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Comprehensive Analysis of the Co-Creation Effects in Mass Personalization Products

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Abstract

This study explored the impact of co-creation on customer preferences and satisfaction in the mass personalization products in Thailand. We used a regression model analysis on survey data collected from 387 participants to examine how customer involvement in the product design process affects their purchase decisions and satisfaction levels. The regression results indicate a significant positive relationship between the degree of co-creation factors and mass personalization. These findings underscore the importance of co-design, understanding customer needs, customer innovativeness, customer-centric approach, and resource integration, especially for businesses and marketers in the mass personalization. The results show that the co-design, customer innovativeness, and understanding customer needs are significantly predicted to the mass personalization marketing strategies. Nevertheless, the customer-centric approach and resource integration are not. The contribution in this research shows the strongly connection between co-creation and mass personalization.

Keywords: Mass Personalization, Co-creation, Customer Satisfaction

Introduction

In the evolving digital marketing landscape, mass personalization has emerged as a transformative strategy, particularly in the context of printing services. This approach, which seamlessly blends the benefits of mass production with the allure of individual customization, has revolutionized how printing services engage with and cater to their diverse clientele (Hakio & Mattelmäki, 2019). By harnessing the power of data analytics, machine learning, and innovative printing technologies, these providers can now offer highly personalized products that resonate more profoundly with each customer's unique

preferences and needs (Baye & Hasnas, 2017). As a result, customers are now allowed to use more than generic, one-size-fits-all printing options (Paritala et al., 2017). Instead, they can choose from a wide range of customizable features such as paper type, color schemes, and design elements, allowing them to create truly unique and personalized printed materials. This level of customization enhances the overall customer experience and enables printing services to differentiate themselves in a highly competitive market (Maciel & Fischer, 2020).

Mass personalization in printing services is a technological advancement and a customer-centric marketing revolution (Frank et al., 2020; Wind & Rangaswamy, 2001). This strategy pivots around understanding and anticipating customer preferences, leading to the creation of products that are not only relevant but also timely and context-specific (Qin & Lu, 2021). The quintessence of this approach lies in its ability to treat each customer as an individual with distinct tastes and requirements, moving away from the one-size-fits-all mentality that dominated traditional marketing paradigms (Zheng et al., 2017). By leveraging data analytics and advanced printing technologies, companies can now offer personalized products that cater to each customer's unique needs and desires. This enhances customer satisfaction, boosts brand loyalty, and drives business growth. Additionally, mass personalization in printing services opens up new opportunities for businesses to create innovative and creative marketing campaigns that resonate with their target audience on a deeper level (Uduwela et al., 2020).

The influencing factors of co-creation, such as customer-centric approach, co-design, customer innovativeness, resource integration, and understanding of customer needs, have been investigated from the various literature. Although these factors have also been explored in the theoretical discovery of mass personalization products, practical studies should be constructed primarily in the context of Thai customer characteristics.

This introduction sets the stage for a comprehensive exploration of mass personalization across the personalized services industry. It was studied in various facets, including the technological underpinnings that make mass personalization feasible, the strategic implications for marketing in the personalized at-scale industry, and real-world applications that highlight the efficacy of this approach. Furthermore, it underscores the challenges and opportunities of mass personalization, offering insights into how personalized service providers can navigate this new terrain to achieve a competitive advantage and foster deeper customer engagement. This study also examines the potential impact of mass personalization on customer satisfaction and loyalty, shedding light on the importance of customization in today's highly competitive market (Kennedy & Guzmán, 2016). Additionally, it discusses the ethical considerations surrounding mass personalization, such as data privacy and security concerns, emphasizing the need for responsible practices in implementing personalized printing services.

Literature review

Mass personalization

Mass Personalization is a trend that focuses on creating highly personalized commercial experiences for individual customers on a mass scale (Aheleroff et al., 2019). This involves using advanced analytics of customer data, such as geographic region and past customized purchases, to detect patterns and offer bespoke products and services. Personalization differs from customization, which involves customers choosing attributes or amenities. It aims to make users feel unique and valued. This trend is already evident in e-commerce, such as movie streaming services suggesting certain films based on selection history and fashion marketplaces suggesting styles based on age and gender (Collier & Bienstock, 2006). As 71% of online shoppers expect personalized interactions, businesses increasingly incorporate AI and big data analytics to fine-tune these personalized journeys (Tran et al., 2022). The logistics industry also adapts to this B2C consumer expectation, with supply chain leaders focusing on data utilization to improve customer experience (Kumar, 2007).

The trend of Mass Personalization has a relatively low impact on the logistics industry, with limited application in B2B logistics relationships (Martínez-Caro et al., 2020). Supply chains should be able to adapt to handle more customized products, and overall operational changes for logistics providers are expected to be smooth. However, offering the proper logistics services to companies with complex product portfolios will be crucial to stay relevant for specific customers (Tiihonen & Felfernig, 2017). The trend is expected to be realized within five years, with significant progress in personalization algorithms and customer experiences (Gale et al., 2021).

In today's fast-paced world, businesses constantly seek innovative ways to engage with their customers and create personalized experiences. One such strategy gaining popularity is mass personalization through co-creation, where customers actively participate in the design and customization process of products and services. This collaborative approach enhances customer satisfaction and enables businesses to tap into valuable insights and ideas from their target audience, ultimately leading to higher success and profitability (Gale et al., 2021). By involving customers in the co-creation process, companies can better understand their needs and preferences, allowing them to tailor their offerings to meet those demands (Tseng et al., 2010). Additionally, this approach fosters a sense of ownership and loyalty among customers, as they feel invested in the final product or service. Ultimately, mass personalization through co-creation has the potential to revolutionize traditional business models and drive long-term growth (Gale et al., 2021).

Co-creation

The co-creation process is used in various domains and marketing strategies, especially in modern marketing that requires customer collaboration (Abeza et al., 2020; Kristensson et al., 2008). This co-creation approach allows companies to involve customers in the product development process, resulting in more innovative and customer-centric solutions. It also helps build stronger relationships with customers by fostering a sense of ownership and loyalty towards the brand.

Research indicates that co-creation is seen as both a method and a procedure involving various stakeholders at different stages of innovation or as a component of organizational decision-making. Co-creation allows for the integration of diverse perspectives and expertise, leading to more innovative and effective solutions (Shi et al., 2020). It fosters collaboration and engagement among stakeholders, ultimately resulting in products or services that better meet the needs of end-users.

Furthermore, co-creation is examined within the service innovation framework, enabling tailored and individualized services by incorporating client input (Abeza et al., 2020). This approach fosters a deeper connection between the service provider and the client, leading to increased customer satisfaction and loyalty. It also allows for more innovative solutions to be developed that better meet the unique needs of each individual customer (Schiavone et al., 2020).

The influencing factors such as, customer-centric approach, co-design, understanding customer need, resource integration, and customer innovativeness, are strongly related to co-creation for personalized products as scales. First, a customer-centric approach enhances customer experience, loyalty, and advocacy by collecting data, understanding behavior, formulating strategies, and fostering a customer-first mindset across all business levels. Second, co-design involves all stakeholders in the design process, ensuring product alignment, functionality, and user experience, benefiting various domains like product development, software design, and healthcare. Third, customer innovativeness helps businesses identify early adopters of new offerings, providing valuable feedback and accelerating market acceptance. Tailoring marketing and engagement strategies to meet these segments' needs is crucial. Next is to understand the customer's needs, one must understand their requirements, preferences, and motivations. Businesses must provide goods that address issues, meet needs, and increase contentment. Essential elements include empathy, research, segmentation, feedback loop, customer journey mapping, and predictive analysis. This continuous procedure guarantees pertinence, allegiance, and expansion of the firm. Finally, resource integration in co-creation comprises blending resources from several stakeholders to generate value cooperatively. The main components include a varied resource pool, engaged stakeholder cooperation, value generation, interactive procedures, customization, and knowledge acquisition. By matching products with stakeholder requirements, this method encourages innovation, consumer happiness, and competitive advantages.

Co-design (CD)

Co-creation is vital to successful product development, and co-design plays a critical role in this process. Co-design involves the collaboration of various stakeholders, including designers, engineers, and end-users, who collectively contribute their expertise and insights to product development. This approach ensures that the final product

meets the requirements and preferences of all parties involved, resulting in a more prosperous and marketable outcome. Moreover, co-design fosters a sense of ownership and engagement among stakeholders, leading to increased innovation and creativity throughout the co-creation process. Co-design is an inclusive process that allows diverse perspectives to be incorporated into the outcome, leading to the mass personalization of products that better meet individual consumers' unique needs and preferences.

The utilization of co-design techniques to achieve mass personalization is a significant milestone in the product development process. Personalized products, created better to meet individual consumers' needs and preferences, are fast becoming the preferred experience for customers, leading to increased customer satisfaction and loyalty. Co-design enables a collaborative approach between designers and consumers, resulting in a better understanding of consumer needs and preferences. This approach enhances the overall quality of the final product and fosters a sense of ownership and satisfaction among consumers (Carvalho & Alves, 2023).

By involving consumers in the design process, companies can gain valuable insights and feedback that can lead to continuous improvement and innovation. This feedback can help companies fine-tune their products to meet customer needs and preferences better, resulting in higher customer satisfaction and loyalty. Moreover, co-design allows personalized products at scale to be produced more efficiently and effectively, leading to better customer experiences and increased profitability. Co-design is a critical factor in successful product development, and its benefits are becoming increasingly evident in today's market.

Therefore, the first hypothesis is as follows.

H1: Co-design positively affects the mass personalization.

Customer innovativeness (CIN)

Customer innovativeness in the context of co-creation for mass personalization products refers to the tendency of customers to actively engage in innovative activities and contribute novel ideas during the co-creation process. This concept recognizes customers as consumers of products and as valuable sources of innovative ideas and solutions. Innovative customers actively participate in co-creation, seeking new and unique experiences or products. They contribute their ideas, preferences, and feedback, leading to the development of new product features, designs, or functionalities. Collaborative efforts involve interaction between customers and the company, sharing knowledge, ideas, and expertise. Engaging innovative customers can provide significant benefits for businesses, as they provide fresh perspectives and ideas, leading to more creative and successful products. In addition, involving innovative customers in the co-creation process can also foster a sense of loyalty and brand advocacy. When customers feel valued and heard, they are likelier to become loyal advocates for the company and its products, spreading positive word-of-mouth and attracting new customers. Furthermore, by actively engaging with innovative customers, businesses can stay

ahead of their competitors by constantly evolving and adapting their products to meet their target market's changing needs and preferences. Moreover, it can enhance customer satisfaction and loyalty (Escobar-Rodríguez & Carvajal-Trujillo, 2014).

Technology, such as online platforms, social media, and data analytics, can facilitate the involvement of innovative customers in the co-creation process, making it easier to gather ideas, feedback, and preferences from a wide range of customers. This approach can enhance customer satisfaction and loyalty, ultimately benefiting businesses.

As described above, the customer innovativeness in the context of co-creation for mass personalization goods involves utilizing consumers' creativity and ideas to improve and advance the product development process. This strategy recognizes the importance of client involvement in developing a more comprehensive range of innovative and customized products (Zhang et al., 2023).

Therefore, the second hypothesis is as follows.

H2: Customer innovativeness positively affects the mass personalization.

Customer-centric approach (CCA)

A customer-centric approach in co-creation for mass personalization products refers to a business strategy that places the customer at the center of the product design and development process (Lacroix et al., 2021). This approach emphasizes the active involvement of customers in creating personalized products that meet their specific needs and preferences (Papachristou et al., 2022). A customer-centric approach to product creation involves active customer involvement, personalization, feedback, and iteration. This approach differs from mass production, where standardized products are created for a broad audience. Feedback and iteration are crucial in refining products to align with customer desires. This approach fosters a deeper relationship between the customer and the company, fostering loyalty and a sense of ownership. Technology, such as digital platforms, AI, and data analytics, can help understand customer preferences and create personalized experiences. By adopting this approach, businesses can increase customer satisfaction and loyalty, differentiate their products, and potentially command higher prices due to the added value of personalization.

Finally, a customer-centric approach in co-creation for mass personalization involves actively involving customers in the product development process to create personalized products that better meet their needs and preferences. This strategy enhances customer satisfaction and gives businesses a competitive edge by offering unique, tailored experiences. By understanding and catering to individual customer preferences, businesses can build stronger customer relationships and foster brand loyalty. Additionally, this approach allows businesses to stay ahead of their competitors by constantly adapting and improving their products based on customer feedback and insights.

Therefore, the third hypothesis is as follows.

H3: Customer-centric approach positively affects the mass personalization.

Understanding customer needs (UCN)

Customer needs analysis in co-creation for mass personalization products involves thoroughly identifying and interpreting customers' distinct requirements, preferences, and expectations to collaboratively develop products customized to their desires. This idea is an essential element of the co-creation process since it directly impacts the efficacy with which a customized product fulfills the distinct requirements of individual customers. The product creation process encompasses several stages, such as gaining a profound understanding of consumer needs, actively involving customers, establishing feedback mechanisms, utilizing data and analytics, demonstrating empathy and considering the customer's perspective, offering customization and personalization choices, and engaging in iterative development. Deep customer insight entails comprehending consumers' wishes, grievances, inclinations, and anticipations, encompassing not just their product choices but also the underlying motivations and intended usage (Pallant et al., 2020). Active consumer involvement entails collecting qualitative data through various means such as surveys, interviews, focus groups, or interactive web platforms. Feedback loops enable consumers to offer ongoing input throughout the product development process, enhancing the product to align with their requirements. Data analytics solutions are employed to accurately understand client data, encompassing shopping trends, internet behavior, and interactions on social media platforms. Empathy and customer perspective entail adopting the client's point of view in order to comprehend their experiences and ascertain how the product might enhance their lives. Customers can customize and personalize the product to meet their requirements.

Within the co-creation framework for mass personalization products, comprehending customer needs extends beyond mere responsiveness to explicit desires. It entails foresight in anticipating needs, recognizing the subtleties of customer preferences, and creating a product that deeply connects with each customer individually. This profound degree of comprehension is essential for the achievement of collaboratively developed, customized goods.

Therefore, the fourth hypothesis is as follows.

H4: Understanding customer needs positively affects the mass personalization.

Resource integration (RI)

Resource integration in the context of co-creation for mass personalization goods involves efficiently combining and utilizing diverse resources, including talents, knowledge, technology, and other assets, to develop customized products (Frow et al., 2015). In this cooperative methodology, the firm and the customers pool their resources to create a product that closely corresponds to their specific requirements and preferences (Maddikunta et al., 2022). Resource integration in co-creation entails amalgamating heterogeneous resources

from several stakeholders, including enterprises, customers, and technology. This approach emphasizes the utilization of client inputs, insights, ideas, and feedback to influence the development of the final product (Barile et al., 2020). Advanced technologies like artificial intelligence (AI), data analytics, and digital platforms enable the integration of resources by collecting, analyzing, and utilizing consumer data. The objective is to generate reciprocal value, wherein customers derive advantages from customized goods, and enterprises attain heightened customer pleasure and loyalty. A climate encouraging collaboration, focusing on transparent communication, shared objectives, and reciprocal regard, is crucial for successful co-creation. Resource integration in co-creation differs from traditional product development in that it is a continuous process that involves continual involvement with consumers at every stage of the product development cycle, from generating ideas to delivering the completed product. This strategy guarantees that the result satisfies customers' and enterprises' requirements and anticipations.

Resource integration, under the framework of co-creation for mass personalized goods, is a collaborative and dynamic process involving the pooling of resources from the organization and its consumers. It involves utilizing the company's technical and professional knowledge alongside the client's insights and preferences to develop a product specifically tailored to each consumer.

Therefore, the fifth hypothesis is as follows.

H5: Resource integration positively affects the mass personalization.

Methodology

The quantitative research method was used for this study. This study employed descriptive statistics and a multiple regression model to test our hypotheses. The mean, standard deviation, and frequency are selected as analytical tools for descriptive statistics, which present the characteristics of respondents. The relationships between co-design, customer innovativeness, a customer-centric approach, resource integration, and understanding customer needs with the mass personalization variable. The details of the methods to be analyzed are as follows.

Data and sample

The study collects the opinions of Thai people who the interesting or purchased mass personalization products. We collect data through an online questionnaire using Microsoft Forms. The selected 387 participants who completed replied to the questionnaires and qualified profiles to be analyzed. The literature on Hair in 2014 (Hair Jr et al., 2014) specified a minimum sample size of 60 for the regression research (ten times the largest number of formative indicators: 10x6). All 387 participants successfully tested the hypothesis.

Research instrument

The online questionnaire in this study can be separated into 3 parts: Section 1 – The general information of the participants, Section 2 – The general knowledge about the variables in this study, and Section 3 –

The opinions of the participants about the relative variables in this study. The items used in Section 3 questionnaire were constructed as the 7-Likert scale (1 = strongly disagree to 7 = strongly agree). The questions in questionnaire were developed from the previous reviews' literature and translated to Thai language. The questionnaire underwent a rigorous evaluation to ensure its measurement precision and content validity, focusing on the Index of Item Objective Congruence (IOC). A team of three experts conducted the assessment, ensuring the accuracy and validity of the constructs. Due to the large sample size, the reliability of each construct was assessed. The evaluation revealed that each construct had a reliability coefficient higher than the minimum criterion of 0.7, confirming their suitability for analysis and measurement in this research. Precise data from the expert's item analysis was obtained to calculate the IOC value. However, a simulated IOC value was generated using customary academic criteria, typically falling between -1 to +1. In this academic context, the simulated IOC score was 0.87, indicating a strong consensus among experts regarding the importance and clarity of the questionnaire items about their intended objectives. This further confirms the content validity of the instrument for this study. The elements abbreviation summary and examples of the question items can be detailed in Table 1.

Conceptual framework

Based on the concepts discussed in the previous section, we developed a conceptual framework to identify the factors leading to the Mass personalization from the Co-creation influencing factors (Figure 1).

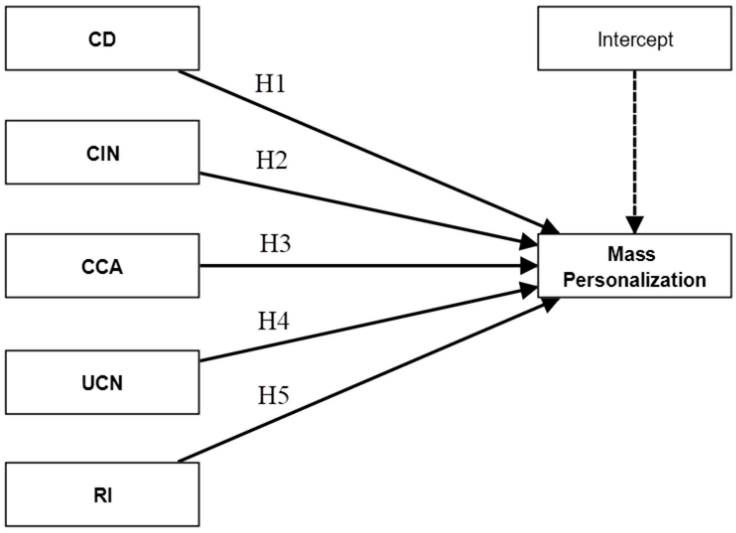

Figure 1 Conceptual framework of the study

Result and discussion

We performed the description of the data and analysis of correlation, as shown in Table 2. The average of co-design, customer innovativeness, customer-centric approach, understanding customer needs, mass personalization, and resource integration are 5.747, 5.835, 5.822, 5.825, 5.675, and 5.778, consequently. Moreover, the correlation analysis of mass personalization through the another variables show the value between 0.810 – 0.852, which the maximum value be understanding customer needs factor. In addition, we performs the data analysis using linear regression model. The model summary in Table 3 was shown the determination of goodness of the model. Our adjusted R-square value is 0.768, which means that 76.8% of the mass personalization is explained by the five independent variables in the good results. The F change = 256.833 and p-value <0.005, is indicating that regression model if good fit. Moreover, the hypotheses testing was conducted to consider whether the relationships proposed in our model are significant, as shown in Table 4. These results shown that the H1, H2, and H4 hypotheses are accepted. Co-design, Customer innovativeness, and Understanding customer needs, significantly influence the mass personalization, while Customer-centric approach and Resource integration do not. Finally, Table 5 revealed the reliability and validity of the factors and question items. The values of Cronbach's alfa are between 0.934 – 0.946 which encouraged by the minimum requirements (>0.7) of Cronbach alfa value.

Discussion

The co-design is a significant predictor of mass personalization products. This result consistently related with previous literature (Turner et al., 2020) which offered the co-design phase to the mass customization. The mass personalization become the higher-level of customized products and at scale.

Particularly in customer innovativeness factor, the significant predictor was shown the relationship between them. The mass personalized products required the more innovative preference from the customer to design the personalized products and mass production (Kumar, 2007).

Finally, Understanding customer needs is parallelly related to the mass personalization with statistically significant. This surprising result come to basic concepts of the marketing strategies. the needs of the customer with understanding embedded the strongly connected with the mass personalization paradigm (Katoozian & Zanjani, 2022). The customer must be defined the requirements of the uniqueness preferences. The firms should be gathering the needs and segmented into the categories.

Conclusion

Practical implications

The mass personalization marketing strategies has become the new challenge.

Predictions show that opportunities in this industry are growing and making it more attractive. The perception of the customer in the context of mass customization and mass personalization are similarity. Nevertheless, the co-creation affecting factors, such as, co-design, customer innovativeness, and understanding customer needs, can boost the attractiveness of the mass personalization products with the strong predictor. Moreover, the customer-centric approach and resource integration are not significantly to the target variable. It cannot be affected enough to indicate the personalized levels of the product. The integration of resources is only operated internal management of the company. The current study found that co-design factor is one main driver of mass personalization product. The finding is in line with that of Hsiao and Chiu in 2014, Kumar in 2007, and Zheng et al. in 2017 (Hsiao & Chiu, 2014; Kumar, 2007; Zheng et al., 2017) of co-design supporting the mass personalization marketing strategies. Moreover, the customer innovativeness also has been the moderating factor for mass personalization which found in Mourtzis in 2022, Wang et al. in 2017, and Zheng et al. in 2017 (Mourtzis, 2022; Wang et al., 2017; Zheng et al., 2017). Finally, the positive effective factor of understanding customer needs for mass personalization is supported by Hyun et al. in 2022, Katoozian and Zanjani in 2022, and Merle et al. in 2010 (Hyun et al., 2022; Katoozian & Zanjani, 2022; Merle et al., 2010).

The interconnection between co-design and mass personalization is deeply intertwined with the progression of Industry 4.0 and digital technologies, highlighting the criticality of internal and external integrations alongside technological preparedness for practical customization efforts (Wang et al., 2017; Weller et al., 2015). However, existing literature reveals gaps, particularly the underexplored influence of internal and external factors on co-design and mass personalization within the Industry 4.0 framework, suggesting areas for further research.

The relationship between customer innovativeness and mass personalization has been a topic of interest in product innovation and customer loyalty (Kumar, 2007). Studies have shown that knowing what customers like and how they behave influences their loyalty (Mittal et al., 2023). Businesses are advised to add creative elements to their offerings to keep customers interested and loyal. In 2010, Lau, Tang, and Yam studied how working closely with suppliers and customers affects product innovation and performance in Hong Kong manufacturing companies (Lau et al., 2010). They found evidence that collaborating with customers positively influences product innovation and performance. The existing literature provides valuable insights into the implications of customer innovativeness and its relationship with product innovation and customer loyalty. Nevertheless, there are still gaps in knowledge that require more investigation. Future research could

investigate the specific mechanisms through which customer innovativeness influences the adoption and success of mass personalization strategies in businesses. Furthermore, examining how technology and online platforms support customized experiences for customers based on their innovative preferences could provide valuable insights for businesses in the digital era.

Understanding customer needs is fundamental to mass personalization, as it enables businesses to tailor products and services to individual preferences, enhancing customer satisfaction and loyalty (Tseng et al., 2010). The relationship between these concepts suggests that a deep comprehension of customer desires not only informs the personalization process but also drives innovation in product development and service delivery, ultimately contributing to a competitive advantage in today's market (Zhou et al., 2009). Effective mass personalization, therefore, relies on an enhanced mechanism for capturing and analyzing customer insights, ensuring that products and services remain closely aligned with evolving consumer expectations.

Nevertheless, unsupported correlation between a customer-centric approach strategy and mass personalization suggests that adopting a business model centered on comprehending and satisfying individual customer requirements does not inherently improve the capacity to provide personalized products and services on a large scale (Wind & Rangaswamy, 2001; Zendoia et al., 2013). These findings indicate that additional elements, such as technology capabilities or operational tactics, may have a more significant impact on attaining effective mass personalization. Thus, business enterprises should contemplate adopting a comprehensive strategy encompassing several aspects, such as customer-centricity, to customize their products or services proficiently.

Lastly, the absence of a correlation between resource integration and mass personalization implies that a company's capacity to personalize its products for individual consumers is independent of how it integrates its resources. This finding suggests that various aspects, including technology, market understanding, and customer engagement tactics, are crucial in attaining successful mass personalization and resource integration (Kumar, 2007). This research presents a counterargument to the prevailing belief that internal resource management directly influences personalization capabilities. It emphasizes the need for a more comprehensive perspective to comprehend the factors driving mass personalization (Aheleroff et al., 2021).

Limitations and recommendations for future research

Our study has several limitations, and we propose several future research agendas. The first limitation of this study is its methodology. Although we already started from exploratory research to obtain the factors and validate them through nationwide quantitative surveys,

the study of customer experience might be more captivating using an experimental approach in collecting data. Moreover, the mass personalization products have been the new marketing strategy in Thailand. Increased levels of perception of the customer should be selected to raise awareness in future research.

References

Abeza, G., O'Reilly, N., Finch, D., Séguin, B., & Nadeau, J. (2020). The role of social media in the co-creation of value in relationship marketing: a multi-domain study. *Journal of Strategic Marketing*, *28*(6), 472–493.

Aheleroff, S., Mostashiri, N., Xu, X., & Zhong, R. Y. (2021). Mass Personalisation as a Service in Industry 4.0: A Resilient Response Case Study. *Advanced Engineering Informatics*, *50*.

Aheleroff, S., Philip, R., Zhong, R. Y., & Xu, X. (2019). The degree of mass personalisation under industry 4.0. *Procedia CIRP*, *81*, 1394–1399.

Barile, S., Grimaldi, M., Loia, F., & Sirianni, C. A. (2020). Technology, value co-creation and innovation in service ecosystems: Toward sustainable co-innovation. *Sustainability (Switzerland)*, *12*(7).

Baye, I., & Hasnas, I. (2017). Consumer flexibility, data quality and location choice. *Journal of Economics/ Zeitschrift Fur Nationalokonomie*, *120*(2), 135–169.

Carvalho, P., & Alves, H. (2023). Customer value co-creation in the hospitality and tourism industry: a systematic literature review. *International Journal of Contemporary Hospitality Management*, *35*(1), 250–273.

Collier, J. E., & Bienstock, C. C. (2006). Measuring service quality in E-retailing. *Journal of Service Research*, *8*(3), 260–275.

Escobar-Rodríguez, T., & Carvajal-Trujillo, E. (2014). Online purchasing tickets for low cost carriers: An application of the unified theory of acceptance and use of technology (UTAUT) model. *Tourism Management*, *43*, 70–88.

Frank, L., Poll, R., Röglinger, M., & Rupprecht, R. (2020). Design heuristics for customer-centric business processes. *Business Process Management Journal*, *26*(6), 1283–1305.

Frow, P., Nenonen, S., Payne, A., & Storbacka, K. (2015). Managing Co-creation Design: A Strategic Approach to Innovation. *British Journal of Management*, *26*(3), 463–483. https://doi.org/10.1111/1467-8551.12087

Gale, C., Zhang, G., & Shi, Y. (2021). Co-design: a novel approach to create value-added products in the creative fashion industry. *Journal of Textile Engineering & Fashion Technology*, *7*(4), 134–141. https://doi.org/10.15406/jteft.2021.07.00280

Hair Jr, J. F., Sarstedt, M., Hopkins, L., & Kuppelwieser, V. G. (2014). Partial least squares structural equation modeling (PLS-SEM): An emerging tool in business research. *European Business Review*, *26*(2), 106–121.

Hakio, K., & Mattelmäki, T. (2019). Future skills of design for sustainability: An awareness-based co-creation approach. *Sustainability (Switzerland)*, *11*(19).

Hsiao, W. P., & Chiu, M. C. (2014). A mass personalization methodology based on co-creation. *Advances in Transdisciplinary Engineering*, 698–705.

Hyun, Y., Hlee, S., Park, J., & Chang, Y. (2022). Discovering meaningful engagement through interaction between customers and service robots. *The Service Industries Journal*, *42*(13–14), 973–1000.

Katoozian, H., & Zanjani, M. K. (2022). Supply network design for mass personalization in Industry 4.0 era. *International Journal of Production Economics*, *244*(June 2021), 108349.

Kennedy, E., & Guzmán, F. (2016). Co-creation of brand identities: consumer and industry influence and motivations. *Journal of Consumer Marketing*, *33*(5), 313–323.

Kristensson, P., Matthing, J., & Johansson, N. (2008). Key strategies for the successful involvement of customers in the co-creation of new technology-based services. *International Journal of Service Industry Management*, *19*(4), 474–491.

Kumar, A. (2007). From mass customization to mass personalization: A strategic transformation. *International Journal of Flexible Manufacturing Systems*, *19*(4), 533–547.

Lacroix, R., Seifert, R. W., & Timonina-Farkas, A. (2021). Benefiting from additive manufacturing for mass customization across the product life cycle. *Operations Research Perspectives*, *8*.

Lau, A. K. W., Yam, R. C. M., & Tang, E. P. Y. (2010). Supply chain integration and product modularity. *International Journal of Operations & Production Management*, *30*(1), 20–56.

Maciel, A. F., & Fischer, E. (2020). Collaborative Market Driving: How Peer Firms Can Develop Markets Through Collective Action. *Journal of Marketing*, *84*(5), 41–59.

Maddikunta, P. K. R., Pham, Q. V., B, P., Deepa, N., Dev, K., Gadekallu, T. R., Ruby, R., & Liyanage, M. (2022). Industry 5.0: A survey on enabling technologies and potential applications. In *Journal of Industrial Information Integration* (Vol. 26). Elsevier B.V.

Martínez-Caro, E., Cepeda-Carrión, G., Cegarra-Navarro, J. G., & Garcia-Perez, A. (2020). The effect of information technology assimilation on firm performance in B2B scenarios. *Industrial Management and Data Systems*, *120*(12), 2269–2296.

Merle, A., Chandon, J.-L., Roux, E., & Alizon, F. (2010). Perceived Value of the Mass-Customized Product and Mass Customization Experience for Individual

Consumers. *Production and Operations Management*, *19*(5), 503–514.

Mittal, V., Han, K., Frennea, C., Blut, M., Shaik, M., Bosukonda, N., & Sridhar, S. (2023). Customer satisfaction, loyalty behaviors, and firm financial performance: what 40 years of research tells us. *Marketing Letters*, *0123456789*.

Mourtzis, D. (2022). Chapter 4 - The mass personalization of global networks. In D. Mourtzis (Ed.), *Design and Operation of Production Networks for Mass Personalization in the Era of Cloud Technology* (pp. 79–116). Elsevier.

Pallant, J. L., Sands, S., & Karpen, I. O. (2020). The 4Cs of mass customization in service industries: a customer lens. *Journal of Services Marketing*, *34*(4), 499–511.

Papachristou, E., Dimou, Z., Grammatikopoulou, M., Mpaltadoros, L., & Stavropoulos, T. G. (2022). *Personalized Fashion On-Demand and e-Fashion Business Models: A User Survey in Greece BT - Advances in Product Design Engineering* (P. Kyratsis, N. Efkolidis, & J. P. Davim (eds.); pp. 83–103). Springer International Publishing.

Paritala, P. K., Manchikatla, S., & Yarlagadda, P. K. D. V. (2017). Digital Manufacturing-Applications Past, Current, and Future Trends. *Procedia Engineering*, *174*, 982–991.

Qin, Z., & Lu, Y. (2021). Self-organizing manufacturing network: A paradigm towards smart manufacturing in mass personalization. In *Journal of Manufacturing Systems* (Vol. 60, pp. 35–47). Elsevier B.V.

Schiavone, F., Leone, D., Sorrentino, A., & Scaletti, A. (2020). Re-designing the service experience in the value co-creation process: an exploratory study of a healthcare network. *Business Process Management Journal*, *26*(4), 889–908.

Shi, X., Li, G., Dong, C., & Yang, Y. (2020). Value co-creation behavior in green supply chains: An empirical study. *Energies*, *13*(15).

Tiihonen, J., & Felfernig, A. (2017). An introduction to personalization and mass customization. *Journal of Intelligent Information Systems*, *49*(1), 1–7. https://doi.org/10.1007/s10844-017-0465-4

Tran, T., Taylor, D. G., & Wen, C. (2022). Value co-creation through branded apps: enhancing perceived quality and brand loyalty. *Journal of Research in Interactive Marketing*, 1–19.

Tseng, M. M., Jiao, R. J., & Wang, C. (2010). Design for mass personalization. *CIRP Annals - Manufacturing Technology*, *59*(1), 175–178.

Turner, F., Merle, A., & Gotteland, D. (2020). Enhancing consumer value of the co-design experience in mass customization. *Journal of Business Research*, *117*, 473–483.

Uduwela, W. C., De Silva, R. K. J., Rupasinghe, T. D., Silva, R. K. J. De, & Rupasinghe, T. D. (2020). Digital transformations in the apparel value chain for mass personalization. *IEEE International Conference on Industrial Engineering and Engineering Management*, 450–454.

Wang, Y., Ma, H. S., Yang, J. H., & Wang, K. S. (2017). Industry 4.0: a way from mass customization to mass personalization production. *Advances in Manufacturing*, *5*(4), 311–320.

Weller, C., Kleer, R., & Piller, F. T. (2015). Economic implications of 3D printing: Market structure models in light of additive manufacturing revisited. *International Journal of Production Economics*, *164*, 43–56.

Wind, J., & Rangaswamy, A. (2001). Customerization: The next revolution in mass customization. *Journal of Interactive Marketing*, *15*(1), 13–32.

Zendoia, J., Zapp, M., Agyapong-Kodua, K., Lohse, N., & Singh, M. (2013). Fundamentals of a co-design methodology for improving the performance of machine tools based on semantic representation. *International Journal of Computer Integrated Manufacturing*, *26*(8), 751–761.

Zhang, X., Ming, X., & Bao, Y. (2023). Online merchant resource allocation and matching for open community collaborative manufacturing (OCCM) in mass personalization model. *Advanced Engineering Informatics*, *55*.

Zheng, P., Yu, S., Wang, Y., Zhong, R. Y., & Xu, X. (2017). User-experience Based Product Development for Mass Personalization: A Case Study. *Procedia CIRP*, *63*, 2–7.

Zhou, K. Z., Brown, J. R., & Dev, C. S. (2009). Market orientation, competitive advantage, and performance: A demand-based perspective. *Journal of Business Research*, *62*(11), 1063–1070.

Table 1 Abbreviations of the elements and their question items

Attributes	Abbr	Question Items
Customer-Centric Approach (CCA)	CCA1	You were satisfied with Mass personalization brands should be focused on the customer needs and creativity from the customers as the primary focus on the business driven.
	CCA2	You satisfied the product's brand that generated a better experience for the customer.
	CCA3	You admit that value co-creation increases the brand's value perceptions and provides a valuable new outlook for the customer.
Co-design (CD)	CD1	You are satisfied that we have the chance to engage co-creation to the Mass personalization product.
	CD2	You admit that the co-design product of customers and the company becomes the new creativity product.
	CD3	The co-design products are the product that you preferred to purchase.
Customer Innovativeness (CIA)	CIN1	You prefer product brands with co-creation activities that offer modern product innovation.
	CIN2	You admit that customer innovativeness will boost the creativity of the product.
	CIN3	You trust in the cooperation of the product's brand and customer to increase the quality of the product.
Resource Integration (RI)	RI1	You are satisfied to express the co-creativity opinions with the company, which has adaptability in resource materials for product brands.
	RI2	You were satisfied that your creativity opinions are fully responded from the resource optimization in production process of the company.
	RI3	You trust in creativity products that came from the company which provided the optimized materials in mass personalization products.
Understanding Customer Needs (UCN)	UCN1	You satisfied the product brands which collected the customer needs of the customers.
	UCN2	You satisfied to attend the co-creation opinions for the product with the company.
	UCN3	You were satisfied with the co-creation process assists the product's brand to understand the customer needs increasingly.

Table 2 Descriptive and correlation analysis

	Mean	SD	Co-design	Customer Innovativeness	Customer-centric Approach	Understanding Customer Needs	Mass Personalization	Resource Integration
Co-design	5.747	0.960	1.000					
Customer Innovativeness	5.835	0.922	0.859	1.000				
Customer-centric Approach	5.822	0.933	0.864	0.896	1.000			
Understanding Customer Needs	5.825	0.960	0.862	0.920	0.920	1.000		
Mass Personalization	5.675	0.874	0.821	0.849	0.829	0.852	1.000	
Resource Integration	5.778	0.880	0.843	0.907	0.855	0.858	0.810	1.000

Table 3 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df 1	df2	Sig. F Change	
1	.878[a]	0.771	0.768	0.4215344	0.771	256.833	5	381	0.000	1.681

a. Predictors: (Constant), Resource Integration, Co-design, Customer-centric approach, Understanding customer needs, Customer Innovativeness
b. Dependent Variable: Mass Personalization

Table 4 Hypothesis result

H	Hypothesis	Coefficients	*p*-value	Significant
H1	Co-design → Mass Personalization	0.220	0.000***	Accepted
H2	Customer Innovativeness → Mass Personalization	0.244	0.005***	Accepted
H3	Customer-centric Approach → Mass Personalization	0.078	0.212	Rejected
H4	Understanding Customer Needs → Mass Personalization	0.290	0.000***	Accepted
H5	Resource Integration → Mass Personalization	0.088	0.132	Rejected

Table 5 Reliability and validity

Construct	Indicator	Cronbach's alfa	R-Statistics
Customer-centric Approach	CCA1	0.946	0.707
	CCA2		0.656
	CCA3		0.671
Co-design	CD1	0.934	0.656
	CD2		0.708
	CD3		0.711
Customer Innovativeness	CIN1	0.952	0.712
	CIN2		0.698
	CIN3		0.649
Resource Integration	RI1	0.939	0.624
	RI2		0.599
	RI3		0.654
Understanding Customer Needs	UCN1	0.949	0.729
	UCN2		0.719
	UCN3		0.703