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UTILISING FAILURE MODE AND EFFECT ANALYSIS AND THE KANO MODEL FOR INDUCTION STOVE PERFORMANCE IMPROVEMENT DURING INDONESIA'S ENERGY CONVERSION PROGRAM

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A B S T R A C T

In 2022, the Indonesian government, through the Indonesia State Electricity Company (PT. PLN), launched a program to shift from gas to electric induction stoves. This study analyzed induction stove failures, using data from 241 participants via WhatsApp Group (WAG) feedback. This research was combining Failure Mode and Effect Analysis (FMEA) and the KANO model to analyzing those failures and proposing the improvement. The failures that be prioritized for improvement were the monitor screen was off, the electricity was suddenly off, the stove went off when using the boiling function and the installation was inconvenient. Improvements were proposed to the program team, the stove producers and the community. This research finding offers insight for researchers and practitioners, namely enriching FMEA and KANO model integration for electric household appliances. These research findings also provide information on the use of induction stoves by the community for product improvements in subsequent programs.

1. INTRODUCTION

The development of technology enables the emergence of various innovations, including cooking equipment, specifically stoves. Currently, most Indonesian households involve liquefied petroleum gas (LPG) stoves. The LPG consumption in Indonesia increased yearly until it reached 8.2 million tons in 2022 (Adi, 2022). The Indonesian government provides subsidies for the use of 3 kg canister LPG to the low-budget society in Indonesia for cooking activities; however, in implementation, impoverished and middle-income communities received this subsidy (al Irsyad et al., 2022), weakening Indonesia's financial state (al Irsyad et al., 2022; Hakam et al., 2022) because the raw materials, *butene and propene*, are still being imported (Hakam et al., 2022).

On the other hand, Indonesia has surplus electricity reserves, which can be used for community activities. The Electricity Supply Business Plan shows that 21,482 MW of electricity will be generated in the Java-Bali area in 2021–2030 (PLN, 2019). Therefore, the Indonesian government, through the Indonesia State Electricity Company (PT. PLN), has implemented a pilot project for an induction stove conversion program. This program aims to replace 3 kg canister LPG stoves

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with electric induction stoves. The participants have been provided with a program package comprising a two-burner induction stove and its utensil, free electricity installation and power increase and a special electric rate.

Two regions of Indonesia, namely Surakarta in Central Java and Denpasar in Bali, were selected for the implementation of this program in 2022. This program started in Surakarta with 1,000 program participants. During this program, PT. PLN performed monitoring activities by forming a *WhatsApp* Group (WAG) for each participant's program sub-district to collect feedback about the experience of using induction stoves. During the 6-month program implementation period, this pilot project received positive (66%),negative (28%) and neutral (6%) feedback. The positive responses expressed users' agreement regarding the ease of activities using induction stoves. The users that provided tepid responses expressed appreciation for the gift, but because they have not yet applied the induction stove, they still cannot provide more in-depth feedback. However, several user concerns hinder the use of induction stoves. Common problems include electrical installations, induction stove errors, stove barcodes going off and induction stoves turning off due to overheating; thus, 40% of the participants stated that they do not intend to substitute for an induction stove.

To anticipate that program participants will not be increasingly reluctant to transform to induction stoves to support the long-term energy transition program, further studies are needed to consider the obstacles of the pilot project, especially in induction stove operations. Complaints submitted by program participants potentially become the basis for evaluation to ultimately improve the quality of the induction stove conversion program so induction stoves can be broadly used. This research integrated failure mode and effect analysis (FMEA) and the KANO model to perform this analysis.

FMEA can systematically evaluate processes to identify potential failure modes for each system component, the causes of failure and their potential impact on the system and parts that require change or repair (Ozturk et al., 2023). The various failures identified by FMEA are analysed using the KANO model to improve the induction stove for a more sustainable implementation that could meet community expectations. The KANO model is used to categorise and prioritise users' needs and provide guidance for product development (Allwin et al., 2023). Although many researchers have widely applied the combination of FMEA and the KANO model to improve product quality (i.e Madzík &Kormanec, 2020; Shahin, 2004; Tang et al., 2021), it is novel in induction stove products, especially in energy conversion programs. The induction stove energy conversion program has been relatively new performed in developing countries, including Indonesia. Therefore, this research offer interesting insight and fresh analysis of experience induction stove implementation and its failure usage by the developing region community.

This research aims to improve the performance of induction stove products by integrating FMEA and the KANO model to support the implementation of the induction stove conversion program in Indonesia. The research targets include identifying and classifying induction stove product failures and providing suggestions for improvements to mitigate induction stove performance failures in the subsequent conversion program. Our study can aid in realizing scientific contributions in quality systems, especially enriching the integration of FMEA and the KANO model to improve product quality. Besides, our study may be beneficial for program stakeholders, including induction stove manufacturers, to improve the performance of induction stoves.

2. LITERATURE REVIEW

2.1 Failure Mode and Effect Analysis

FMEA is used to identify failures and the risk priority number (RPN) to rank failure modes (Simiele et al., 2023). This method uses root cause analysis to prevent the loss from recurring (AIAG, 2019). Failure analysis can be performed via two actions: by using historical data to analyse data for similar products or services, data warranties, user complaints and other related information and by performing inferential statistics, mathematical modelling, simulation and concurrent and other reliability engineering (Stamatis, 2003).

There are three factors to determine failure priority, namely Severity (S), event or occurrence (O) and detection (D). Severity is the seriousness of the impact of failure. Occurrence is the failure frequency, and Detection is the ability to detect failure (Besterfield et al., 2012; Čička et al., 2022). There is a direct relationship between effect and Severity. For example, if the impact is critical, the Severity value is high and vice versa (Gupta, 2023). Furthermore, Occurrence is the adjusted assessment value with an estimate of the frequency and cumulative number of possible failures (Gupta, 2023; Wang et al., 2022) and detection is a measure of the ability to monitor or control potential losses (Gupta, 2023). These three criteria (S, O and D) are multiplied to determine the RPN of product failures that need to be prioritised (Stamatis, 2003).

2.2 KANO Model

Noriaki Kano (1984) developed the KANO model to classify product and service attributes based on their ability to meet user needs. KANO model differentiates product criteria into three categories, *must-be*, *one-dimensional* and *attractive*, based on user satisfaction (Kano, 1984). Along with developments related to user satisfaction, other criteria emerged, namely *indifferent requirements*(Madzík & Kormanec, 2020).

The *must-be* criteria are competitive factors, which, if present in a product, do not increase customer satisfaction, but users would no longer be interested in the product if not fulfilled. So, it can be interpreted that this is the primary criterion for a product.

The *one-dimensional* criteria in which user satisfaction is directly proportional to the level of the requirement met. The fulfilment level increases as the level of user satisfaction increases. The *attractive* requirements are product criteria that significantly influence the level of user satisfaction. Meeting these criteria impacts more satisfaction. However, if these criteria are not met, this will not cause user dissatisfaction. Lastly, the *indifferent criterion* does not change user satisfaction and dissatisfaction; thus, sometimes it can be ignored (Kano, 1984; Madzík & Kormanec, 2020).

In addition to improving product quality based on failure identification, the KANO model categorises and prioritises user needs and provides guidance for product development (Allwin et al., 2023). The KANO model measures the relationship between satisfaction/dissatisfaction and the fulfilment of product attributes (Madzík & Kormanec, 2020).

2.3 Integration of FMEA and the KANO Model

The FMEA and KANO model integration method was initially used to determine priority failures in the service quality of a travel agency. This integration method is not limited to exceptional cases and can be applied in any organisation for any service or product (Shahin, 2004). In addition, this integration is used to determine quality attributes in the case studies of airline services (Puspitasari et al., 2018) and retail store logistic centres (Tang et al., 2021). Over time, the integration of FMEA and the KANO model was also used to determine customer needs in a smartphone product (Madzík & Kormanec, 2020).

This integration can cover the limitation of FMEA; that is, the level of Severity, determined based on only the organisation's point of view, disregarding that of the user (Tang et al., 2021). Integrating FMEA with the KANO model creates a customer-oriented method. In addition, this integration allows the team to detect the most dangerous failure types based on user reactions (Madzík & Kormanec, 2020).

Technically, the KANO model is integrated with the severity level in FMEA to obtain a new formula for calculating the RPN, called RPN_0. Besides the changes in the RPN, this method also considers the correction ratio (Cr) value, which can be used to determine critical failures for improvement based on the target occurrence criteria (Madzík & Kormanec, 2020; Tang et al., 2021). This shows that the integration of FMEA and the KANO model improves the capability of the FMEA method at a strategic level.

3. METHODOLOGY AND DATA

This research involved a pilot project case study in Surakarta, the first city in Indonesia where induction stoves have been implemented in an energy conversion program. The data were collected by identifying induction stove conversion program feedback from the pilot project information centre WAG. This WAG information centre was formed as a communication medium for program participants with PT. PLN (representative of the Indonesian government, implementer of the conversion program). Through this WAG, PT PLN monitored the use of induction stoves and 241 complaints and feedbackwere collected from May to November 2022. Tab. 1 shows the types of induction stove failures, with the frequency ofcomplaints during that period.

Table 1. Induction Stove Failures

No.	Failure Type	Frequency
1	Sudden power failure	94
2	The stove turns off while boiling the water	28
3	The monitor screen is off	25
4	Installation place is not convenient	24
5	Undetected induction material utensil	16
6	One stove does not work	13
7	Stove short circuit	12
8	The information on the screen is not current	10
9	The barcode does not appear	8
10	Open circuit sensor on coil plate, temperature sensor on coil not appropriately connected and temperature sensor on ring not working	5
11	Loud fan noise	3
12	The supply voltage is too low/lower than 160V, a socket is loose and the line diameter is too small	2
13	The temperature sensor on the IGBT is not connected properly	1
TOTAL		241

These induction stove failure data were then processed using the FMEA and KANO model integration methods. This research refers to the integration stages of FMEA and the KANO model from Shahin (2004), which was also cited by many researchers (i.e. Madzík and Kormanec, 2020; Tang, Chen and Lin, 2021). These stages comprised determining the occurrence and detection rates of each failure, determining the KANO category value of each loss, calculating the RPN as the result of the integration of FMEA and the KANO model, calculating the Cr value, determining priority failure and identifying the causes and lastly providing suggestions for improving the quality of the induction stove conversion program. These stages are explained as follows:

3.1 Stage 1: Integration of FMEA and The KANO Model

The Occurrence rank (O) is a failure frequency rate. There are 10 (ten) occurrence levels, from 1 to 10, where the higher the frequency of a failure, the higher the Occurrence level (Tab. 2).

Table 2. Occurrence Rank Determination Reference

Score	Rank	Description	Failure Rate
1	None	Failure is unlikely	<0,02%
2	Remote	No failure occurs	0,02%
3	Very low	Relatively few failures	≤0,2%
4	Low	Not uncommon	≤1%
5	Moderate	Occasional failures	≤2%
6	Likely	Frequent failures	≤4%
7	High	Failure is typical	≤6%
8	Very High	Repeated failures	≤8%
9	Severe	Failure is almost inevitable	≤10%
10	Extreme	Failure is normal	>10%

Source: (Gupta, 2023; Wang et al., 2022)

Furthermore, the detection rank (D) comprises 10 levels, where the more complex the possibility of catching a loss, the higher the detection level (Tab. 3). This study held discussions with electrical experts on the pilot project of the induction stove conversion program in Indonesia to determine this rank.

Table 3. Detection Rank Determination Reference

Score	Description
1	Severity is insignificant; The effect does not affect product quality; Users may not be aware of this failure
2	The possibility of this failure is minimal
3	The case of this failure is rarely
4	The probable cause is deficient; Prevention methods could be the cause
5	The likely cause is common; Prevention methods could be the cause
6	The possible reason is moderate; Prevention methods could be the cause
7	The probability of the cause is high; Ineffective prevention methods; Recurring causes
8	The probability of the cause is relatively high; Ineffective prevention methods, Recurring causes
9	The probability of the cause is relatively very high. Ineffective prevention methods
10	The probability of the cause is relatively very high; Prevention methods do not work

Source: (Gupta, 2023)

3.2 Stage 2: Determining the KANO Category Value of Each Failure

The second step is to determine the KANO category in which failures are classified based on *must-be (M), one-dimensional (O), attractive (A) and indifferent (I)*. Each category has a KANO category value (k), which describes the level of user satisfaction when failure occurs. This classification is determined by integrating the severity level value of each loss (Tab. 4). In this study, the failure's Severity is related to the participants' intension to use the induction stove. If a failure causes a low induction stove use, the loss has a high severity value.

Table 4. KANO Category Determination Reference

Score	Severity Rank	KANO Category	k Value
1	None	*Attractive*	−1
2	Remote	*Attractive*	−1
3	Very low	*Indifferent*	0
4	Low	*Indifferent*	0
5	Moderate	*Indifferent*	0
6	Likely	*Indifferent*	0
7	High	*One-dimensional*	+1
8	Very High	*Must-be*	+2
9	Severe	*Must-be*	+2
10	Extreme	*Must-be*	+2

Source: (Shahin, 2004)

This classification was performed by conducting a focus group discussion (FGD) with the project team, including the head of the pilot project, technician's supervisor, information technology team and surveyors. In addition to the FGD, the pilot project progress report was also used as the supporting information for the KANO category classification.

3.3 Stage 3: Calculating the Risk Priority Number

The third step is to calculate the RPN value. Integrating the KANO model in the FMEA method, results in different RPN outputs, namely RPN_0 and RPN_{Tg}. In the new RPN formula, Severity is combined with the KANO model, where the Severity of failure has a relationship with user dissatisfaction and the product performance has a relationship with the occurrence rate of a loss. Therefore, the Severity is replaced with Equation 1, where S stands for Severity, D and O stand for detection and occurrence rank and k denotes the KANO category value. The Severity of this study is formulated as follows:

$$S = DO^k \quad (1)$$

The difference in the formulas for RPN_0 and RPN_{Tg} is in the occurrence value, where RPN_0 as the current RPN value uses O_0 or the existing occurrence value and RPN_{Tg} as the targeted RPN uses O_{Tg} or the target occurrence value. O_{Tg} is smaller than the smallest O_0 value. In this study, the lowest value for O_{Tg} was used, which is 1, because the occurrence value ranged from 1 to 10 (Besterfield et al., 2012; Ravi Sankar & Prabhu, 2001). The RPN_0 and RPN_{Tg} were calculated using Equations 2 and 3 as follows:

$$RPN_0 = D^2 {O_0}^{k+1} \quad (2)$$

$$RPN_{Tg} = D^2 {O_{Tg}}^{k+1} \quad (3)$$

3.4 Stage 4: Calculating the Corection Rasio (Cr)

The fourth step is to calculate the Cr value. Cr or the correction ratio results from the integration of FMEA and the KANO model, which is used to understand the difference between the current quality and the targeted quality. After RPN_0 is calculated, Cr can be determined based on the estimated target (RPN_{Tg}).

Equation 4 is used to calculate the Cr:

$$Cr = 1 - \frac{RPN_{Tg}}{RPN_0}. \quad (4)$$

3.5 Stage 5: Determining Priority Failure and Identifying its Causes

The fifth step is to determine priority failure improvements, which are determined based on the highest Cr value, followed by identifying the causes of priority failures. These causes are identified using the Root Cause Analysis (RCA).

3.6 Stage 6: Determining Quality Improvement

The last step is to propose suggestions for improving the quality of the induction stove. Quality improvement suggestions are given based on the root causes of most failures in the induction stove. These quality improvements are provided to various parties involved in the induction stove conversion program, such as the project team, PT PLN and the government, also stove manufacturers and the community.

4. RESULTS AND DISCUSSION

Using the methodology described earlier, this research determined the O_0 (based on frequency), O_{Tg}, D and k values (based on Severity). These numbers were then used to calculate RPN_0 (Equation 2), RPN_{Tg} (Equation 3) and Cr (Equation 4). The Cr value indicates the main priority for improvement; thus, a higher Cr value indicates a higher-priority failure for quality improvement.

In this research, five prioritised failures with the highest Cr value above 0,9 were chosen, namely monitor screen in induction stove is off; sudden power failure; stove turns off while boiling water; induction stove installation place is not convenient; undetected induction material utensil. Tab. 5 shows the resume of FMEA and KANO model integration.

Table 5. RPN and Cr Values

No	Failure Type	O_0	O_{Tg}	D	KANO Category	k	RPN_0	RPN_{Tg}	Cr
1	The monitor screen is off	10	1	5	M	2	25000	25	0,999
2	Sudden power failure	10	1	7	M	2	49000	49	0,999
3	The stove turns off while boiling the water	10	1	2	M	2	4000	4	0,999
4	Installation place is not convenient	9	1	1	O	1	81	1	0,988
5	Undetected induction material utensil	8	1	2	O	1	256	4	0,984
6	The information on the screen is not current	7	1	6	I	0	252	36	0,857
7	Stove short circuit	7	1	7	I	0	343	49	0,857
8	One stove does not work	7	1	8	I	0	448	64	0,857
9	Open circuit sensor on coil plate, temperature sensor on coil not appropriately connected and temperature sensor on ring not working	6	1	7	I	0	294	49	0,833
10	The barcode does not appear	6	1	6	I	0	216	36	0,833
11	The temperature sensor on the IGBT is not connected properly	4	1	7	A	−1	49	49	0,000
12	The supply voltage is too low/lower than 160V, the socket is loose and the line diameter is too small	4	1	4	A	−1	16	16	0,000
13	Loud fan noise	5	1	3	A	−1	9	9	0,000

M=Mustbe; O=OneDimensional; A=Attractive; I=Indifferent

Based on calculations (Tab. 5), five induction stove failures had real RPN_0 values above RPN_{Tg}, meaning the failure risk level exceeded the target. Three of these failures were included in the must-be category, indicating that the three basic features of the induction stove were not fulfilled, potentially disappointing the users. Two priority failures fell into the one-dimensional category: installation accuracy and the utensil detection sensor on the stove. This means that if these two failures can be overcome, the user satisfaction in this energy conversion program can be increased.

The RCA is used to explore the causes of these failures, which are then classified into three aspects of problem sources: product, usage and electrical installation. Tab. 6 presents the causes and problem sources of failure. Based on the RCA (Tab. 6), the performance of the induction stove product is not optimal because of the damage of several components and parts, namely the circuit board, fan, coil and cables, indicating that these parts are critical. Overheating is a challenge for electricity-based household cooking equipment (Ichwana et al., 2023). Induction stove manufacturers must pay attention to these parts to prevent failure because this aspect is included in the must-be feature category.

Table 6. Causes of Prioritised Failures

Failure Type	Cause Type	Root Cause
The monitor screen is off	Product	Damage to the circuit board
		Damage to the fan
		Damage to the coil
		Damage to the cable
	Usage	The stove is not yet connected to electricity
		The monitor screen generation button has not been pressed
		Generating button covered with dirt
		The stove overheats because the stove's support legs are not installed
		Air inlets/outlets covered with dirt
Sudden power failure	Installation	Short-circuited
		Electric connection exposed to water
		Loose electrical socket
	Usage	User poorly understands the concept of electrical power increase The s
Stove turns off while boiling the water	Product	The safety component shorted out stove is damaged
	Usage	The timer feature is not set
		The stove overheats because the stove's support legs are not installed
		Air inlets/outlets covered with dirt
		The stove fan stops working
		The cookware/utensils used are not ferromagnetic
		Cookware/utensil is not in the stove sensor area
Installation place is not convenient	Installation	Limited home electricity connection
		The installation cable has not sufficiently reached the kitchen location
Undetected induction material utensil	Product	Damage to the circuit board
		Damage to the fan
		Damage to the coil
		Damage to the cable
		Stove program error after upgrade
	Usage	Cookware/utensil is not in the stove sensor area
		The cookware/utensils used are not ferromagnetic
		No cooking utensils on the stove
		Dirty stove surface

The next aspect that causes failure is related to electrical installation errors, which result in short circuits, improper installation of electrical sockets and the installation of cables that are not long enough. Electrical installation is an essential aspect of the continued implementation of the induction stove program (Gould et al., 2018). This factor is also a must-be criterion that needs to be of great concern to program organisers (Jürisoo et al., 2018).

The next source of failure is related to usage, which is one of the root causes of the induction stove failure. For the current users, induction stoves are new technology. Previously, the participants used a 3 kg canister LPG stove for daily cooking activities. This change has resulted in several usage errors for users who may not be used to it. This condition is expected because misuse and the burden of electricity costs are the basis for barriers to using this new technology (Gill-Wiehl et al., 2021). Providing information, outreach and mentoring regularly, consistently and comprehensively can mitigate this potential failure (Mbungu & Kammen, 2020).

The root cause of induction stove failure and the potential impact on user satisfaction have been identified. Solutions must be formulated to mitigate losses and meet the expectations of induction stove users. This effort is needed to improve the quality of induction stove products and support the sustainability of the energy conversion program in Indonesia. The stakeholders' involvement is required to strengthen induction stove products to support long-term energy conversion programs. The role of each stakeholder in this context is determined as follows:

4.1 Proposed Improved for PT PLN

PT. PLN, as the government representative implementing the energy stove conversion program, plays a significant role as a provider of electrical energy sources. Regarding the origin of induction stove failure, PT PLN must be concerned about installation problems. To ensure the accuracy of electrical installations for users of induction stoves, a standard operating procedure (SOP) for installation preparation needs to be followed: (1) determine cable length requirements to the user's cooking area, (2) provide electrical sockets that comply with standards and (3) ensure that electrical power has been upgraded to mitigate short circuits and operational disruptions of the induction cooker when used. The SOP is crucial in implementing a new program or technology in an organisation or region (Hoefsmit et al., 2023; Wahab et al., 2023).

Besides installation, as a program implementer, PT PLN must provide outreach, information and education to the public regarding induction stoves in a more structured and comprehensive manner. PT PLN can collaborate with schools and universities to organise these activities. The involvement of regional stakeholders, such as sub-districts with PT PLN, is also suitable for getting program participants used to induction stoves. This activity is a solution to popularise the induction stove program, get people habitual to using induction stoves and reduce concerns about implementing new programs or technologies (Gill-Wiehl et al., 2021; Mbungu & Kammen, 2020).

4.2 Proposed Improvement for Induction Stove Producer

In this conversion program, during six months of implementation, failures in the performance of induction cookers were identified, which caused user inconvenience. This is caused by the parts or components of the induction cooker that do not perform optimally, such as induction coils, circuit boards and noisy fans that cannot prevent overheating. The failure category is also included in the must-be classification, which impacts users who feel annoyed and dissatisfied.

Material evaluation and stricter product inspection controls may be employed by induction stove manufacturers. The quality control of components for electronic products is performed during the production process so that the packaging and mode of transportation for delivery need to be determined (Ding et al., 2019; Ren et al., 2023).

Furthermore, induction stove manufacturers must publish an operational pocketbook to complement the work instruction book. The target is that induction stove users are interested in reading to understand the use of induction stoves. Users want a furnace that provides complete instructions on using it correctly, making it easier for users to minimise errors in service (Gill-Wiehl et al., 2021).

Induction stove manufacturers are also highly suggested to develop a service centre to handle complaints, damage and guarantees for induction stoves. Ease of repair and service has been shown to increase user satisfaction (Afshar-Bakeshloo et al., 2021; Feng et al., 2021) and has become part of the dimensions of product quality (Garvin, 1984).

4.3 Proposed Improvement for Sub-District Regional Administrator

Regional stakeholders can also play a role in mitigating failures, primarily related to the operational use of induction stoves. Regional stakeholders around the program participant area can collaborate with PT. PLN to assist in using induction stoves. Periodic assistance is also needed to hone the induction stove habit. The involvement of local community leaders can increase motivation to use new technology according to work instructions (Aczel et al., 2022; de Moura et al., 2022).

Several sub-district programs are also recommended to collaborate with PT PLN to popularise induction stoves. Sub-districts can also act as an information centre for residents participating in the induction stove conversion program. The more socialised a new program or technology is in society, the closer and faster people will master the technology (Gupta, 2023).

5. CONCLUSIONS

This study answered the research problems formulated on a case study in Indonesia's energy conversion program pilot project. First, this study succeeded in integrating two methods, the FMEA and KANO model, for identifying 13 (thirteen) types of failure, which were then chosen as the top five highest correction ratios that showed the most critical loss. Those failures were grouped into three causes: product functional failure, electrical installation and usage error. Second, based on those failed findings, this research formulated suggestions for each stakeholder directly involved with this induction stove conversion program for long-term successful implementation. Those suggestions and recommendations potentially support failure mitigation and improve induction stove product quality for the subsequent implementation project.

However, this study has limitations. First, this research only took feedback data from induction stove users via the WAG during the first six months of implementation. This condition only reflects product failures in the initiation phase of program implementation. Exploration with a more extended deadline, for example, 12 months of implementation, needs to be performed for further research opportunities that can accommodate this weakness to obtain more decadent and more varied feedback data.

The second limitation of this study is that the feedback was only based on WAG communication. This condition may result in bias and errors in user failure reports because users may not be detailed in submitting complaints to WAG. In-depth exploration by conducting direct surveys with users has the potential to fill this gap, which is highly recommended for further research.

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