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Implementation of a Profit Website and Introduction of IoT Technology to Support Business Decision-Making for MSMEs in Plaosan Village

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ABSTRACT

Digital transformation in the agricultural Micro, Small, and Medium Enterprises (MSMEs) sector is crucial for enhancing the economic competitiveness of rural communities. Plaosan Village in Malang Regency, a producer of Mount Kawi coffee, faces challenges in financial management and agronomic efficiency. This community service program aims to: (1) implement the "Hitung Profit Kopi" web application (https://indowhiz.com/kopikawi) as a Decision Support System (DSS) for calculating farming profitability; and (2) introduce Internet of Things (IoT) concepts for post-harvest quality control. The program consisted of needs assessment, website design and testing, hands-on training on website use, and lectures plus demonstrations of an IoT prototype. Evaluation used short pre- and post-tests, satisfaction questionnaires, and observation of participants' engagement during practice sessions. The results show that participants were able to operate the profit website, input their own business data, and interpret the calculated outputs. Furthermore, participants' understanding of IoT and its potential applications increased, as indicated by improved post-test scores and feedback. This program represents an initial step towards the digital transformation of MSMEs in Plaosan Village through data-driven business management.

Keywords: Community Service; Decision Support; Internet of Things; MSMEs; Profit Website.

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INTRODUCTION

The Indonesian agricultural sector, particularly coffee plantations, stands at a crossroads between traditional practices and global market modernization requirements (Gafurov et al., 2023). In highland areas such as Malang Regency, coffee is the economic backbone of thousands of smallholder households (Wahyuni et al., 2019). However, the reality in the fields shows chronic information asymmetry. Farmers often act as price takers, with limited bargaining power, because they cannot precisely calculate their Cost of Goods Sold (COGS) Putera et al., 2023).

Plaosan Village has agro-ecological characteristics supporting both Robusta and Arabica cultivation due to the fertile volcanic soil of Mount Kawi (Putera et al., 2023). While local coffee has a distinct flavor potential, productivity and quality fluctuate.The primary issues identified include traditional financial calculations and post-harvest quality risks. Currently, farmers struggle to project their future income. The decision to sell red cherries or green beans is often driven by immediate cash flow urgency rather than long-term profitability. However, the high rainfall and humidity on Mount Kawi often trigger mold growth during storage. Data-driven environmental monitoring remains a novel concept.

Digital transformation of agricultural MSMEs offers a potential solution to break this cycle of inefficiency (Singh et al., 2025). Simple information technology, such as a web-based profit calculator, can help bridge this gap. With increasing smartphone penetration in rural areas, there is an opportunity to introduce decision-support tools that do not require new hardware investments. At the same time, almost all owners already have smartphones and occasional Internet access. This creates an opportunity to introduce a simple web-based application that supports business decision-making without requiring advanced technical skills.

Another emerging technology with strong potential for agriculture and agro-based MSMEs is the Internet of Things (IoT)(Yulian et al., 2017). The IoT enables the use of low-cost sensors connected to microcontrollers and networks, allowing users to monitor environmental parameters such as temperature and humidity in real time. For MSMEs in coffee, food processing, or storage, this information can be linked to quality control and productivity.

However, in Plaosan Village, the IoT is still an unfamiliar concept. Owners typically view technology as social media or messaging applications. There is a clear need for a light, introductory activity that explains IoT in simple language, provides a concrete prototype, and connects these ideas to their daily business reality(Oktaviandi & Persaulian, 2025). Based on this context, this community service program was designed with three objectives.

1. To develop and implement a website called “Hitung Profit Kopi” include the profit calculator that can help MSMEs in Plaosan Village calculate potential harvest, revenue, and profit more systematically.
2. To introduce basic IoT concepts and demonstrate a simple prototype relevant to agriculture and agro-processing.
3. To evaluate changes in participants’ understanding and perceptions of data-driven decision-making and technological adoption.

This article presents a comprehensive examination of the program's lifecycle, detailing the theoretical framework underpinning the design, the specific methodologies applied during the implementation phase, and an analysis of the empirical results of the program. Furthermore, it provides a critical discussion of the current limitations and identifies strategic opportunities for future scalability and refinement.

METHOD

Participants and Location

The program was conducted in Plaosan Village, Wonosari District, and Malang Regency, Indonesia. The main participants were MSME owners and managers, especially those engaged in coffee and other agricultural product processing indutries. Several village officials also joined as companions to the expedition. In total, 24 participants attended the training. The core facilitation team consisted of lecturers and students from Asia Malang Institute of Technology and Business, supported by lecturers from a partner university in Malaysia, who contributed to the design of the material and delivery of an introductory session on agriculture and technology.

Program Design

The community service program used a training and technology demonstration approach with three main stages. A detailed flowchart of the program design is Shown in Figure 1.

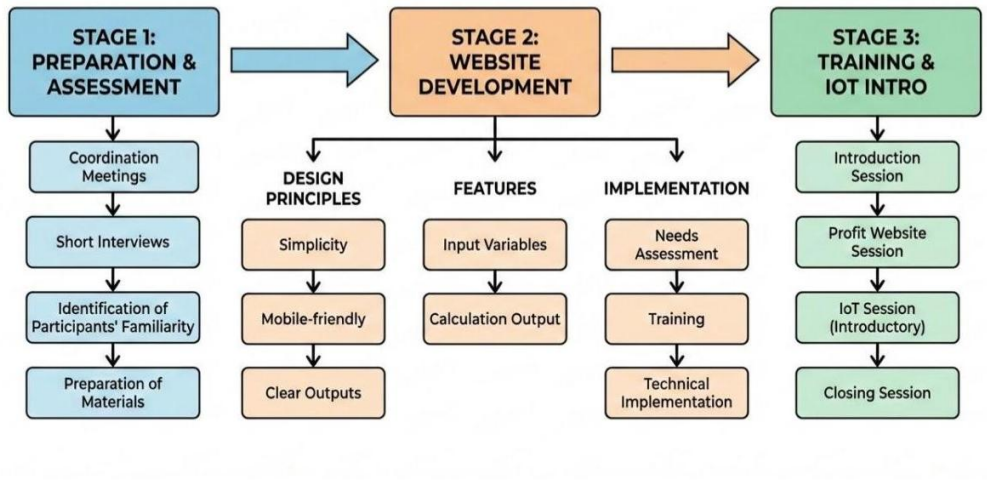


Figure 1. Flowchart of the program design

Stage 1 – Preparation and Needs Assessment

Activities in this stage included:

1. Coordination meetings with the Head of Plaosan Village and relevant village officials were held to agree on target participants, schedule, and venue.

2. Short interviews and informal conversations with several MSME owners were conducted to understand how they currently calculate profit, keep records, and decide on selling prices.
3. Identification of participants' familiarity with digital tools and internet usage.
4. Preparation of training materials, including slides, simple handouts, and demo scenarios for the website and IoT prototype.

Findings from this stage confirmed that most MSMEs calculate profit using approximate methods, often mixing personal and business expenses, and rarely simulating different price or cost scenarios.

Stage 2 – Development of the Website "Hitung Profit Kopi"

The "Hitung Profit Kopi" web application operates on a 1-Year Cycle (1 season). It was designed based on the following principles:

1. Simplicity: Only essential input fields and minimal navigation.
2. Mobile-friendly layout: Optimized to be accessible via smartphone browsers (Park, 2011).
3. Clear outputs: Display of potential harvest, revenue, and profit for different selling prices (Wahyuni et al., 2025).

The calculator uses the following algorithmic logic, verified against standard agricultural data:

1. Input Variables:
    a. Land Area (*L*): Hectares.
    b. Tree Population (*N*): Number of productive trees. The ideal standard is 1,300-1,600 trees/ha for Arabica with a 2.5m _× 2.5m spacing (Source: Dinas Pertanian).
    c. Productivity Details. The yield per tree, *a* conservative estimate for smallholders is 1 kg/tree whereas intensive farming can reach 2 kg/tree. Ratio 5:1 for the Fully Washed process (5kg Wet Cherry to 1 kg Dry Green Bean).
    d. Costs & Capital (Estimates). Labor Care/Fertilizing (e.g., IDR 1.2M) and Harvest/Picking (e.g., IDR 1.5M). Materials *(for example, fertilizer, medicine, and tool depreciation)*.
    e. Sales Target: Plan the selling price for Green Beans (e.g., IDR 100,000/kg) based on market surveys.
2. Calculation Output:
    a. Seasonal Profit Prediction: Total Revenue - Total Capital (Wahyuni et al., 2021).
    b. Financial Warning Logic: If the monthly equivalent is below the regional minimum wage (UMR avg IDR 3M), the system triggers a warning: "*Financial Warning: Figure is below average UMR. Suggested to seek side income (livestock/vegetables) between coffee seasons*."
3. Implementation Steps
    a. Needs Assessment: Mapping current planting patterns and cost structures.
    b. Training: Hands-on practice using https://indowhiz.com/kopikawi. Participants input their actual farm data into the app.

Technically, the website was implemented using a straightforward web stack (e.g., HTML/CSS, JavaScript, and a simple server-side script with database or spreadsheet storage). The team conducted internal testing to verify the calculation accuracy and page responsiveness before training.

Stage 3 – Training and IoT Introduction

The one-day event combined lectures, live demonstrations and hands-on practice. The sequence was:

1. Introduction session
    a. Explanation of the importance of data for business decision-making.
    b. Overview of the goals of the program and the structure of the training.
2. Profit website session
    a. Step-by-step demonstration of how to open the website, fill in the data, and read the calculation output.
    b. Participants practiced using either their own business data or simple sample data as guided by the facilitators.
    c. Discussion of how they can use the results to decide on selling prices and production plans.
3. IoT session (introductory only)
    a. Simple explanation of IoT concepts: sensors, microcontrollers, connectivity, and dashboards using non-technical language and analogies (Roviqoh et al., 2023).
    b. Demonstration of a basic IoT prototype (for example, a temperature and humidity sensor connected to a microcontroller and displayed on a small screen or web dashboard)(Singh et al., 2025).
    c. Examples from Indonesia and Malaysia were shared, highlighting how agriculture and small-scale agribusinesses have begun adopting sensor-based monitoring and digital tools.
    d. At this stage, the IoT component was limited to conceptual introduction and demonstration, without any expectation that participants would immediately implement IoT systems in their businesses.
4. Closing session

    Reflection on lessons learned, open discussion, and collection of verbal feedback from participants on what they found most useful and what they would like to explore further.

RESULTS AND DISCUSSION

Use of the Profit Website in Practice

The "Hitung Profit Kopi" can be accessed at this link: https://indowhiz.com/kopikawi/. Durin training, all participants with smartphones were able to open the profit website via the provided link. Participants without smartphones shared devices with other participants or used laptops provided by the research team. With facilitator guidance, the participants successfully entered basic

data, including estimated land area or production capacity, expected yields, approximate costs (e.g., labor, packaging, and transportation), and selling prices. The documentation of the material presentation of "Hitung Profit Kopi" is Shown in Figure 2. The user interface of the website "Hitung Profit Kopi" is Shown in Figure 3 and Figure 4.

Figure 2. Training session of MSME participants using the "Hitung Profit Kopi" website in Plaosan Village.

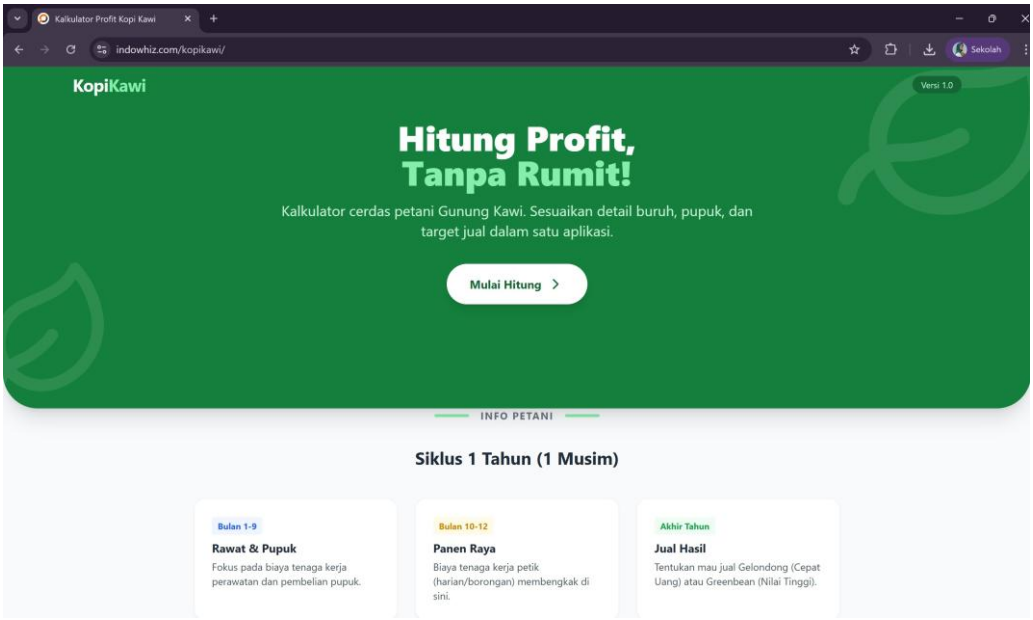
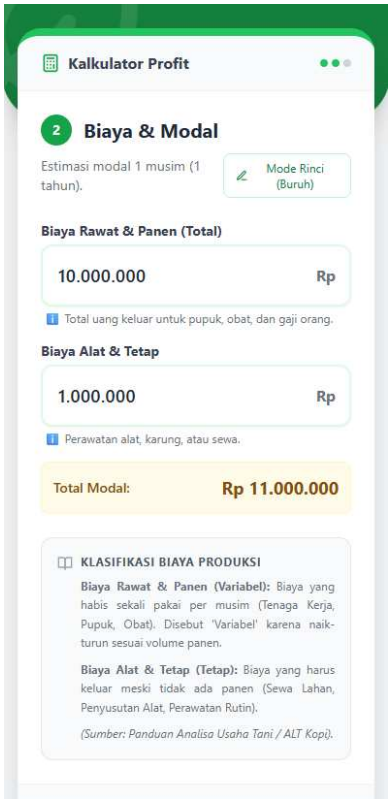


Figure 3. User interface of the profit website used by MSME participants.



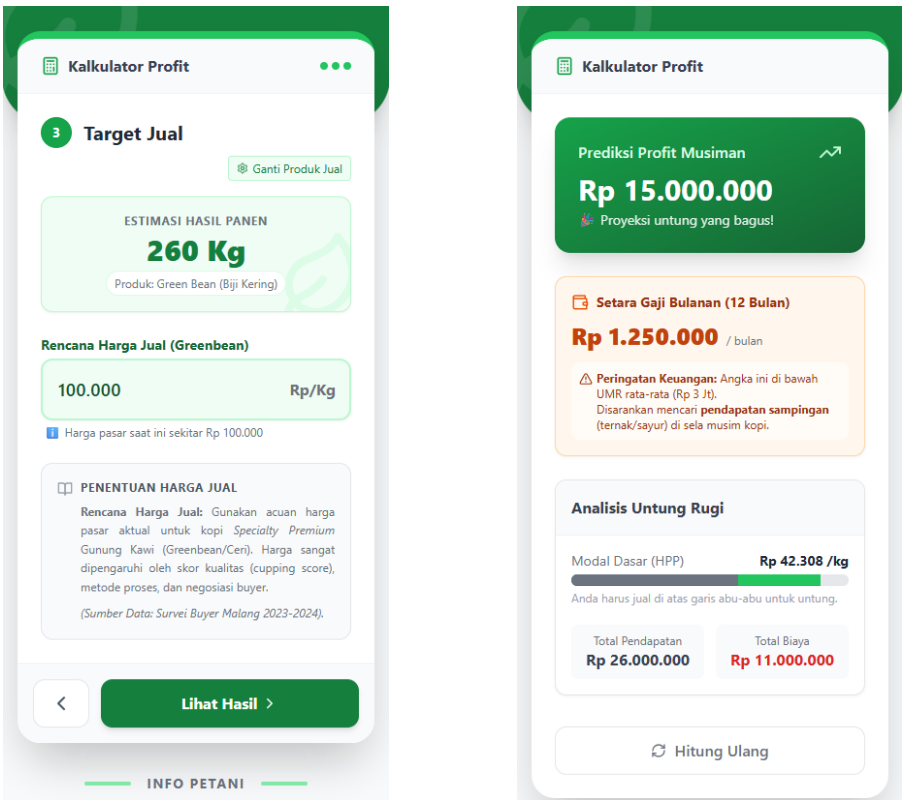


Figure 4. Example of detailed profit calculation on the website.

Case Study Analysis: 0.29 Hectare Land

Using the 'Hitung Profit Kopi' website, a simulation was performed for the partner's specific land using updated population and yield data. The results are presented in Table 1.

Table 1. Profit Simulation Results (0.29 Ha Case Study)

Category	Parameter	Value	System Analysis / Note
Productivity	Land Area	0.29 Ha	-
	Tree Population	377 Trees	Density: ~1,300 trees/ha (Meets Ideal Standard).
	Yield per Tree	4 kg Cherry	Equivalent to ~0.8 kg Greenbean/tree (Ratio 5:1).
	Est. Harvest	301.6 kg Greenbean	Total production for 1 season.
Financials	Total Revenue	IDR 30,160,000	Sales Target: Greenbean @ IDR 100,000/kg.
	Total Capital	(IDR 10,860,000)	Est. Costs (Fertilizer, Care & Harvest Labor).
Profitability	Seasonal Profit	IDR 19,300,000	Net profit for one season (1 year).

	Monthly Income	IDR 1,608,333	Equivalent monthly wage.
Feasibility	UMK Malang 2025	IDR 3,553,530	Regional Minimum Wage benchmark.
	Status	⚠️ Warning	Income is ~55% below the standard living wage.

Reception of the IoT Introduction

The IoT component of the program was explicitly introduced. No practical IoT installation has been attempted in the field, nor have any technical skills beenassessed. Nevertheless, the session generated a lively discussion.

Before the IoT session, very few participants had heard the term “Internet of Things After the lecture and demonstration, participants described IoT in their own words as“devices with sensors that can send data automatically” or “machines that can report temperature and humidity to our phones.”

Several participants suggested possible future applications, such as:

a. Monitoring the temperature and humidity of drying areas for coffee or other agricultural products.
b. Checking storage room conditions to reduce the risk of mold or spoilage.
c. Simple digital measurement tools can be used as the first step towards more advanced IoT-based systems.

Because the IoT content was positioned as an introduction only, the immediate outcome was best described as increased awareness and curiosity rather than changes in practice. This is appropriate for a first-stage community service program and provides a basis for more technically focused follow-up projects. The documentation of the material presentation for the IoT Introduction is shown in Figure 5.

Figure 5. Introductory session on IoT, showing the demonstration of a simple sensor prototype to participants.

Role of International Collaboration

The involvement of a Malaysian partner added value in two main ways:

1. Content Enrichment
   a. The Malaysian lecturer shared examples of small-scale agribusinesses in Malaysia that already use simple digital tools and sensor-based monitoring.
   b. These comparative stories helped the participants see that the challenges they face in Plaosan Village are similar to those in other countries and that gradual technological adoption is possible.
2. Participant Motivation
   a. Participants expressed pride and enthusiasm that their village was the site of an international collaboration.
   b. This symbolic recognition may increase their motivation to continue engaging with digital tools and participate in future programs.

International collaboration, therefore, contributed not only to the technical content but also to the program's perceived prestige and motivational atmosphere. The documentation of the material presentation by Malaysian lecturers is shown in Figure 6. Agroup photo of Indonesian and Malaysian lecturers, MSME participants, and village officials in Plaosan Village is shown in Figure 7.

Figure 6. The material presentation by Malaysian lecturers

Figure 7. Group photo of Indonesian and Malaysian lecturers, MSME participants, and village officials in Plaosan Village.

Discussion of Results

Upon entering the data, the website generated a side-by-side comparison of the total estimated production, gross revenue, total operational costs, and net profit for the selected price scenario. This visual representation elicited a strong positive response from the participants, facilitating deeper cognitive engagement with their business metrics. First, the participants noted that they had never previously encountered such a transparent visualization of profit, which allowed them to instantly distinguish between high-revenue and high-profit outcomes. Second, the simulation revealed a critical financial insight: a marginal increase in selling price does not automatically translate to significant profit growth if accompanied by a proportional rise in production costs, such as labor or processing fees. Finally, the tool's interactive nature empowerse farmers to conduct "what-if" analyses, enabling them to test various pricing strategies and market conditions before committing to a final sales decision. This shift from intuitive guessing to evidence-based simulation marks a significant step in the educational journey toward professional agribusiness management.

After the explanation, the farmer realized that “Cash Received” is not “Profit,” but when labor costs are included in the calculation, their actual net income creates a deficit relative to the Malang Regency Minimum Wage (approx. IDR 3.55 million in 2025). While the “Warning?” feature motivated farmers to consider selling Greenbean rather than Cherries (which offer faster cash but lower margins) to maximize their limited yield. These observations suggest that even without a formal quantitative evaluation, the website helped participants think about their businesses in a more structured way. The design proved sufficiently user-friendly; most difficulties observed were related to typing numbers on small smartphone screens and unfamiliarity with using forms rather than the website's layout,

The Challenges

The implementation of this digital transformation program revealed several structural and behavioral challenges while concurrently uncovering significant opportunities for future development in the Plaosan coffee sector. The challenges we face include the following:

1. Device and connectivity constraints, although smartphone penetration is high, the technological infrastructure in rural Wonosari remains uneven. Not all participants possessed up-to-date smartphones capable of running modern web applications smoothly. Furthermore, Internet connectivity in the highland terrain of Mount Kawi is often unstable, with download/upload speeds fluctuating significantly. This connectivity gap limits the farmers' ability to use the 'Hitung Profit' website in real-time while in the field, forcing them to rely on delayed data entry when they return to areas with better signals (e.g., the village hall or WiFi spots).
2. Varied Digital Literacy The gap in digital proficiency among the participants was substantial. While younger farmers adapted quickly, older participants struggled with basic navigation, such as using browsers, filling out digital forms and interpreting validation errors in numeric input fields. Some required individual step-by-step assistance for simple actions Shuch as deleting or correcting a typo. This suggests that the "User Interface" (UI) for agricultural tools must be designed with extreme simplicity, perhaps incorporating voice commands or visual icons to bypass text-heavy inputs**.**
3. Many MSMEs are accustomed to “mental accounting,” in which business expenses and household funds are mixed and labor costs are ignored. Changing this habit requires more than just a tool; it requires cultural shift. Without persistent reminders or immediate incentives, there is a risk that farmers will revert to making quick decisions based on “gut feeling” rather than performing the systematic calculations offered by the profit website.

CONCLUSION

This community service program in Plaosan Village demonstrates that a simple profit website, combined with an introductory IoT session, can serve as an effective starting point for digital transformation among MSMEs, even without formal quantitative evaluation instruments such as pre- and post-tests. The main conclusions are as follows:

1. The profit website enabled participants to calculate potential harvest, revenue, and profit more systematically than their previous manual approaches and explore different selling-price scenarios.
2. Facilitator observations and participants reflections suggest a clearer understanding of fundamental business concepts and the value of data-informed decision-making.
3. Altough the introduction Of Iot waslimited to conceptual explanations and demonstrations, issuccessfully raised awareness and curiosity about potential sensor-based monitoring applications in production and storage.

4. International collaboration with a Malaysian university strengthened the program academic quality and offered participants comparative insights that can inspire further innovation in their local MSME practices.

Further work is recommended to (a) provide follow-up mentoring on the routine use of the profit website, (b) enhance the application with features such as historical data storage, and (c) design small, realistic pilot projects to implement IoT-based monitoring in ways that match local needs and resource constraints.

Funding Statement

This community service program and the development of the profit website were funded by the Asia Malang Institute of Technology and Business, Indonesia.

Ethical Compliance

All procedures involving human participants followed the ethical standards of the authors' institutions and local regulations. The Participation of MSME owners and village officials was voluntary. The program objectives and the nature of the activities were explained to all participants at the beginning of the event, and verbal informed consent was obtained from all participants. No sensitive personal data were collected, and field notes were handled anonymously.

Data Access Statement

No structured quantitative datasets (such as test scores) were collected in this program. Qualitative materials consisted of anonymized facilitator field notes and summarized participant feedback. These descriptive materials are available from the corresponding author upon reasonable request, subject to ethical and privacy considerations.

Conflict of Interest declaration

The authors declare that there are no conflicts of interest related to the implementation of this community service program or the preparation of this manuscript.

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