag was introduced and elaborated.

In this study, design-based research model put forward by Ma & Harmon (2009) was used as the framework and method used as it provided the processes clearly (Figure 1).

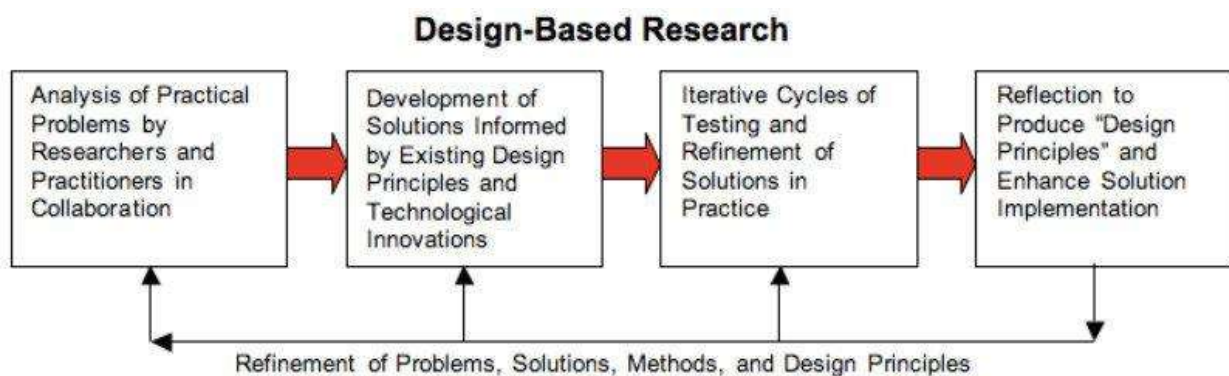


Figure 1: Reeves’s Model

The “analysis of practical problems” was the first phase as in the Reeves’s model. In this phase, a practical recycling process of unused files was identified and the related literature about the practical ideas of recycling and DIY was reviewed. The questionnaire was developed and distributed. The sampling method used is non-probability sampling—convenience sampling where data collections are from individuals who are easily accessible. A total of 295 responses were collected for this study through distribution in various WhatsApp groups, including those of lecturers, other colleagues and close friends, which are scattered around UiTM Melaka Branch’s staff *WhatsApp* groups. A set of questionnaires using Google form were distributed to these *WhatsApp* groups who are using cardboard files in their daily work and personal filings.

The instrument used for this study to generate data was the survey questionnaire developed through Google form. This instrument was used as it is easy to reach the respondents and analysis was done automatically by the application. The questionnaires consisted of ten questions that are related to recycling such as how often they got involve in recycling, did they ever conduct a DIY with any recycle items, and what did they do with their broken files when they no longer need them. The last question asked was about the newly innovated DIY idea called D'Bag from old/broken cardboard files.

The second phase involved the creation of solutions to the practical issue identified in the initial phase by developing a prototype or product aimed at addressing the research problem. During this phase, an innovative DIY project named D'Bag was conceived and crafted specifically to tackle the research objectives. This was achieved by utilizing old and unused files, surplus fabric, glue, and additional decorative items to create the bags.

The third phase focused on the evaluation and practical testing of the solutions. Given that the solution in this study was to produce several bags from discarded files, research played a crucial role through multiple iterations, incorporating relevant studies concerning the needs and requirements of stakeholders (individuals possessing old or unused files). Furthermore, to create a prototype that fulfilled the research objectives, the researchers themselves constructed several D'Bags from their own old and unused files.

This study was also influenced by the design-based action research model put forward by Keskin & Kuzu (2015) where phase 3 is an iterative cycle rather than a linear process. In this phase, problems related to the prototype are recognized and action plans are developed. At the implementation, these plans are implemented, and the consequences of the action are evaluated and reflected by asking other parties to use the bags for their daily routine activities. In this case, a school child who puts in her books and documents while another bag was used by a midwife who use the bag to put in her equipment when she goes to her clients' house for routine check.

The final phase was “documentation and reflection” where design principles are generated, and research papers was documented to provide guidance to encourage all public individuals who are interested in doing their own DIY bags from old files and other recycle materials.

Since design-based research is a multi-phase study, the present study involved the researchers, Office systems Management students, one school children, a product agent, and a midwife. In this study, researchers took the initiative and were involved from the beginning of the design process together as researchers, and as persons who do the bag according to these school children, a product agent, and a midwife.

Results and Discussion

Result 1 (Phase 1)

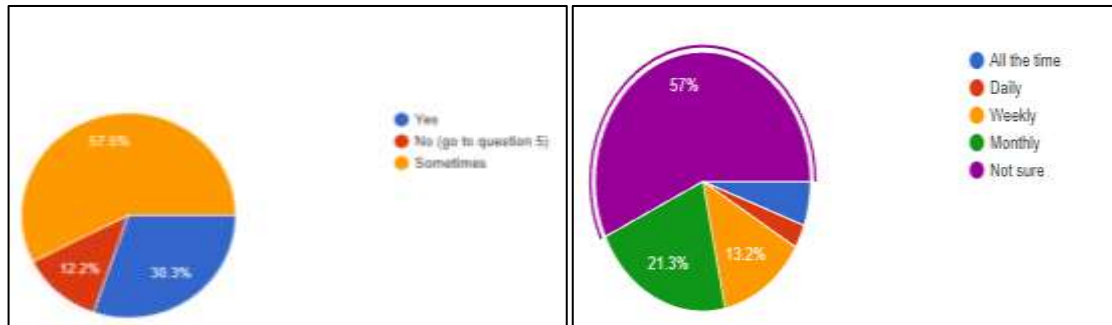


Figure 2: Recycle and how often recycle are conducted

Figure 2 shows that 57.5% of the respondents mentioned that they sometimes conduct a DIY project, but projects vary from one to another. However, 57% of the total respondents were not sure on how often they recycle.

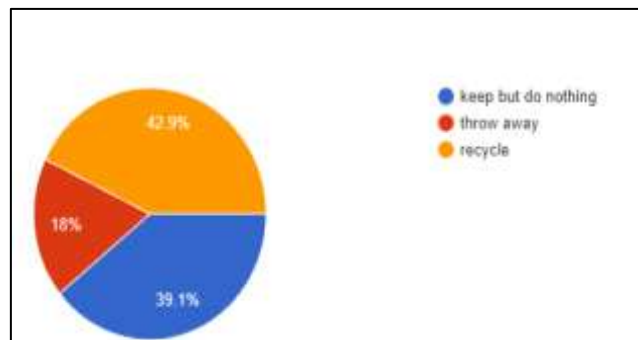


Figure 3: Broken and unused files

Figure 3 shows that 42.9% of the total respondents do recycle on their broken files and 39% kept their files but with no intention of doing anything with the files. In the meantime, 18% just threw it away when they do their sprint cleaning as they believed that the files have no use anymore when the files can no longer hold documents.

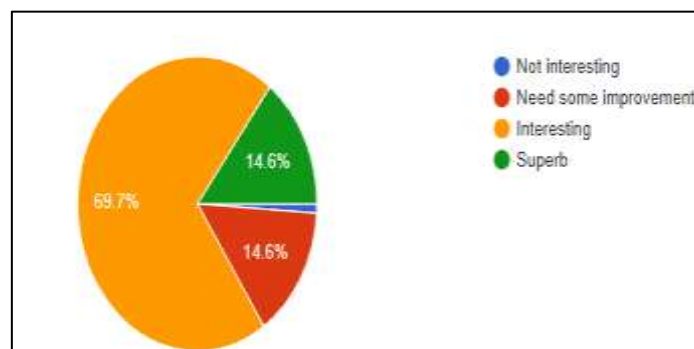


Figure 4: Responds on the D'Bag DIY efforts

Figure 4 shows the initial response of the respondents towards the new DIY product called D’Bag. It was found that 69.7% of the respondents thought that D’Bag is very interesting while 14.6% mentioned it as superb DIY project. However, another 14.6% stated that the DIY needs some improvement.

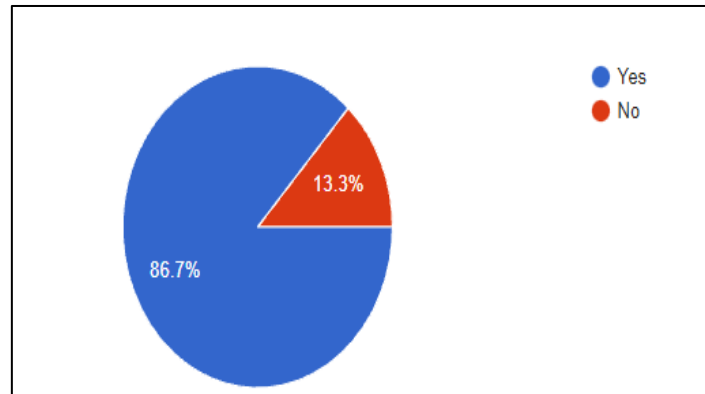


Figure 5: Awareness on working on DIY Projects

After seeing the picture of D’Bag, as shown in Figure 5, 86.7% of the respondents thinks that they would also do the similar DIY project and have much interested in doing so, while only 13.3% of the total respondents were not interested with the DIY efforts.

Result 2 (Phase 2,3,4)



Figure 6: Pictures of basic broken files with other recycled cloths glued together and other materials that could be creatively used to make a DIY Tote Bags



Figure 7: Pictures of complete simple D'Bags DIY Tote Bag



Figure 8: Pictures of a school teenager, a midwife and a product agent who are enjoying themselves using D'Bag in their daily commitments.

The feedback from D'Bag users suggests that the product is generally effective, useful for organizing their belongings, somewhat difficult to disassemble, convenient for storage, visually appealing, and engaging. It is important to exercise caution, as this preliminary study was limited to the staff and students of the Office Systems Management WhatsApp group at UiTM Melaka Branch. Nevertheless, from the researchers' perspective and the overall results of this study, it is essential to recognize that DIY projects can be enjoyable, and success depends on our commitment and creativity. It ultimately requires time and innovative thinking.

Limitation and Future Works

Although this D'Bag project was carried out to achieve its main objective of raising awareness and promoting recycling through simple DIY efforts, this study also has several limitations. Firstly, the number of respondents involved was from a small group, including UiTM Melaka staff, students, and personal acquaintances. The results of this indicate that the findings may not be fully representative of the public's views. Secondly, the feedback collected is based on personal opinions and experiences. No formal testing was conducted to measure the strength or practicality of the D'Bag in different situations. For future work, it would be useful to involve a larger and more diverse group of users, so that the results of the study are more

interesting. Further studies could also explore how this DIY project can be introduced in schools, communities, or recycling programs. One example: Adding waterproofing materials or testing with different types of recycled fabrics could also be considered to improve the product design. However, please be aware that the project could cost more if you were to use some extra new materials,

Conclusions

As a conclusion, it was determined that the design-based research, which emphasizes stakeholder engagement, was effective in the development of the D'Bag DIY. This effectiveness stemmed from the researchers' active participation throughout the entire process, as they collaborated to create the D'Bag from discarded and unused cardboard files. Despite the difficulties in ensuring that the bag remains both appealing and functional, the primary goal is to inspire and encourage others to embrace creativity and invest their time in DIY projects, particularly using broken and unused files they possess. The only shortcoming of this tote bag is a lack of water proofing when recycled cloths were used. Further design using recycled polyvinyl chloride (PVC) materials are taken into considerations. Often, we overlook the fact that these files are relatively inexpensive and easily replaceable; however, what is more crucial is our mindful approach to recycling to protect our planet. This conclusion aligns with the findings of Jamil et.al (2024) who conducted a study among six Malaysian universities extended the Theory of Planned Behavior (TPB) and found that attitude, recycling information, and personal norms significantly influenced recycling intention, and inline with Ali & Yusof (2018), who indicated that the consequences of green practices have a significant positive correlation with the intention to reduce, reuse, and recycle (3R), thereby positively influencing the intention to participate in recycling activities.

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