Developing a coffee tray made from coffee waste to enable carrying several cups at once

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As of January 1st, 2024, the government implemented measures to reduce single-use plastics, banning disposable cups (Netherlands Enterprise Agency, n.d.). This regulation has compelled companies, particularly those with large offices, to seek sustainable alternatives. Coffee Based, a company specializing in turning coffee waste into valuable products, offers reusable coffee cups in different sizes as a solution. However, these cups are incompatible with existing office coffee trays, preventing employees from conveniently carrying multiple cups.

While some customers have inquired about Coffee Based providing their own coffee trays, the demand thus far has not been sufficient to justify the development costs. However, with increasing interest from larger customers, Coffee Based would like to bring their own coffee trays to the market. The company commissioned this thesis with the main objective of designing a coffee tray using materials developed from coffee waste. Two potential material options, developed by Coffee Based, were explored: an injection-mouldable material, which requires a large investment but offers durability, and the Coffee Panel, a flexible sheet made from coffee waste with an MDF core, which lacks water resistance. The research focused on determining the feasibility of these materials and creating a tray design that complements Coffee Based's branding and aligns with its product range. The research question guiding this thesis is:

How can a sustainable and cost-effective coffee tray be designed that provides optimal user convenience in an office environment?

The approach combined research into ergonomics, material properties, and user needs, alongside iterative design and testing.

Results

A production-ready tray design was developed using the Coffee Panel. Additionally, three concept designs were created for potential production using Coffee Based's injection-mouldable material, which requires further testing and refinement. These designs emphasize functionality, eco-consciousness, and user-friendliness.

The final coffee tray design, made from Coffee Based's Coffee Panel materials, achieved several objectives but also revealed certain limitations. The tray successfully accommodates six cups of both Coffee Based's cup sizes and aligns with Coffee Based their branding and design style. It features two handles, allowing it to be carried with both hands. This ensures precision and control, minimizing the risk of spilling the drinks.



Figure1: Coffee tray made from the Coffee Panel

The entire tray is made from Coffee Based's Coffee Panel material, which was a challenge as it limited the use of additional materials, especially for the handles. Research into ergonomics revealed that, when carrying six cups, the tray becomes quite heavy and difficult to handle with one hand, which was one of the original requirements for improving user experience.

Despite this, the final design prioritizes aesthetic choices that align with Coffee Based's branding, which resulted in the tray being difficult to carry with one hand. This compromises the functionality, particularly in situations that require single-handed use, such as when opening a door.

While the material exceeded expectations in certain areas, it failed to meet some requirements identified through surveys and observations. For instance, the tray is not dishwasher-safe, which is quite a drawback, considering one of the clients who has requested these trays, will not purchase these trays if not dishwasher-safe.

Another limitation of the material is its susceptibility to staining and the expansion of the MDF core when exposed to liquids. Over time the tray's visual appearance will change. However, it is yet to determine the user's opinions on these stains. The sustainability might outweigh the aesthetics. Due to these limitations, three concepts were designed intended for injection moulding. An injection moulded design offers several advantages. It would enhance the durability of the tray, make it dishwasher-safe, and allow for the inclusion of a condiment compartment for items such as sugar and milk. Additionally, the design will feature custom-fitting elements to improve the stability of the cups, reducing the risk of spills.

The coffee panel material was used as it fulfils most of the important functionalities and can be produced right away. A Coffee tray produced with injection moulding takes much longer and Coffee Based wished to launch their own coffee tray as soon as possible on the market.

Conclusions & recommendations

In conclusion, the research question was addressed by delivering a functional and costeffective tray design that integrates well with Coffee Based's product range and branding. The Coffee Panel-based tray is market-ready and suitable for office environments. It is designed to be compact for easy storage and can carry up to six cups, accommodating varying diameters when the cups are slanted. Its eco-friendly design minimizes material usage per unit and generates minimal waste during production, making it a cost-effective solution.

To improve the tray, future work could explore a coating or alternative core materials other than MDF. However, the injection moulded design would solve these problems effectively.

References

Netherlands Enterprise Agency. (n.d.). Single-use plastics: These are the rules. Business.gov.nl. Retrieved October 7, 2024, from https://business.gov.nl/running-your business/environmental-impact/making-your-business-sustainable/single-use-plasticsthese are-the-rules/