

# DECOUPLING THROUGH CIRCULARITY: A CROSS-COUNTRY ANALYSIS OF LOCALIZATION OPPORTUNITIES FOR REFURBISHED MOBILE PHONES IN SOUTHEAST ASIA

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## **Abstract**

**Purpose:** This paper explores the consumer perception of remanufactured products in three different Southeast Asian countries to investigate the potential of such circular strategies for localization to decouple the local markets from global supply chain strategies.

**Design/methodology/approach:** This paper uses survey research as the key method. A large amount of survey data has been collected in the relevant markets and has been analyzed using a multinomial logistic regression model.

**Findings:** Results are showing similarities between the data from the analyzed countries, such as a high level of price sensitivity and concerns about the battery life. Prior knowledge of remanufacturing strategies has a positive impact on the willingness to opt for such products. Besides the similarities, differences have also been identified, such as a strong behavioral tendency to keep used products in Cambodia, a high level of demand for sufficient information in Thailand, and a high eco-consciousness in Vietnam.

**Research limitations/implications:** This research has local limitations on the three defined markets, as well as product-related limitations on mobile phones. Future research should extend this research to additional ASEAN countries and other product groups.

**Practical implications:** Based on these findings, recommendations on governmental strategies, communication actions, and tailored activities for each market are provided, leading to the potential of localizing remanufacturing businesses in these three countries and thereby reducing the negative impact from global supply chain disruptions.

**Originality/value:** This research is among the first academic approaches to provide large-scale data on these Southeast Asian countries to analyze the potential of circular strategies to decrease on the one hand, the negative impact from production and consumption of electronic products, and on the other hand, reduce the dependencies on global supply chains.

## **Keywords:**

Decoupling, supply chain risks, circularity, refurbishing, closed-loop supply chain, Southeast Asia

## **Introduction**

The growth of the electronic sector and the coupled increase of electronic waste (e-waste) in Southeast Asia (SEA) have created both an environmental challenge and an economic opportunity. At the same time, geopolitical tensions are disrupting global supply chains, prompting companies to localize operations. The electronics sector, especially mobile phones, is highly impacted due to reliance on rare earths, a raw material in the year 2022 mined 60% by China. The 2021 chip shortage alone caused \$210 billion in losses (AixPartners, 2021; Depraeter et al., 2025).

Circular strategies like remanufacturing and refurbishment offer a way to localize production and thereby decouple from global supply chains. Additionally, such strategies have the potential to reduce e-waste and CO<sub>2</sub> emissions by up to 80-90%. Although the global market for refurbished and used phones will exceed \$73 billion in 2025 and is forecasted to reach a size of \$120 billion by 2032 as shown in Fig. 1, the awareness of circular strategies in Southeast Asia "remains lacking, with practices further behind than they should be" (ERIA, 2024; GSMA, 2025; Persistence Market Research, 2025; Liakos et al., 2019).



Figure 1: Refurbished and used mobile phone market outlook 2019-2032 (Source: Persistence Market Research, 2025).

Therefore, this study aims to examine, on the one hand, why circular strategies lag in these regions and have a lower market relevance than in other parts of the world, and on the other hand, strives to explore their potential to strengthen supply chain resilience by localizing remanufacturing and refurbishing to decouple from global supply chain disruptions. Both models, one with a later decoupling point of global supply chain disruptions using a classical supply chain strategy and one with an earlier decoupling point using remanufacturing are visualized in Fig. 2.

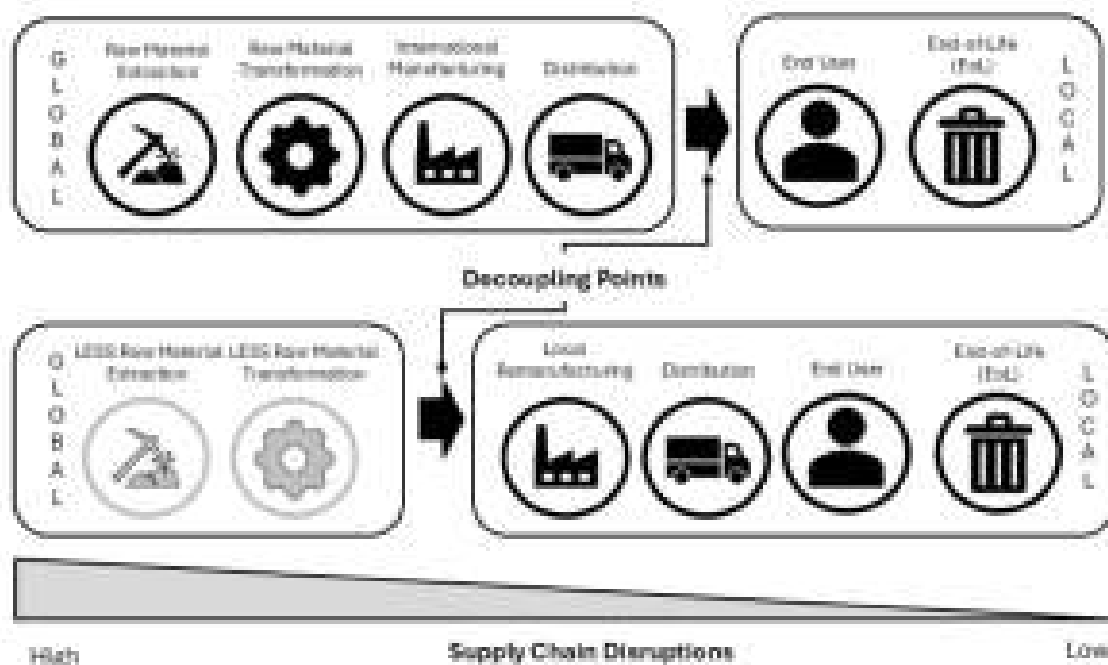


Figure 2: Model (top) with later decoupling point of global supply chain disruptions and earlier decoupling point using remanufacturing (Source: the authors).

## Literature Review

### Advancing Circularity through Remanufacturing and Refurbishing

Remanufacturing is an industrial process aiming to bring back a product “as-good-as-new” to the market. It is an essential strategy to gain closed-loop supply chains, CLSCs, and offer the opportunities to gain circularity within local and global supply chains (Lund, 1984; Singhal et al, 2020). Remanufacturing strategies can have a positive impact on businesses in general and on sustainability specifically in three different dimensions: environmental, economic, and social. As it preserves the key value of the initial part, the needed energy to produce a product is reduced, with a positive effect on the carbon footprint. Moreover, the generation of waste is reduced or avoided. It has the potential to generate employment locally and internationally and offer business opportunities that have a positive impact on the economic situation. Additionally, it gives opportunities to develop new skills in respect of work in operations and reverse logistics with a positive social impact (Chakraborty et al, 2019; Ragoanig and Schneider, 2019; Sakao and Sundin, 2019).

Key process steps within remanufacturing are the collection of the used parts and returning it to a remanufacturing company in a reverse logistics process. Main operational steps within the remanufacturing procedure are the initial inspection, disassembly, cleaning of the parts, repair of defective components, machining of components, scrapping of components that cannot be reused or repaired or machined, assembly, and final testing (Singhal et al, 2020). The process is visualized in Fig. 3.

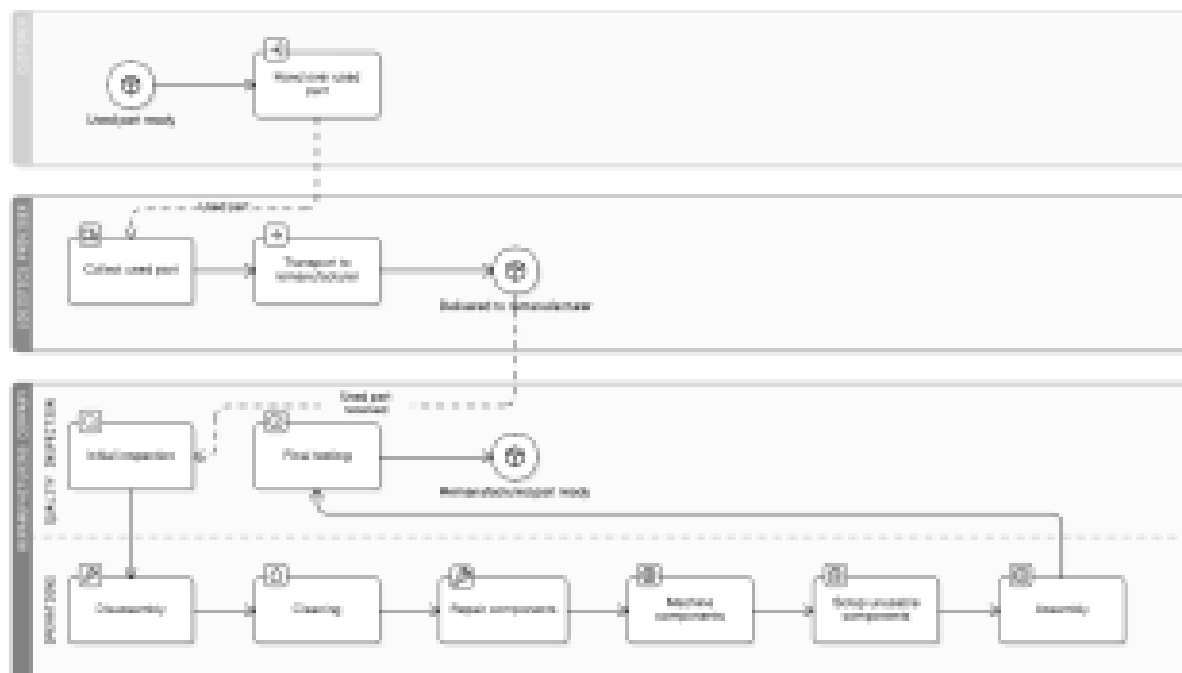


Figure 3: Remanufacturing process flow broken down into key stakeholders (Source: the authors).

The success and effectiveness of remanufacturing strategies are highly dependent on the attractiveness, availability, and perception of such products within the relevant market or region (Casper et al., 2025a). These variations are described in the following section on “Regional Variations in Perceptions of Remanufacturing and Refurbishing”.

For circular strategies applied to electronic devices, such as mobile phones or computers, the term ‘refurbishment’ is often used instead of the term ‘remanufacturing’; e.g., a refurbished phone or a refurbished notebook (Apple, 2025; Samsung Thailand, 2025).

Gharfalikar et al. (2016) describe this unclarity within academic publications and stress inconsistencies in the usage of terms, such as ‘remanufacturing’ and ‘refurbishing’. Chen and Chen (2019) explored different forms of recovery of products and analyses remanufacturing and refurbishing. They defined the difference between these forms of recovery as ‘remanufactured product matches the quality level of the new product, while no such requirements exist for the refurbished product’. Gray and Charter

(2007) concluded that the closeness of refurbishment to remanufacturing is “not clear”, which leads to further confusion, as also explored by Kurlova-Palssaitene et al (2023).

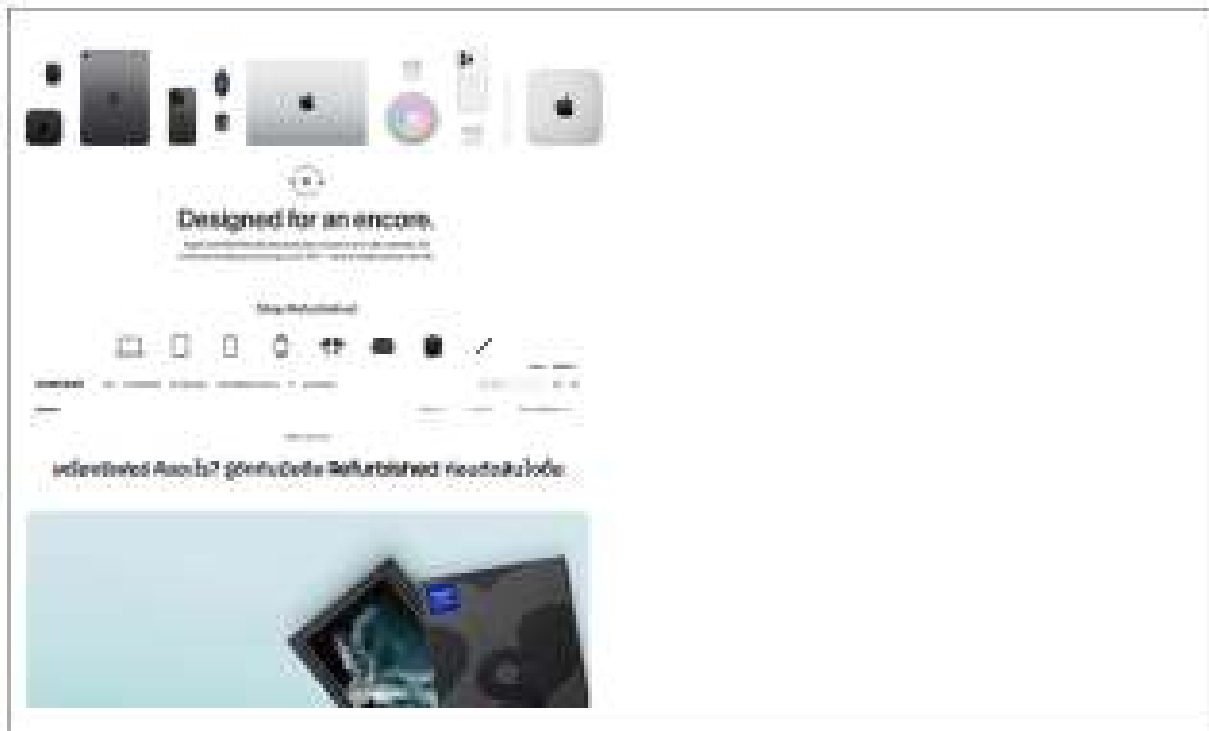


Figure 4: Online offer from Apple Thailand (left) and Samsung Thailand (right) for refurbished mobile phones including warranty (Source: Apple, 2025; Samsung Thailand, 2025).

In the three explored markets, both terms and strategies, remanufacturing and refurbishing, are rather unknown and have a low market relevance. Therefore, even if it might lead to a certain inaccuracy, this research explores both strategies together and uses the term synonymously.

#### **Regional Variations in Perceptions of Remanufacturing and Refurbishing**

Meeting customer requirements and expectations is a key criterion in the process of decision-making for customers. If the perceived value of the product is met from the perspective of the customer, he/she is likely to decide in favour of a certain product (Hanemann, 1991). These requirements and expectations often cover a wide range of factors influencing the final purchasing decisions, ranging from the practical value the item might offer, price levels, quality-related perceptions, performance and durability, as well as sustainability and environmental friendliness (Kabel et al., 2021; Wang et al., 2018).

Such requirements and expectations are therefore crucial for circular strategies, such as for remanufacturing. They vary regionally. Key knowledge on such variations in the relevant market is summarized in Table 1 hereunder.

Table 1: Regional variations in the perception of remanufacturing broken down by explored country.

| Country         | Perception  |
|-----------------|---|
| <b>Cambodia</b> | <ul style="list-style-type: none"> <li>• Previous research performed in Cambodia concluded that most Cambodian people are aware of remanufactured products but have a rather negative perception of remanufactured goods. An exploration performed on remanufactured motorcycle parts found that Cambodians in general saw new parts as superior to equivalent remanufactured parts. (Casper et al., 2025a.)</li> <li>• A different investigation found behavioural and cultural barriers that were preventing efficient remanufacturing. Cambodian people tend to keep used products and not return them to the market, which would be essential for circular strategies such as remanufacturing (Casper et al., 2025b).</li> <li>• About 50% stated that they likely opt for a remanufactured product (here: remanufactured motorcycle part) if it is offering a "good-as-new" quality. In such a case, a price level of 70% to 90% was defined as appropriate. (Casper et al., 2025a.)</li> </ul>  |
| <b>Thailand</b> | <ul style="list-style-type: none"> <li>• Research performed by Chaowanapong et al. (2018) found barriers for remanufacturing in Thailand based on insufficient circular strategies as well as insufficient laws and regulations. Missing awareness, standards, and support from the government were additional issues found when analysing this market.</li> <li>• Additionally, insufficient waste policies and responsibilities of end-of-life solutions in Thailand are hindering circular strategies, as remanufacturing (Ramstetter, 2012).</li> <li>• Matsumoto et al. (2018) analysed the customer perception of remanufactured parts in Southeast Asia, including the Thai market, and found that the availability of information and knowledge on the product is essential to lead to a positive customer decision. They derive from this finding the need for standardization and certifications for remanufactured parts in the Thai market.</li> <li>• Chinen et al. (2022) confirm this observation in their research and stress that a purchasing decision for a remanufactured part in Thailand can be influenced positively by making sure that all relevant information is available, especially with respect to environmental benefits and functionality compared to the equivalent new part.</li> <li>• Pisitsankhakar and Vassanadumrongdee (2020) explored the decision-making process of Thai car owners and concluded that the purchasing decision for such parts in Thailand is highly dependent on the subjective opinion of the car owner.</li> </ul> |
| <b>Vietnam</b>  | <ul style="list-style-type: none"> <li>• Le et al. (2025) researched the factors that influence Vietnamese people in their purchase decision for remanufactured parts. Their results show that the attitude of the decision-maker has the highest impact. Moreover, the availability of the parts and knowledge on the part is of key relevance.</li> <li>• A cross-country analysis performed in Vietnam exploring the perception of remanufactured auto parts found that Vietnamese people have a comparatively high knowledge of such parts. Additionally, their perceived benefits are also higher compared to countries like Malaysia or Thailand (Matsumoto et al., 2018).</li> <li>• Guidat et al. (2020) analysed the potential for remanufactured motorcycle parts in Vietnam and found uncertainty among the Vietnamese people related to the product quality of remanufactured parts. Additionally, the research stresses the market-specific fact that in Vietnam, counterfeit parts have a significant market relevance. These low-cost parts provide additional competition between the existing competition between new and remanufactured parts.</li> </ul>   |

Besides the challenges remanufactured products are facing in the three explored markets, they are offering opportunities for the local environment and business. Specifically, it offers opportunities to decouple these markets from global supply chain disruptions, which is described in the following sub-chapter.

### Supply Chain Disruptions and Remanufacturing and Refurbishing Opportunities

The global economy has been facing multiple supply chain disruptions in recent years. Solarí et al. (2024) explored the key supply chain disruptions with global impacts between 2004 and 2023. Of highest importance were:

- COVID-19 / pandemic disruptions
- Russia–Ukraine war
- Brexit
- Climate change or environmental disasters
- Energy security or raw material disruptions
- Food supply chain disruptions
- Digital or technological disruptions (Industry 4.0, blockchain, AI, IoT, digitalization)

Bai et al. (2024) stressed the potential of such 'supply chain shocks' to drive global inflation. Meier and Pinto (2024) analysed the disruptions resulting from COVID-19 and found major declines in production, with fewer imports and exports and rising prices. Analysing the same scenario, Shen et al. (2021) describe severe consequences resulting from the disruption, such as a scarcity of essential goods like medicine and food. As a learning from such supply chain disruptions, McDougall et al. (2024) identified a transition towards a local supply chain. This localization strategy offers increased resilience of future supply chains.

Successfully performing remanufacturing strategies offers the potential to localize new businesses or to extend existing businesses by adding this circular strategy. The opportunity to localize remanufacturing, for example, from the initial point of production of a car engine in North America to a remanufacturing site in Southeast Asia, has the potential to decouple economic growth from negative environmental impact due to a lower CO<sub>2</sub> footprint as well as to decouple it from global supply chain disruptions (Casper et al., 2025a).

### Methodology

This study provides a comparative analysis of three SEA countries: Thailand, Cambodia, and Vietnam. Each country represents different stages of economic development, consumer awareness, and cultural perspectives on refurbished products. Data has been collected using online surveys, which have been designed and translated by experienced researchers having strong insights into the cultural background for each market and native language proficiency levels. For each country, a survey in the local language has been created. Additionally, an English survey was available, which was the basis for communication within the multi-national and multi-cultural research team, and also could be optionally chosen by survey participants to answer the questions. The questionnaire in all four languages (English, Khmer, Thai, and Vietnamese) is available in Appendix A.

The data has been collected in a field research approach by different local research groups. The data for Cambodia has been collected between December 2023 and May 2024, and its results have been published in a previous publication focusing exclusively on the local Cambodian market (Nanthakom, 2024). The data from the Thai and Vietnamese markets has been collected between October and November 2024 and has not been published before.

Based on the received data, the adoption of circular economy principles was tested against consumer behaviour models in diverse markets. This approach offers insights into how marketing, policy, and supply chain strategies can be tailored to enhance consumer acceptance. Multinomial Logistic Regression (MLR) was employed as the analytical framework for modelling nominal dependent variables with more than two outcomes.

This study compares the determinants of purchase intention towards refurbished phones across the selected countries. Purchase intention was therefore selected as the dependent variable. A set of independent variables (IV) has been modelled and broken down into five categories. The first category is summarizing **demographics (IV-1)**, such as age, gender, education, occupation, and location. The second category consists of **knowledge (IV-2)** factors, for example, the prior awareness of refurbished phones. The third category summarizes the **perceived risks (IV-3)**, such as the reliability of the battery and data security. The fourth category gathers the **perceived benefits (IV-4)**, such as savings and the positive environmental impact. Finally, the last category gathers the **price sensitivity (IV-5)**, which measures what kind of price range is seen as acceptable for a remanufactured product relative to the

price for a new part. Together, these five categories are the key determinants, which have been tested using MLR across the three relevant markets: Cambodia, Thailand, and Vietnam. An overview of all independent variables, their breakdown, their focus, and how they relate to the dependent variable can be found in Fig. 5.

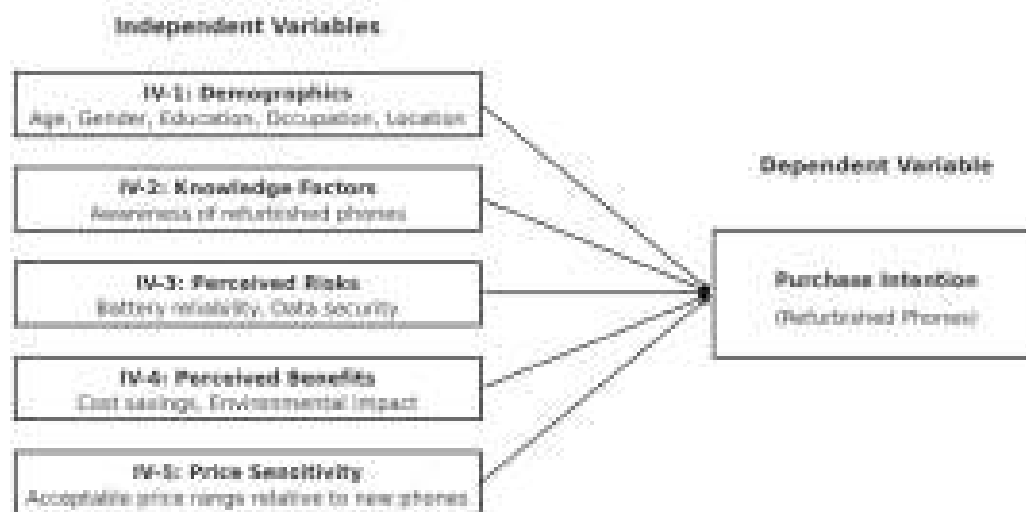


Figure 5: Analytical framework of factors influencing purchase intention toward refurbished phones using Multinomial Logistic Regression (MLR).

Questionnaires were randomly distributed to potential respondents via online surveys. The study collected 450 responses from Thailand, 596 responses from Cambodia, and 1,034 responses from Vietnam. These data sets needed to be cleaned, and answers from participants outside the population (e.g. as exceeding the age limit or due to not living in one of the three target markets) were taken out. An overview of the valid answers per country can be found in Table 2. Detailed characteristics of the respondents are provided in the Findings section.

Table 2: Breakdown of valid surveys by country.

|                                  | Cambodia   | Thailand   | Vietnam     |
|----------------------------------|------------|------------|-------------|
| <b>Complete Surveys received</b> | <b>596</b> | <b>450</b> | <b>1034</b> |
| ... being older than 38 years    | 94         | 5          | 28          |
| ... living abroad                | 4          | 3          | 4           |
| <b>Valid received surveys</b>    | <b>498</b> | <b>442</b> | <b>1002</b> |

Each valid survey response was recoded into binary variables for model estimation. The reference category for the dependent variable was set to 'No intention to purchase', allowing the model to estimate the likelihood of 'Yes' or 'Maybe' responses relative to rejection. Model evaluation included Pearson chi-square tests, deviance statistics, Pseudo  $R^2$  measures, and classification accuracy.

Figures in this paper were partly created with the support of Eraser.io software.

### Findings

Based on the data received and the results after performing the Multinomial Logistic Regression (MLR), the following key findings broken down by each explored country can be summarized, as shown in Table 3.

Table 3: Key findings broken down by explored country.

| Country         | Findings per Market  |
|-----------------|--|
| <b>Cambodia</b> | <ul style="list-style-type: none"> <li>• The model also achieved significant results with Pseudo R<sup>2</sup> between 0.18 and 0.30 and classification accuracy of 63-68%.</li> <li>• Price sensitivity and prior knowledge remained strong determinants.</li> <li>• Demographic factors such as gender displayed less consistent influence compared to Thailand.</li> <li>• Battery concerns were the primary negative determinant.</li> </ul>                             |
| <b>Thailand</b> | <ul style="list-style-type: none"> <li>• The model demonstrates strong significance with Pseudo R<sup>2</sup> measures ranging from 0.20 to 0.35 and positive predictive performance, with classification accuracy reaching 65-70%.</li> <li>• Female consumers, prior knowledge, and cost sensitivity emerged as the most influential positive factors.</li> <li>• Battery concerns represented the strongest deterrent.</li> </ul>   |
| <b>Vietnam</b>  | <ul style="list-style-type: none"> <li>• The country showed a strong model fit with Pseudo R<sup>2</sup> between 0.22 and 0.36 and classification accuracy of 66-71%.</li> <li>• Similar to Thailand, price sensitivity and prior knowledge were important determinants.</li> <li>• Battery risk remained consistently negative, whilst environmental benefits emerged as statistically significant. This suggests higher eco-consciousness compared to Cambodia.</li> </ul> |

Across all three countries, notable similarities emerged: price sensitivity, battery concerns, and prior knowledge. Price sensitivity was the strongest predictor across all three countries, underscoring cost considerations as the most universal determinant of purchase intentions. Battery concerns served as the leading deterrent, highlighting the need for reliability assurance from regional refurbished phone retailers. Prior knowledge also played a significant role in boosting purchasing intentions across all three countries, pointing to challenges in information distribution throughout the region.

Besides the similarities of the findings in the markets explored, several notable differences emerged. Firstly, the gender effect was pronounced in Thailand, weaker in Vietnam, and negligible in Cambodia. Secondly, environmental benefits carried greater weight in Vietnam, moderate importance in Thailand, and marginal importance in Cambodia. A detailed cross-country comparison of the results can be found in Table 4 below.

Table 4: Cross-Country Analysis Comparison.

| Factor                                  | Thailand                             | Cambodia        | Vietnam                           |
|---|--------------------------------------|-----------------|-----------------------------------|
| <b>Model Fit (Pseudo R<sup>2</sup>)</b> | 0.20–0.35                            | 0.18–0.30       | 0.22–0.36                         |
| <b>Accuracy</b>                         | 65–70%                               | 63–68%          | 66–71%                            |
| <b>Gender Effect</b>                    | Females are more likely (OR 1.5–2.0) | Not significant | Slightly positive, weaker than TH |
| <b>Prior Knowledge</b>                  | OR 2.0–2.5                           | OR ~2.0         | OR ~2.3                           |
| <b>Battery Concern</b>                  | OR ~0.6                              | OR 0.5–0.6      | OR ~0.5                           |
| <b>Price Benefit</b>                    | OR > 2.0                             | OR ~1.8         | OR > 2.0                          |

|                              |                     |                         |                       |
|------------------------------|---------------------|-------------------------|-----------------------|
| <b>Environmental Benefit</b> | Marginal positive   | Weak/marginal           | Significant (OR ~1.4) |
| <b>Price Sensitivity</b>     | Strongest (OR ~3.0) | Strongest (OR ~2.5–3.0) | Strongest (OR ~3.2)   |

The interpretation of the Pseudo  $R^2$  value followed this structure: Values between 0.0 and 0.1 were indicated as very weak fits, whereas values between 0.1 and 0.2 were interpreted as a moderate fit. Values between 0.2 and 0.4 were seen as a good fit, whereas all values above 0.4 were seen as a strong fit.

In addition to this model for the interpretation of Pseudo  $R^2$ , the odds ratio (OR) followed this model of interpretation: For OR ratios equal to 1, the interpretation has been made that there is no effect on the likelihood of the outcome. If the OR value is above 1, it is assumed that the factor increases the odds, meaning it has a positive effect. If the OR value is below 1, it is assumed that it decreases the odds, meaning it has a negative effect. These models can be found in detail in Appendix B.

### **Discussion**

The comparative findings from Thailand, Cambodia, and Vietnam reveal both convergence and divergence in consumer decision-making towards refurbished phones. The data indicates that consumers in all countries prioritise cost savings in their purchase intentions but may be deterred by concerns about product performance, particularly battery health. This strongly suggests that any regional strategy must focus on competitive pricing and comprehensive warranties.

In Thailand, gender differences highlight the value of demographic targeting, particularly towards female consumers. In Cambodia, the weak role of demographics implies that awareness campaigns and broad educational initiatives are more important than market segmentation. In Vietnam, the significance of environmental benefits indicates a higher degree of eco-consciousness, suggesting that marketing strategies can leverage sustainability messaging in addition to price considerations.

Besides these challenges and barriers identified, the local markets offer a big potential to localize remanufacturing businesses. Taking into consideration the recommendation made in the following sub-chapter, the local markets are of significant importance and size for such businesses. The opportunity to set up such remanufacturing operations locally and to move them from their initial production location (e.g., China) to one of the three analyzed countries would decrease the risks from global supply chain disruptions significantly.

### **Comparison with Literature Review**

The empirical exploration performed in this research confirms several previously made observations described in the literature. Besides this, it provides additional information and new perspectives on the phenomenon. A comparison between the findings of this exploration and the literature, broken down by each relevant market, can be found in Table 5.

Table 5: Comparison of findings with the literature, broken down by explored country.

| <b>Country</b>  | <b>Comparison of findings with the literature</b>   |
|-----------------|---|
| <b>Cambodia</b> | <ul style="list-style-type: none"> <li>• Previously raised scepticism by the Cambodian people on quality concerns and cultural barriers towards remanufactured products is confirmed by research (Casper et al., 2025a; Casper et al., 2025b).</li> <li>• This research adds that the price sensitivity for Cambodian consumers is high and an important determinant (own statistical analysis: OR ~2.5–3.0, the strongest positive predictor in the Cambodian model, Pseudo <math>R^2 = 0.18–0.30</math>). Competitive pricing might offer opportunities to decrease the negative influence of the previously described scepticism.</li> </ul> |
| <b>Thailand</b> | <ul style="list-style-type: none"> <li>• The strong demand from Thai customers for having a sufficient level of knowledge is confirmed by this exploration (own statistical analysis: OR 2.0–2.5 for prior knowledge, Pseudo <math>R^2 = 0.20–0.35</math>) and has been identified in previous research (Matsumoto et al., 2018; Chinen et al., 2022; Chaowanapong et al.,</li> </ul>   |

|                |   |
|----------------|---|
|                | <p>2018). Thai customers with prior awareness of remanufacturing were more than twice as likely to opt for such products.</p> <ul style="list-style-type: none"> <li>• Additionally, this exploration adds that gender has a strong impact on whether purchasing decisions are made in favour of remanufactured products. (own statistical analysis: female consumers OR 1.5–2.0 compared to males). Female Thai customers are more likely to opt for such products compared to male Thai consumers.</li> </ul>   |
| <b>Vietnam</b> | <ul style="list-style-type: none"> <li>• The strong emphasis of Vietnamese customers on acceptance and availability of remanufactured products has been confirmed (own statistical analysis: OR =2.3 for prior knowledge; Pseudo R<sup>2</sup> = 0.22–0.36), which confirms previously made and described observations (Le et al., 2025; Matsumoto et al., 2018).</li> <li>• Moreover, this research found there is a strong eco-consciousness (own statistical analysis: environmental benefit OR =1.4, significant positive effect), which could be an opportunity to tackle competition from counterfeit parts (Guidat et al., 2020).</li> </ul> |

### Recommendations

Based on the findings described and on the learnings from comparing those findings with previously made observations, the following recommendations, broken down into the key groups of stakeholders, can be derived and are summarized in Table 6.

Table 6: Recommendations for key groups of stakeholders.

| Recommendations for (Re-)Manufacturer  | Recommendations for Policy Makers  |
|--|--|
| <ul style="list-style-type: none"> <li>• <b>Improve communication on product quality and warranty:</b> A key finding in all markets explored shows concerns with respect to the product quality (especially related to battery life). An improved communication and marketing strategy, stressing the fact that in a standardized refurbishing process, usually the battery is in 100% of cases replaced by a new battery, might raise the level of acceptance for such products. Additionally, providing warranty conditions comparable to new parts might have a positive effect on the purchasing decision-making in all explored countries.</li> <li>• <b>Tailor country-specific communication:</b> Analyzing the different markets has shown similarities as well as differences in the local perception of remanufactured products. Especially, these differences should lead to tailored communication strategies for each market, such as: <ul style="list-style-type: none"> <li>○ Using the higher price sensitivity in the <b>Cambodian market</b>, to overcome local skepticism based on quality concerns and cultural barriers towards remanufactured products.</li> <li>○ Understanding and serving the higher demand for sufficient product information in the <b>Thai market</b> might increase the success of remanufactured products in this region. Additionally, the stronger interest from female consumers should be addressed, and actions to increase the interest from male customers should be analyzed.</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>• <b>Define governmental support and incentives:</b> In all explored markets, the level of standardization of remanufactured products might raise the customer perception of such products.</li> <li>• <b>Introduce tax incentives and market campaigns:</b> For the Cambodian market, especially legislation to return used products might decrease the behavior of keeping old products. In the Thai market, the previously mentioned improved level of standardization might serve the local demand for a sufficient level of information. In the Vietnamese market, legal actions against the high level of counterfeit products might have a positive impact on the market for remanufactured products.</li> </ul> |

- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>o Actions in the <b>Vietnamese market</b> should use the higher level of eco-consciousness and provide sustainability-oriented marketing campaigns.</li> </ul> |  |
|---|--|

### **Conclusion**

This research explored the consumer perception of remanufactured products in three different Southeast Asian countries in order to investigate the potential of such circular strategies for localization to decouple the local markets from global supply chain strategies. A large amount of survey data has been collected in the relevant markets and has been analyzed using a multinomial logistic regression model. Results show similarities between the data from the countries analyzed, such as a high level of price sensitivity and concerns about battery life. Prior knowledge of remanufacturing strategies has a positive impact on the willingness to opt for such products. Besides the similarities, differences have also been identified, such as a strong behavioral tendency to keep used products in Cambodia, a high level of demand for sufficient information in Thailand, and a high eco-consciousness in Vietnam. Based on these findings, recommendations on governmental strategies, communication actions, and tailored activities for each market are provided, leading to the potential of localizing remanufacturing businesses in these three countries and thereby reducing the negative impact from global supply chain disruptions.

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**Appendix A**

Questionnaire in four relevant languages: English, Khmer, Thai, and Vietnamese

| #  | ENGLISH  | KHMER   | THAI  | VIETNAMESE  |
|----|--|---|---|---|
| 1  | How old is your mobile phone?  | 1 2 3 4 5   | 1 2 3 4 5 6 7   | Điện thoại của bạn đã sử dụng bao lâu?  |
| 2  | How often do you buy a new mobile phone, on average?   | ?   | 1 2 3 4 5 6 7   | Trung bình bạn đã mua bao nhiêu điện thoại mới?   |
| 3  | If you decide to buy a new mobile phone, what is the most important reason?  | 1 2 3 4 5 6 7   | 1 2 3 4 5 6 7   | Hãy bạn quyết định mua điện thoại mới, lý do quan trọng nhất là gì?   |
| 4  | If you decide to buy a new mobile phone, is your old phone still working?  | 1 2 3 4 5 6 7   | 1 2 3 4 5 6 7   | Hãy bạn quyết định mua điện thoại mới thì điện thoại cũ của bạn đang như thế nào?   |
| 5  | If you decide to buy a new mobile phone, what do you do with the old phone?  | 1 2 3 4 5 6 7   | 1 2 3 4 5 6 7   | Hãy bạn quyết định mua điện thoại mới, bạn sẽ làm gì với chiếc điện thoại cũ của mình?  |
| 6  | Did you ever hear about refurbished mobile phones before this survey?  | ?   | 1 2 3 4 5 6 7   | Trước khi có khảo sát này, bạn đã bao giờ nghe nói về điện thoại được tân trang chưa?   |
| 7  | If a company would offer you a refurbished phone in which all worn-out and broken parts (e.g., battery, housing) are replaced by original new parts. Which of the following REASONS would you use? (multiple answers possible) | 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 | 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 | Hãy một công ty đã nghĩ cung cấp cho bạn một chiếc điện thoại được tân trang lại mà hầu hết các chi tiết bị hỏng bị sửa, ví dụ, tổng cơ điện, vỏ điện thoại được thay thế bằng các bộ phận nguyên bản, thì bạn có thể mua chiếc đó nếu sau đây? (Bạn có thể chọn nhiều câu trả lời) |
| 8  | If a company would offer you a refurbished phone in which all worn-out and broken parts (e.g., battery, housing) are replaced by original new parts. Which of the following REASONS would you use? (multiple answers possible) | 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 | 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 | Hãy một công ty đã nghĩ cung cấp cho bạn một chiếc điện thoại được tân trang lại mà hầu hết các chi tiết bị hỏng bị sửa, ví dụ, tổng cơ điện, vỏ điện thoại được thay thế bằng các bộ phận nguyên bản, thì bạn có thể mua chiếc đó nếu sau đây? (Bạn có thể chọn nhiều câu trả lời) |
| 9  | What price would you be willing to pay for a refurbished phone?  | ?   | 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 | Chiều nào sẽ được cho là hợp lý đối với 3 chiếc điện thoại được tân trang lại?  |
| 10 | Did you buy a refurbished mobile phone?  | ?   | 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 | Bạn đã từng mua một chiếc điện thoại được tân trang lại?  |
| 11 | Would you buy a refurbished mobile phone?  | ?   | 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 | Bạn sẽ mua điện thoại được tân trang lại?   |
| 12 | How old are you?   | ?   | 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 | Bạn bao nhiêu tuổi?   |
| 13 | What is your gender?   | ?   | 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 | Giới tính của bạn là gì?  |
| 14 | Where are you living at the moment?  | ?   | 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 | Hiện tại bạn đang sống ở đâu?   |
| 15 | What is your profession?   | ?   | 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 | Nghề nghiệp của bạn là gì?  |
| 16 | What is your highest degree of education?  | ?   | 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 | Mức độ giáo dục cao nhất của bạn là gì?   |

## **Appendix B**

Applied interpretation of Pseudo  $R^2$  and Odds Ratio (OR) in this exploration

### **Interpretation of Pseudo $R^2$ :**

- 0.0-0.1: Very weak fit
- 0.1-0.2: Moderate fit
- 0.2-0.4: Good fit
- 0.4 or more: Strong fit

### **OR = Odds Ratio:**

- OR = 1: The factor does not affect the likelihood of the outcome
- OR > 1: The factor increases the odds of the outcome (positive effect)
- OR < 1: The factor decreases the odds of the outcome (negative effect)