

Business Strategy for the Commercialization of a Community-Based Waste Sorting Center (PPSM) Using the Verticulture-Plus Model in Batam

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Abstract

This study analyzes the commercial feasibility of the Community Waste Segregation Empowerment (PMPS) program implemented through the Community Waste Segregation Center (PPSM), integrated with Verticulture Plus (Vertiplus) and Ecoenzyme derivatives (Ecomzy). Utilizing a convergent parallel mixed-methods design, data were collected from 47 purposively sampled respondents across three piloting sites. Results indicate the PPSM model reaches Technology Readiness Level (TRL) 6–7 and shows commercial viability, with user acceptance dimensions scoring 81–87% alongside strong positive inter-variable correlations. Qualitative findings confirm reduced household waste volume, heightened environmental awareness, and tangible economic benefits. Value Chain, STP architecture, and Go-To-Market strategy analyses further reinforce its commercial potential. Full commercialization projections estimate a first-year net profit of Rp16,097,440 with a break-even point in month seven, proving economic, social, and environmental feasibility. The findings contribute a replicable community-based commercialization framework that integrates waste management, urban food production, and community empowerment, providing practical guidance for local governments, CSR institutions, and educational institutions seeking to advance community-based circular economy initiatives.

Keywords: Community Empowerment; Organic Waste; Circular Economy; Urban Farming; Technology Acceptance Model.

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INTRODUCTION

The city of Batam is one of the 2,408 islands in the Riau Islands Province (Pemerintah Provinsi Kepulauan Riau, 2025) with a topographically relatively flat terrain, an unstable climate, and a predominance of *utisol* soils with low fertility, which poses a structural constraint on the development of horticultural commodities (Budiana et al., 2026). These limitations in local production mean that meeting food needs depends on supplies from outside the region, compounded by distribution challenges and high prices for horticultural commodities in Batam's markets. On the other hand, the rapid industrialization and urbanization of Batam City have not been matched by an adequate waste management system. Waste generation in Batam City in 2023 was recorded at 423,054.13 metric tons per year, or the equivalent of 1,159 kg per day, with a waste collection rate of 77.51% (Pemerintah Kota Batam, 2024), places significant strain on the capacity of landfills that still rely on open dumping, contrary to PP No 81 of 2012 and UU No 32 of 2009. This situation makes food security and waste management two interrelated structural issues that require integrated solutions.

Scientific studies on environmental management have identified urban agriculture, particularly *verticulture* as a solution to urban land constraints that can increase crop productivity on a household scale and support household food security (Andriani et al., 2024; Ntoma et al., 2023; Wulandari et al., 2023). It is also well-suited for densely populated areas because it uses recycled materials as a growing medium, in line with the circular economy (Ntoma et al., 2023). However, conventional *Verticulture* relies heavily on the application of external chemical fertilizers, which increases operating costs. On the other hand, *Biopori* Percolation Holes (LRB) technology has been proven to improve soil permeability and accelerate the decomposition of organic waste into compost (Sandri et al., 2024), while also reducing the volume of organic waste sent to landfills and raising public awareness of source-based waste management (Fardhani et al., 2025; Ruhimat et al., 2025). Despite extensive research, existing studies have treated *verticulture* and *biopore* systems separately. Research integrating both systems into a single functional unit remains scarce. This study addresses that gap by offering an innovative, integrated solution that simultaneously tackles the issues of organic waste management and reliance on chemical fertilizers.

To address this gap, *Verticulture Plus* (*Vertiplus*) was developed a growing medium that combines conventional *verticulture* and *biopores* in a single functional container, allowing the decomposed organic matter from the *biopores* to be directly utilized as nutrients for the plants in the same container. This organic waste management approach has been expanded through the production of *Ecoenzyme* (*Ecomzy*), a multipurpose liquid produced by fermenting fruit and vegetable peels, which has economic value. (Langsa et al., 2024; Nurliah et al., 2022). The successful adoption of these two innovations required integration into the social ecosystem; thus, a research team from the Batam State Polytechnic, in collaboration with the Tajuk Pohon Nusantara Foundation, initiated the Community Waste Sorting Empowerment (PMPS) program, which was implemented through Community Waste Sorting Centers (PPSM) in several residential areas. This program covers two areas of waste management: inorganic waste through partnerships with local manufacturing industries, and organic waste through *Vertiplus* and *Ecomzy*. It also serves as a tool for economic empowerment and strengthening local food security, supporting a community-based circular economy ecosystem. (Purwono & Rahayu, 2025; Supandi et al., 2024; Susanti et al., 2024), as well as contributing to the Paris Agreement and the achievement of SDGs 2, 3, 6, 8, 11, 12, 13, 15, and 17.

The implementation of this innovation is supported by a multi-stakeholder collaboration among local governments (Pemerintah Kota Batam, 2024), the public, farming communities, and educational institutions, in line with a stakeholder-based waste management model that has also proven effective in other sectors (Aritonang et al., 2024). Batam's status as an industrial zone opens up opportunities for collaboration through corporate social and environmental responsibility initiatives in accordance with PP No. 47 of 2012 and POJK No. 51/POJK.03/2017, which have been implemented, among other things, through the "Vertical

Culture Plus” CSR program by the Indonesia Stock Exchange (Batamfm, 2025) as well as support from PT Pertamina DPPU Hang Nadim (Fedro, 2026). By the second month, the five sites had completed 2–3 harvest cycles, producing 1,097 kg of vegetables, which were distributed to beneficiaries, with surplus sold to support operations. However, the urgency of this research lies precisely in the challenge of long-term sustainability, as many community-based environmental innovations cease once funding or external supervision ends (Andini et al., 2025; Meirezaldi et al., 2025), due to program planners who focus on technical excellence but neglect the behavioral and psychological readiness of end users. Thus, the commercial viability of the PPSM ecosystem cannot be adequately measured by financial profit projections alone, but is determined by the consistency and autonomy of the community in adopting the technology without relying on external incentives.

To assess the adoption of these green technologies, this study uses the Technology Acceptance Model (TAM) as its theoretical foundation and conceptual framework, which emphasises perceived usefulness and perceived ease of use as fundamental dimensions of technology acceptance (Mariscal et al., 2026). Recent research further highlights that green technology adoption is embedded within broader social and institutional contexts, including community support, trust, legitimacy, and transparency (Mariscal et al., 2026). The theoretical dimensions of TAM were operationalised using the USE Questionnaire developed by Lund (Putro et al., 2024), which evaluates four core aspects: Usefulness, Ease of Use, Ease of Learning, and Satisfaction, with the addition of a contextual dimension, Community Independence. Community Independence was treated as a contextual outcome-oriented construct rather than as a formal antecedent or moderator within the TAM framework. Positioning the analysis as a descriptive evaluation rather than a structural TAM test, this study combines TRL analysis, empirical TAM correlations, and market strategy mapping to comprehensively analyse the commercialization of the PPSM model in Batam.

RESEARCH METHOD

This study uses a convergent parallel mixed-methods design, collecting quantitative (October 5–15, 2025) and qualitative data (October 5–8, 2025) concurrently to gain a comprehensive understanding of the program's commercial feasibility (Creswell, 2009). This approach captures both statistical trends and underlying social dynamics. Data were analyzed separately and integrated via triangulation; any conflicting findings between quantitative and qualitative dimensions are explicitly reported as divergent perspectives rather than forcibly aligned.

The subjects of the study include the implementation of the PMPS program in two areas: inorganic waste management through partnerships with local manufacturing industries, and organic waste management through Vertiplus and Ecomzy production, which support local food security and sustainable production and consumption practices. The research stages include: (1) problem identification; (2) development of research instruments; (3) quantitative analysis via questionnaires processed using SPSS; (4) qualitative analysis through interviews using the interactive model proposed by Miles et al. (2014); (5) integration of results through data triangulation; and (6) development of commercialization strategies based on the research findings.

Of the five initial piloting sites (Bida Asri III, Permata Bandara, SMPN 8 Nongsa, Bale-Bale Nongsa, and Punggur), only three active locations agreed to participate in this study (Bida Asri III, Permata Bandara, and SMPN 8 Nongsa). The quantitative sample comprised 47 participants, consisting of 30 users/clients and 17 managers/coordinators, selected through purposive sampling (Creswell, 2009; Etikan, 2016) with the following criteria: (1) actively involved in the PMPS program; (2) having direct experience in using or managing Vertiplus, waste sorting, or ecomzy production; (3) willing to complete a questionnaire and/or participate in an interview; (4) holding a strategic role as an administrator, partner, or active client; and (5)

residing in Batam or having a direct connection to the program. The same criteria were used in selecting six key informants for qualitative interviews at three locations, as presented in Table 1.

Table 1. Interview Activity Data

No	Location	Date	Informants	Details
1.	PPSM Bida Asri III	05 Oktober 2025	Chairperson and 2 Supermak members	Informant 1 (PPSM Board Chairperson)
				Informant 2 (PPSM Board Member)
2.	PPSM Permata Bandara	08 Oktober 2025	2 board members and the RTONE Supermak Chair	Informant 3 (PPSM RTONE Chair)
				Informant 4 (board member)
				Informant 5 (board member)
3.	SMPN 8 Nongsa	08 Oktober 2025	SMPN 8 Nongsa Teacher and Vertiplus Board Member	Informant 6

Source: Data compiled by the researcher, 2026

The research instrument was adapted from the USE Questionnaire developed by Lund, consisting of 30 items covering four dimensions: Usefulness, Ease of Use, Ease of Learning, and Satisfaction. An additional five items were included to measure the Community Independence construct, resulting in a total of 35 items (Appendix 1). The adaptation process involved forward-backward translation, expert judgment, and pilot testing with 30 respondents. The instrument employed a 4-point Likert scale (1 = Strongly Disagree to 4 = Strongly Agree) without a neutral option to reduce respondents' tendency to select the midpoint as a safe or uncertain response. Likert-scale data were treated as ordinal because the intervals between response categories cannot be assumed to be equal. Therefore, relationships between variables were analyzed using the nonparametric Spearman's rho correlation, which is appropriate for ordinal data and does not require a normal distribution (Al-jaishi et al., 2026).

Quantitative data was collected through an online questionnaire using Google Forms from October 5 to 15, 2025, while qualitative data was collected through semi-structured interviews using the funneling technique, moving from general to specific topics. (Hendrayadi et al., 2023) combined with a community-based participatory approach (Barqah et al., 2024) (see Appendix 2), Data validity was ensured through methodological triangulation, including source triangulation across informants from different locations and method triangulation by comparing quantitative TAM scores with participants' narratives for the same dimensions.

Quantitative data were analyzed using SPSS version 20, including: (1) descriptive statistics; (2) Pearson Product-Moment correlation for validity testing ($r_{\text{calculated}} > r_{\text{table}}$, $\alpha = 5\%$); (3) Cronbach's Alpha for reliability testing ($\alpha \geq 0.60$ = reliable; $\alpha \geq 0.80$ = highly reliable) (Sekaran & Bougie, 2013) ; (4) a feasibility test following the adaptation benefit percentage standards of Putro et al. (2024) , with categories of $\geq 81\%$ Very Feasible, 61–80% Feasible, and $< 61\%$ Needs Improvement; and (5) Relationships among dimensions were examined using Spearman's rho correlation.. Qualitative data were analyzed using the interactive model of Miles et al. (2014), adapted by Rofiah (2022), comprising data reduction, data display, and conclusion drawing. During data reduction, the researcher repeatedly reviewed the interview transcripts, identified relevant meaning units, and assigned initial codes. Similar codes were compared and grouped into sub-themes and overarching themes based on recurring patterns across informants. The resulting themes were presented as thematic narratives, while conclusions were drawn by interpreting the emerging patterns and comparing them with the quantitative findings for triangulation. Coding was conducted by one researcher, and this single-coder approach is acknowledged as a methodological limitation.

To minimize potential social desirability bias arising from the researchers' involvement as program mentors, data collection employed strict anonymity protocols and standardized self-administered questionnaires. Quantitative findings were additionally triangulated with objective

technical and financial indicators, including waste volume reductions and financial cash flows. Qualitative findings were further cross-validated through direct physical observations and comparison across the three implementation sites to strengthen the credibility of the findings.

RESULTS AND DISCUSSION

RESULTS

The questionnaire was distributed online via Google Forms between 5 and 15 October 2025 to all individuals who had previously participated in the community empowerment program at the program's implementation site. Given that the program is still relatively new and the participant population is therefore limited, total sampling was employed. During the data collection period, 47 responses were received; all met the inclusion criteria and were used as primary data, with the distribution presented in Table 2. This figure represents the entire available population at the initial stage of the program's implementation.

Table 2. Respondent Data

No	Respondent	Data Collected	Data Processed
1	UBS Supermama, Bida Asri 3 Housing Complex	6	6
2	UBS RTONE BERSERI, Permata Bandara Housing Complex	8	8
3	SMPN 08 Nongsa	31	31
4	General	2	2
Total		47	47

Source: Data compiled by the researcher, 2026

Descriptive statistics were used to obtain an overview of the distribution of scores for each dimension. On a 4-point Likert scale, the theoretical minimum score is 1 and the maximum score is 4; therefore, an average above 3.0 per item reflects a positive perception.

Table 3. Descriptive Statistical Test Results

Variabel	Total Item	Observations	Observed Minimum	Observed Maximum	Average	Std. Deviation
Usefulness	8	47	8	32	26.81	4.97
Ease of Use	11	47	11	44	36.23	6.47
Ease of Learning	4	47	4	16	13.00	2.48
Community Independence	5	47	5	20	17.32	2.74
Satisfaction	7	47	10	28	23.57	4.31

Source: Data compiled by the researcher, 2026

Table 3 shows that all variables have relatively high mean scores compared with their minimum ranges. Ease of Use has the highest mean (36.23; SD 6.47), followed by Usefulness (26.81; SD 4.97), Satisfaction with Use (23.57; SD 4.31), and Community Independence (17.32; SD 2.74). Ease of Learning has the lowest mean but the smallest standard deviation (13.00; SD 2.48), indicating the most homogeneous responses from respondents. The theoretical minimum score was achieved across four variables (Usefulness, Ease of Use, Ease of Learning, and Community Independence), indicating that one respondent awarded the lowest score (1) to all items within these four dimensions. Based on field observations and face-to-face interviews, which formed part of this study's design, this respondent was identified as having experienced digital literacy difficulties in completing the online questionnaire; given that the programme participants were predominantly aged over 40, this did not reflect actual dissatisfaction with the programme.

The instrument's validity was assessed using Pearson's item-total correlation, with an item considered valid when the calculated r exceeded the critical value. For $n = 47$ ($df = 45$, $\alpha =$

0.05), the critical r was 0.287. As shown in Table 4, all 35 items across the five dimensions exceeded this threshold, with correlation coefficients ranging from 0.552 to 0.908, indicating that all items were valid.

Table 4. Validity Test Results

Dementions	Total item	Pearson Correlation	r Table	Description
Usefulness	8	0.793- 0.876	0.287	Valid
Ease of Use	11	0.750-0.879	0.287	Valid
Ease of Learning	4	0.862-0.908	0.287	Valid
Community Independence	5	0.779-0.865	0.287	Valid
Satisfaction	7	0.552-0.899	0.287	Valid

Source: Data compiled by the researcher, 2026

Reliability was assessed using Cronbach's alpha, with $\alpha \geq 0.60$ considered reliable and $\alpha \geq 0.80$ highly reliable (Sekaran & Bougie, 2013). As shown in Table 5, all five dimensions demonstrated high internal consistency, with alpha values ranging from 0.882 to 0.948.

Table 5. Reliability Test Results

Dementions	Total Items	Cronbach's Alpha	Description
Usefulness	8	0.938	Highly Reliable
Ease of Use	11	0.948	Highly Reliable
Ease of Learning	4	0.900	Highly Reliable
Community Independence	5	0.882	Highly Reliable
Satisfaction	7	0.913	Highly Reliable

Source: Data compiled by the researcher, 2026

The feasibility test assessed the acceptability of programme implementation by comparing the actual scores obtained for each dimension with their corresponding ideal scores. The resulting percentages were interpreted using the feasibility categories adapted from (Putro et al., 2024; Sibagariang et al., 2021), with scores of $\geq 81\%$ classified as Very Feasible, 61–80% as Feasible, and $< 61\%$ as Needs Improvement.

Table 6. Feasibility Study Results

	Usefulness	Ease of Use	Ease of Learning	Community Independence	Satisfaction
Actual Score	1.260	1.703	611	814	1.108
Ideal Score	1.504	2.068	752	940	1.316
Percentage	84%	82%	81%	87%	84%

Source: Data compiled by the researcher, 2026

All variables in Table 6 fall into the 'Very Adequate' category, with 'Community Independence' achieving the highest percentage (87%) and 'Ease of Learning' the lowest, though still classified as 'Very Adequate' (81%).

Because the data were measured using a 4-point ordinal Likert scale, Spearman's rho was used to assess relationships among the five dimensions. Shapiro–Wilk tests also indicated non-normal distributions for all dimensions ($p < 0.05$). As shown in Table 7, all dimensions were positively and significantly correlated ($p < 0.01$), with coefficients ranging from 0.586 to 0.851. The strongest correlation was between Usefulness and Ease of Use ($\rho = 0.851$), whereas the weakest was between Usefulness and Community Independence ($\rho = 0.586$). These results indicate association rather than causation.

Qualitative findings were obtained through interviews at three main pilot locations (PPSM RTONE Permata Bandara, PPSM Bida Asri III, and SMPN 8 Nongsa) which had

completed the full program cycle. These locations represented three different institutional contexts: an urban residential community, a community-based waste management group, and an educational institution. A total of six key informants were interviewed. The qualitative informants were not evenly distributed across locations, with only one informant from SMPN 8 Nongsa compared with its dominant share of survey respondents (66%). This was due to limited access and the school's operational schedule, where student-based waste management activities were centrally coordinated by one teacher serving as the Scout advisor/environmental coordinator.

Table 7. Correlation Test Results

	Usefulness	Ease of Use	Ease of Learning	Community Independence	Satisfaction
Usefulness	1	0.851	0.751	0.586	0.639
Ease of Use	0.851	1	0.789	0.652	0.671
Ease of Learning	0.751	0.789	1	0.790	0.732
Community Independence	0.586	0.652	0.790	1	0.687
Satisfaction	0.639	0.671	0.732	0.687	1

Source: Data compiled by the researcher, 2026

Thematic analysis identified five overarching themes and their corresponding sub-themes, as summarized in Table 8.

Table 8. Thematic Analysis Results

Theme	Sub-theme	Supporting Informants
Initial Adoption Motivation	Household waste management concerns; perceived economic potential of waste	Informants 3 and 6
Adoption and Learning Process	Learning through observation and repeated practice; external support and facilities	Informants 2 and 6
Economic, Social, and Educational Benefits	Affordable harvest products; food-support initiatives; environmental education; community interaction; institutional demand for derivative products	Informants 1, 3, 5, and 6
Community Participation and Emerging Independence	Community-initiated participation; self-financing initiatives; independent production and gradual expansion; social and recreational benefits	Informants 1, 3, and 6
Sustainability Challenges	Limited drums and infrastructure; low awareness of waste sorting; dependence on external support	Informants 2 and 3

Source: Data compiled by the researcher, 2026

The three pilot locations had different starting points but followed a similar pattern: the program emerged from concerns about suboptimal household waste management and was strengthened by external facilities and mentoring. At PPSM RTONE Permata Bandara, the activity originated from awareness of the economic potential of household waste that had previously been discarded.

“At first, we saw that the house itself had quite a lot of potential. Then there was the issue of poor waste collection, cardboard was being thrown away even though it has economic value if we actually process it. I used to learn about this at the subdistrict office, because the subdistrict office has a waste bank.” (Informant 3, Permata Bandara RTONE PPSM, October 8, 2025)

At SMPN 8 Nongsa, the program began through an IDX initiative and was later continued independently by Scout students when the partner could no longer provide regular guidance.

“At first, it was the people from the IDX. But since they couldn’t come here right away to check things out, we ended up taking over, the students here, especially the Scouts.”(Informant 6, SMPN 8 Nongsa, October 8, 2025)

These statements generated the initial codes waste-management concern, economic potential of waste, and continuation after external support, which were grouped into the corresponding sub-theme and overarching theme in Table 8.

The adoption process involved external facilities and learning through observation and repeated practice. At PPSM Bida Asri III, members learned to produce and maintain Vertiplus units primarily by observing the process, without written instructions.

“Not really, just pay attention, we’ve been through this, you know. For someone your age, it’s easy.”(Informant 2, PPSM Bida Asri III, October 5, 2025)

The program generated economic, social, and educational benefits across the pilot locations. At PPSM Bida Asri III, Vertiplus harvests were sold below market price to attract buyers and maintain affordability.

“Yesterday it was Rp9,000 per kilogram. At the market, it’s actually Rp13,000, but we sell it for Rp9,000 cheaper so people will be interested in buying it.”(Informant 1, PPSM Bida Asri III, October 5, 2025)

Meanwhile, RTONE Permata Bandara prioritized its harvests for stunting-prevention activities through the local community health posts rather than open-market sales.

“Actually, our goal isn’t to sell them on the market, but to supply them to posyandus, so the goal is to prevent stunting. We prioritize vegetables from the waste bank first for supplementary feeding programs at posyandus, as part of our local food initiative.”(Informant 3, Permata Bandara RTONE PPSM, October 8, 2025)

At SMPN 8 Nongsa, the program also served as an environmental education medium, developing students’ awareness and practical skills in waste management and plant cultivation.

“My first thought is that this teaches children to care about the environment. In addition to learning how to plant and care for plants, the children are also taught how to properly compost waste so that it can serve as fertilizer for the vegetables they grow.”(Informant 6, SMPN 8 Nongsa, October 8, 2025)

Maintaining Vertiplus also became a meaningful recreational activity for older community members at PPSM Bida Asri III.

“Regarding satisfaction, we are happy. At our age, it is like having entertainment. Especially when we come here every afternoon to check on things, it feels good. At home, we would just lie down and use our phones.”(Informant 1, PPSM Bida Asri III, October 5, 2025)

Routine demand for Ecomzy from the local community health center indicated product acceptance and potential institutional distribution beyond the residential community.

“I’ve been to the community health center, and the health workers there always say, ‘We’re out of Ecomzy.’ So it’s not just the people here even the people here already know about Ecomzy.”
(Informant 5, PPSM RTONE Permata Bandara, October 8, 2025)

Changes in community participation indicated a shift from organizer-initiated activities toward greater community initiative. At RTONE Permata Bandara, residents who previously had to be approached by organizers began contacting them directly to request waste collection.

“Previously, we were the ones going from house to house asking whether they had waste. Now they put the waste in a designated place, and we just collect it. They even contact us through WhatsApp or by phone and say, ‘Please collect the waste from my house; there is already a lot.’”
(Informant 3, PPSM RTONE Permata Bandara, October 8, 2025)

At SMPN 8 Nongsa, an effort to establish a self-financing cycle was observed through the planned use of vegetable sales to purchase subsequent seedlings rather than relying entirely on CSR-supported distribution.

“We still have some seedlings given by IDX, but when they run out, we will have a problem. So, whether we like it or not, we have to commercialize the produce so that we can buy more seedlings.”(Informant 6, SMPN 8 Nongsa, October 8, 2025)

At PPSM Bida Asri III, members independently produced new Vertiplus units and planned gradual expansion according to available community funds.

“We will obtain the funds gradually. If a little comes in, we expand a little. Now it is from IDX and tomorrow, perhaps from somewhere else.”(Informant 1, PPSM Bida Asri III, October 5, 2025)

Despite these benefits, several operational challenges may affect program sustainability and replication. First, limited drums restricted participation at RTONE Permata Bandara.

“The residents’ enthusiasm is very high, especially after several harvests. However, because we still lack drums, it is not yet optimal, and only residents around this area are currently participating.”(Informant 3, PPSM RTONE Permata Bandara, October 8, 2025)

Second, limited infrastructure at PPSM Bida Asri III, particularly the absence of shade nets, restricted the types of vegetables that could be cultivated during certain periods.

“Perhaps the weather is also a factor because we do not have a shade net yet and cannot afford to buy one. We are making do with what we have. We can still grow mustard greens, but other vegetables have difficulty with the heat.”(Informant 2, PPSM Bida Asri III, October 5, 2025)

Third, awareness of waste sorting among some working-age residents remained relatively low, partly because they considered waste management covered by the waste collection fees they already paid.

“At first, it was difficult to encourage residents because they felt that they had already paid the waste fee. They thought, ‘Why should we separate the waste when the garbage truck already collects it?’ But when they passed by and saw how well the plants were growing, and when we

distributed the harvest, they became more enthusiastic.”(Informant 3, PPSM RTONE Permata Bandara, October 8, 2025)

Fourth, dependence on CSR partners for additional facilities required program managers to demonstrate consistent implementation before receiving further support.

“When we ask Pertamina for something, we have to demonstrate hard work first. They do not simply give it to us. We really have to work hard; we cannot get it instantly.”(Informant 3, PPSM RTONE Permata Bandara, October 8, 2025)

Beyond these operational constraints, the field interview also indicated a substantial increase in the operational scale of RTONE Permata Bandara. According to the RTONE coordinator interviewed on October 8, 2025, the number of waste-bank customers increased from 13 customers in early 2022 to 211 customers in 2025. Over the same period, the reported volume of waste handled increased from approximately 150–300 kg per month to around 3 tonnes per month. The informant also reported that the highest annual income received by a customer increased from approximately Rp500,000 in 2023 to Rp4,500,000 in 2025. These reported changes suggest increasing community participation, waste-handling capacity, and potential economic benefits associated with the RTONE waste-bank activity. However, because the underlying administrative records were not available to the researchers, these figures are treated as reported field evidence rather than independently verified performance data.

Overall, the quantitative and qualitative findings showed a consistent pattern. The high feasibility scores across the TAM dimensions (Table 6) aligned with participants’ accounts of perceived usefulness, ease of adoption, social and economic benefits, and emerging community independence. However, the qualitative findings also revealed operational constraints related to facilities, waste-sorting awareness, and external support that were not fully captured by the quantitative scores. These findings are further discussed in relation to the Technology Acceptance Model.

Discussion

Usefulness

The Usefulness dimension achieved a feasibility score of 84%, with a mean score of 26.81 out of 32 (Table 3) and an item validity coefficient of $r = 0.793$ (Table 4). This indicates that participants generally perceived Vertiplus as beneficial in addressing practical waste-management and food-production needs. The qualitative findings support this result. At PPSM Bida Asri III, organic waste was processed into compost and growing media for Vertiplus, while recyclable inorganic waste was transferred to a waste-collection partner, demonstrating that the program transformed household waste into productive resources rather than treating it solely as a disposal problem (Informant 1, PPSM Bida Asri III, October 5, 2025). The convergence between the quantitative and qualitative findings is consistent with the Technology Acceptance Model (TAM), in which perceived usefulness reflects the extent to which users believe that a technology improves the effectiveness of their activities. This finding also supports Mariscal et al. (2026), who identified perceived usefulness as an important factor in the sustained adoption of green innovations.

The reported operational expansion of RTONE Permata Bandara provides additional practical evidence of the perceived benefits of the program. The increase in reported customers, waste-handling volume, and customer income suggests that the perceived usefulness of the program was accompanied by greater community participation and potential economic benefits. In the PPSM context, therefore, Vertiplus provides value not only as a cultivation technology but also by integrating waste management, food production, and community economic activities. However, these RTONE figures should be interpreted cautiously because they were obtained through an interview and were not independently verified using administrative records.

Ease of Use

Ease of Use obtained a feasibility score of 82%, with a mean score of 36.23 out of 44, the highest mean among the USE dimensions (Table 3), and a validity coefficient of $r = 0.805$ (Table 4). The high score indicates that participants generally perceived Vertiplus as manageable in routine use. This perception was also reflected in changes in community participation. At PPSM RTONE Permata Bandara, residents who previously needed to be approached by program organizers began placing their waste in designated locations and contacting the organizers independently when collection was required (Informant 3, PPSM RTONE Permata Bandara, October 8, 2025).

This behavioral change provides qualitative support for the quantitative finding because it indicates that routine program activities could be incorporated into existing community practices without continuous direct intervention. However, the finding should be interpreted as evidence of increasingly autonomous use rather than definitive proof of long-term actual use. The result is nevertheless consistent with Dong et al, (2022), who found that ease of use contributes to technology adoption in ecological and agricultural contexts. In the PPSM model, a technology that can be incorporated into routine community activities with limited assistance may facilitate broader adoption across similar

Ease of Learning

Ease of Learning recorded the lowest feasibility percentage among the USE dimensions, at 81% (Table 6), with a standard deviation of 2.48 (Table 3). All items were valid, with validity coefficients ranging from $r = 0.862$ to 0.908 (Table 4). Despite having the lowest feasibility percentage, Ease of Learning showed the strongest association with Community Independence, with a Spearman's rho of 0.790 (Table 7). This indicates that participants who perceived Vertiplus as easier to learn also tended to report higher levels of Community Independence.

The qualitative evidence provides a plausible explanation for this association. At PPSM Bida Asri III, members reported that they learned to produce and maintain Vertiplus primarily through direct observation and repeated practice rather than written instructions (Informant 2, PPSM Bida Asri III, October 5, 2025). This practice-oriented learning process may reduce dependence on external trainers and facilitate the transfer of operational knowledge within the community. The finding is consistent with Andriani et al. (2024), who emphasized the importance of learning accessibility in supporting community-level technology adoption. Nevertheless, the correlation should be interpreted as an association rather than evidence of causality, as the present study employed a bivariate correlation analysis and did not test causal pathways.

Community Independence

Community Independence was introduced as a contextual extension of the Technology Acceptance Model and USE Questionnaire to capture the extent to which target communities could operate, maintain, finance, and potentially replicate the PPSM model with decreasing dependence on external intervention. The construct achieved the highest feasibility score among the assessed dimensions, at 87%, with a mean of 17.32 out of 20 (Tables 3 and 6). Its measurement covered operational capability, basic problem-solving, local management activity, independent financing, and replication potential. The construct also demonstrated acceptable item validity and high internal consistency.

The quantitative result was supported by several indications of emerging Community Independence in the pilot locations. At SMPN 8 Nongsa, the Vertiplus activities were continued by Scout students after regular external assistance became limited. The students also planned to use vegetable sales to generate funds for purchasing subsequent seedlings, indicating an attempt to establish a self-financing mechanism (Informant 6, SMPN 8 Nongsa, October 8, 2025). Similarly, at PPSM Bida Asri III, members reported that they were able to produce new Vertiplus units independently and planned to expand gradually according to the availability of

community funds (Informant 1, PPSM Bida Asri III, October 5, 2025). These findings indicate that Community Independence was reflected not only in operational capability but also in locally initiated participation, independent production, and efforts to develop internal financing mechanisms.

The high score should nevertheless be interpreted as emerging Community Independence rather than complete independence. The qualitative findings showed that external support was still required for certain facilities and infrastructure. Thus, the quantitative and qualitative evidence together suggest that the program had progressed beyond purely externally driven implementation, while full operational and financial independence had not yet been achieved. This distinction is particularly important when interpreting Community Independence as an outcome associated with technology acceptance rather than as an indication that all forms of external support are no longer required.

Satisfaction

The Satisfaction dimension achieved a feasibility score of 84% (Table 6), while its item validity coefficients ranged from $r = 0.552$ to 0.899 (Table 4). Although the item coefficients varied in magnitude, all items met the validity criterion, indicating that the dimension adequately captured participants' satisfaction with the program.

Qualitative findings indicate that satisfaction was associated with both the experience of participating in the program and the perceived value of its outputs. At PPSM Bida Asri III, routine Vertiplus maintenance was described as an enjoyable social and recreational activity, particularly for older community members who valued the opportunity to gather and remain active (Informant 1, PPSM Bida Asri III, October 5, 2025). Product acceptance was also reflected in recurring demand for Ecomzy from the local community health center (Informant 5, PPSM RTONE Permata Bandara, October 8, 2025). These findings suggest that satisfaction within the PPSM context encompasses both process-related and outcome-related experiences. The consistency between the quantitative score and qualitative accounts supports the interpretation that participants generally had positive experiences with the program. This is compatible with the broader TAM perspective that favorable perceptions of usefulness and ease of use can contribute to positive user evaluations. However, the qualitative evidence regarding Ecomzy should be interpreted as an indication of repeated product demand rather than a direct measure of consumer satisfaction, because systematic satisfaction data were not collected from end consumers.

Overall, triangulation across the five dimensions showed a consistent pattern: high feasibility scores (81–87%) were supported by participants' accounts of ease of adoption, direct economic benefits, and observed changes in waste-management practices. Based on the Ministry of Research and Technology/BRIN self-assessment criteria, the research team assessed Vertiplus at Technology Readiness Level (TRL) 6–7, supported by trials at five pilot locations and user acceptance results (Table 6). Detailed assessment stages are provided in Appendix 3. As this was an internal assessment without independent external evaluation, the TRL 6–7 classification remains a team-based estimate requiring third-party verification before supporting a commercial-readiness claim.

Commercialization Strategy for the PPSM Model: Value Chain Analysis

Value Chain Analysis maps out primary activities, including inbound logistics (collection and sorting of household waste), production operations (Vertiplus cultivation and Ecomzy fermentation), outbound logistics, marketing through B2C and B2B channels, and after-sales services such as community education and support, supported by secondary activities including human resource development, technology, and partnerships with PT Royal Citra Bersama, Free The Sea (PT WIK), and PT Pertamina DPPU Hang Nadim. The reported operational expansion of RTONE Permata Bandara provides supporting evidence for the collection and sorting stage, indicating increased community participation and material throughput. However, because these

figures were obtained through interviews and were not independently verified against administrative records, they are treated as supporting field evidence rather than audited performance data.

At the production stage, Vertiplus requires Rp562,460 per unit and generates estimated revenue of Rp1,092,000 per unit over 13 harvest cycles, yielding a gross contribution of Rp529,540 per unit. Ecomzy requires Rp137,000 per batch and generates Rp300,000 in revenue, resulting in Rp163,000 gross profit per batch. These figures show that value is primarily captured at the production stage, where collected waste is transformed into marketable agricultural and derivative products. However, separate costs for outbound logistics, marketing, and after-sales activities were not recorded during the pilot, so their individual margins cannot be reliably attributed.

Commercialization Strategy for the PPSM Model: STV (Segmentation, Targeting, Positioning)

STP's business model targets the broader Batam market, with B2C customers such as households and homemakers and potential B2B customers including restaurants, hotels, and modern retail. Vertiplus is positioned as an innovative and sustainable urban farming product, while Ecomzy is positioned as an eco-friendly multifunctional cleaner. Field findings show that Vertiplus harvests at Permata Bandara support Supplementary Feeding (PMT) for stunting prevention through local posyandu, creating a B2G opportunity based on social impact (Informant 3, PPSM RTONE Permata Bandara, October 8, 2025). Ecomzy has also entered the semi-formal market through regular orders from the local Puskesmas, with selling prices consistent with the projected unit cost model, while the development of liquid and bar soap offers future revenue diversification (Informant 5, PPSM RTONE Permata Bandara, October 8, 2025).

Operating System-Based Go-to-Market (GTM) Strategy

The Go-To-Market (GTM) strategy is designed based on an operating system that estimates the Total Relevant Market using the assumptions of 1 kg of waste per person per day and 640 households per residential complex. The Vertiplus brand is built on the concept of "zero-mile food" based on the Just-in-Time principle, as well as customer expansion through a packaging recycling system that enhances consumer loyalty. This strategy is validated by real-world incentive mechanisms, namely a monthly reward program for customers who actively drop off waste to encourage sustained community engagement (Informant 4, PPSM RTONE Permata Bandara, October 8, 2025). Nevertheless, the expansion of production facilities still depends on demonstrating the program's performance to CSR partners before additional drums are provided, underscoring that funding independence remains the primary challenge to the long-term sustainability of this model (Informant 3, PPSM RTONE Permata Bandara, October 8, 2025), in line with the research urgency highlighted in the introduction.

Financial Aspects

The financial projection indicates a gradual improvement in PPSM's financial performance as production capacity increases. Following the initial training and preparation phase, the financial projection covers the first 12 months of commercialization. The projection assumes the addition of three Vertiplus production units per month, resulting in 36 units by the end of the first year. Vertiplus unit produces approximately 8.4 kg of vegetables per harvest cycle, with two harvest cycles per month, and the vegetables are sold at Rp10,000/kg. The unit cost calculations for Vertiplus and Ecomzy are presented in Appendices 4 and 5, respectively. No monetary labour cost is included in the financial projection because PPSM currently operates under a community empowerment model in which operational activities are supported voluntarily by community members. Ecomzy complements Vertiplus as a supporting revenue stream. Each Ecomzy production batch generates 10 liters and requires approximately three months to complete; therefore, four production batches are projected during the 12-month

commercialization period.. While the first-year profit and loss projection is summarized in Appendix 6. Based on the monthly projection in Appendix 7, Vertiplus revenue increases progressively from Rp504,000 in the first month to Rp6,048,000 in the twelfth month. Ecomzy complements Vertiplus as a supporting revenue stream, with production conducted once every three months, generating Rp300,000 in revenue and Rp163,000 in gross profit per batch.

The first-year projection shows that Vertiplus generates Rp39,312,000 in revenue and Rp19,063,440 in gross profit after production costs of Rp20,248,560. Ecomzy contributes Rp1,200,000 in annual revenue and Rp652,000 in gross profit, resulting in a combined gross profit of Rp19,715,440. After deducting fixed operating costs of Rp3,618,000, the projected net profit reaches Rp16,097,440. These results indicate that the increasing production capacity provides a progressively stronger revenue base and improves the financial performance of the PPSM model over the first year.

The monthly projection in Appendix 7 further shows that monthly profit becomes positive in the fourth month; however, cumulative profit remains negative until the sixth month. The projected break-even point (BEP) is therefore reached in the seventh month, when cumulative profit becomes positive at Rp515,840, and continues to increase to Rp16,097,440 by the end of the first year. This financial trajectory indicates the potential of the integrated Vertiplus–Ecomzy model to achieve financial sustainability while utilizing locally available materials and organic waste. This finding supports (Ntoma et al., 2023), who highlight the adoption potential of systems based on local material utilization and recycling. Together with the technical feasibility (TRL 6–7) and social acceptance (81–87%), the financial results strengthen the basis for wider replication of the PPSM model.

CONCLUSION

The findings demonstrate that the Community Waste Sorting Center (PPSM) model, which integrates Vertiplus and Ecomzy derivative products, is a technically, economically, socially, and environmentally viable solution for household waste management. Feasibility test results ranging from 81–87% across all dimensions of the TAM instrument confirm very high acceptance among participants, while Spearman's rho correlation test reveals strong positive relationships among all variables, with the highest correlation observed between Ease of Learning and Community Independence ($r = 0.790$). Qualitatively, the program shifted waste management practices from reactive to proactive, supported by field evidence such as the growth of waste bank clients from 13 to 211 people and the replication of the program at the school level, collectively affirming the operational readiness of Vertiplus (TRL 6–7) for replication on a larger scale.

From a theoretical perspective, the research contributes to the application of the Technology Acceptance Model by examining green technology acceptance in a community-based context within an urban industrial area, a setting that remains relatively underexplored in Indonesia. Practically, the PPSM model offers a program architecture that can be replicated by local governments, corporate CSR institutions, and vocational colleges as a policy instrument to accelerate the transition toward a community-based circular economy. The projected first-year net profit of Rp16,097,440, supported by Value Chain Analysis, STV Architecture, and Go-To-Market analysis, further underscores the commercialization potential of the model in Batam City.

Several limitations should nevertheless be acknowledged. First, the sample comprised 47 participants across three sites in Batam, with approximately 66% of respondents from SMPN 8 Nongsa, which may disproportionately reflect the experience of that site. Second, researchers were involved in co-designing and implementing the PMPS/PPSM program and served as program mentors during data collection, creating a potential risk of social desirability bias. Although anonymity protocols, standardized self-administered questionnaires, and triangulation with technical and financial indicators were employed, researcher influence cannot be completely excluded. Third, qualitative coding was conducted by a single researcher, which

may introduce interpretive bias. Finally, partial reliance on CSR funding for facility expansion may limit the replicability and scalability of the model in settings without comparable external support. Therefore, the findings should be generalized with caution.

Future research should use larger and more geographically diverse samples, balanced representation across sites, and multiple or independent coders. Longitudinal studies and comparative research across different funding contexts are also recommended to assess long-term environmental, community, and financial outcomes and the scalability of the PMPS/PPSM model. Including non-adopters and prospective B2C and B2B customers would further strengthen the assessment of adoption barriers and commercialization potential.

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APPENDIX**Appendix 1. Questionnaire Instrument (USE Questionnaire, 35 Items)**

The instrument was adapted from the USE Questionnaire (Lund), with the addition of one contextual construct (Community Independence). All items were measured using a 4-point Likert scale (1 = Strongly Disagree, 4 = Strongly Agree).

1. Usefulness – 8 Items

No.	Statement
1	The Community Waste Sorting Center (PMPS) program helps make household waste management more effective.
2	This program improves my productivity in managing household waste.
3	This program is useful in my daily activities.
4	This program gives me greater control over household waste management activities in my community.
5	This program makes it easier for me to achieve what I want in household waste management.
6	This program saves me time in sorting and managing household waste.
7	This program meets my needs in household waste management.
8	This program can do everything I expect from a household waste management system.

Source: Data compiled by the researcher, 2026

2. Ease of Use – 11 Items

No.	Statement
1	Vertiplus and Ecomzy products are easy for the community to use.
2	Vertiplus and Ecomzy products are practical for the community to use.
3	Vertiplus and Ecomzy products are user-friendly for the community.
4	Vertiplus and Ecomzy products require only a few processes/steps to produce.
5	Vertiplus and Ecomzy products are flexible for use under various conditions and with different types of plants.
6	Vertiplus and Ecoenzyme products are easy to use in daily gardening activities.
7	I can use Vertiplus and Ecomzy products without having to read written instructions.
8	I do not encounter inconsistencies when using Vertiplus and Ecomzy products.
9	Both new and regular users will like Vertiplus and Ecomzy products.
10	I can quickly and easily correct mistakes when using Vertiplus and Ecomzy products.
11	I can use Vertiplus and Ecomzy products properly every day.

Source: Data compiled by the researcher, 2026

3. Ease of Learning – 4 Items

No.	Statement
1	I learn to use Vertiplus and Ecomzy products quickly.
2	I can easily remember how to use Vertiplus and Ecomzy products.
3	The way to use Vertiplus and Ecomzy products is easy to learn.
4	I quickly become proficient in using Vertiplus and Ecomzy products.

Source: Data compiled by the researcher, 2026

4. Community Independence – 5 Items

No.	Statement
1	Community members have additional jobs to meet their daily needs.
2	Community members independently obtain additional household income.
3	Community members are able to meet their food needs without assistance from external parties.

No.	Statement
4	Community members possess skills or knowledge that support economic independence.
5	Community members demonstrate responsibility in managing available resources sustainably.

Source: Data compiled by the researcher, 2026

5. Satisfaction – 7 Items

No.	Statement
1	I am satisfied with the Community Waste Sorting Center (PMPS) program.
2	I would recommend the Community Waste Sorting Center (PMPS) program to friends or others.
3	Participating in the Community Waste Sorting Center (PMPS) program is enjoyable.
4	This program functions according to my expectations.
5	The Community Waste Sorting Center (PMPS) program is highly beneficial to me.
6	I feel that I need to participate in the Community Waste Sorting Center (PMPS) program.
7	This program provides an enjoyable experience for participants.

Source: Data compiled by the researcher, 2026

Appendix 2. Semi-Structured Interview Guide

No.	Question	Type and Reference
1	What are your daily activities?	Opening
2	Could you describe how you initially became involved in the PMPS program?	Exploratory
3	What changes have you experienced since joining PMPS?	Reflective
4	What difficulties have you encountered as a PMPS member?	Diagnostic
5	How would you describe the overall process that has taken place during the program?	Evaluative
6	During the trial and implementation process, which aspects do you think should be maintained or eliminated?	Analytical
7	In your opinion, is PMPS easy to implement?	Confirmatory
8	What benefits have you gained since joining PMPS?	Outcome-oriented
9	How would you describe community participation during the program? Has there been a significant increase?	Participatory
10	What are your expectations for PMPS in the future?	Projective

Source: Data compiled by the researcher based on qualitative interviewing principles discussed by Patton (1990), Creswell (2009), and Brinkmann & Kvale (2015), 2025

Appendix 3. Detailed Assessment Stages of Technology Readiness Level (TRL)

TRL	Stage	Description	Scope
1	Concept Formulation	Concept formulation based on environmental and social issues.	Conceptual
2	Research question	Individual component testing confirmed proper functionality.	
3	Formulation and Concept Exploration	The structure and design have been tested to meet the targeted standards.	Technical Validation
4	Desain	The prototype was independently developed by Feri over one year.	

TRL	Stage	Description	Scope
5	Simulation	The product was successfully demonstrated at Bida Asri 3 Housing Complex..	Demonstration
6	Demonstration	The prototype was tested at Teluk Bakau and Puri Agung.	Integration and Implementation
7	Prototype	Implemented through the IDX CSR program at SMPN 8 Nongsa and nearby communities	

Source: Data compiled by the researcher, 2026

Appendix 4. Unit Cost of Vertiplus

Cost Component	Qty	Unit	Unit Cost	Total Cost
Direct Materials				
Drum (200 L, 42 holes)	1	unit	Rp200,000	Rp200,000
Paint Bucket (20 L)	2	units	Rp16,000	Rp32,000
Black Soil (10 kg)	10	sacks	Rp20,000	Rp200,000
Manure (10 kg)	3	sacks	Rp20,000	Rp60,000
Total Direct Materials				Rp492,000
Indirect Materials				
Vegetable Seeds (1 pack, 1,000 seeds)	1	pack	Rp460	Rp460
Cocopeat (10 kg)	1	sack	Rp38,000	Rp38,000
Total Indirect Materials				Rp38,460
Overhead				
Monthly Water Cost	12	liters	Rp2,000	Rp24,000
Household Organic Waste	40	kg	Rp200	Rp8,000
Total Overhead				Rp32,000
Total Unit Cost				Rp562,460
Hole Capacity	42	holes		42 Hole
Vegetable Production	8.4	kg		8,4 Kg
Selling Price/kg				Rp10,000
Revenue/Unit				Rp84,000

Source: Data compiled by the researcher, 2026

Appendix 5. Unit Cost of Ecomzy

Cost Component	Qty	Unit	Unit Cost	Total Cost
Direct Materials				
Fermentation Bottles (1 L)	2	units	Rp20,000	Rp40,000
Brown Sugar	1	kg	Rp15,000	Rp15,000
Clean Water	10	liters	Rp200	Rp2,000
Organic Waste (Fruit Peels)	1	kg	Rp10,000	Rp10,000
Strainer	1	unit	Rp20,000	Rp20,000
Total Direct Materials				Rp87,000
Indirect Materials				
Packaging Bottles (500 ml)	20	units	Rp2,000	Rp40,000
Packaging Stickers	20	pcs	Rp500	Rp10,000
Total Indirect Materials				Rp50,000
Total Unit Cost				Rp137,000
Production Volume				10 Liters

Cost Component	Qty	Unit	Unit Cost	Total Cost
Selling Price/unit (500 ml)				Rp15,000
Revenue/Production				Rp300,000

Source: Data compiled by the researcher, 2026

Appendix 6. One-Year Profit Projection

Year 1 Component	Calculation	Result
Total Vertiplus Units	(3 units/month × 12 months)	36 units
Total Vegetable Production	Sum of monthly production in Appendix 7 {(3 units × 8.4 kg × 2 cycles) + (6 units × 8.4 kg × 2 cycles) + ... + (36 units × 8.4 kg × 2 cycles)}	3931,2 kg
Vertiplus Sales Revenue	(3,931.2 kg × Rp10,000/kg)	Rp39.312.000
Vertiplus Cost of Goods Sold (COGS)	(36 units × Rp562,460/unit)	- Rp20.248.560
Vertiplus Gross Profit		Rp19.063.440
Ecomzy Sales Revenue	(4 batches × Rp300,000/batch)	Rp1.200.000
Ecomzy Cost of Goods Sold (COGS)	(4 batches × Rp137,000/batch)	-Rp548.000
Ecomzy Gross Profit		Rp652.000
Total Gross Profit		Rp19.715.440
Operating Expenses	(Rp301,500/month × 12 months)	-Rp3.618.000
Total Net Profit		Rp16.097.440

Source: Data compiled by the researcher, 2026

Appendix 7. Monthly Revenue, Cost, and Profit Projection

Bulan	Total Unit Vertiplus	Revenue Vertiplus	Revenue Ecomzy	Total Revenue	Cost Vertiplus	Cost Ecomzy	Fixed Cost	Laba/(Rugi) Bulanan	Laba/(Rugi) Kumulatif
1	3	Rp504.000	Rp0	Rp504.000	Rp1.687.380	Rp0	Rp301.500	-	-Rp1.484.880
2	6	Rp1.008.000	Rp0	Rp1.008.000	Rp1.687.380	Rp0	Rp301.500	Rp1.484.880	-Rp2.465.760
3	9	Rp1.512.000	Rp300.000	Rp1.812.000	Rp1.687.380	Rp137.000	Rp301.500	-Rp980.880	-Rp2.779.640
4	12	Rp2.016.000	Rp0	Rp2.016.000	Rp1.687.380	Rp0	Rp301.500	-Rp313.880	-Rp2.752.520
5	15	Rp2.520.000	Rp0	Rp2.520.000	Rp1.687.380	Rp0	Rp301.500	Rp27.120	-Rp2.221.400
6	18	Rp3.024.000	Rp300.000	Rp3.324.000	Rp1.687.380	Rp137.000	Rp301.500	Rp531.120	-Rp1.023.280
7	21	Rp3.528.000	Rp0	Rp3.528.000	Rp1.687.380	Rp0	Rp301.500	Rp1.198.120	Rp515.840
8	24	Rp4.032.000	Rp0	Rp4.032.000	Rp1.687.380	Rp0	Rp301.500	Rp1.539.120	Rp2.558.960
9	27	Rp4.536.000	Rp300.000	Rp4.836.000	Rp1.687.380	Rp137.000	Rp301.500	Rp2.043.120	Rp5.269.080
10	30	Rp5.040.000	Rp0	Rp5.040.000	Rp1.687.380	Rp0	Rp301.500	Rp2.710.120	Rp8.320.200
11	33	Rp5.544.000	Rp0	Rp5.544.000	Rp1.687.380	Rp0	Rp301.500	Rp3.051.120	Rp11.875.320
12	36	Rp6.048.000	Rp300.000	Rp6.348.000	Rp1.687.380	Rp137.000	Rp301.500	Rp3.555.120	Rp16.097.440

Source: Data compiled by the researcher, 2026