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Transforming Tofu Quality Control: Integrating Statistical Process Control, Ishikawa, and Interpretive Structural Modeling for Superior Outcomes

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Abstract

In a highly competitive market, maintaining high product quality is essential for maintaining customer satisfaction and loyalty. Producers are famous in East Java and face the challenge of ensuring consistent quality products through strict production processes. Know that as easy products broken and soft, needy control of careful quality to meet hope consumers about freshness, texture, and quality in a way whole. Although traditional control methods often fail to overcome the production complex that causes a disabled product. This research proposes integrating Statistical Process Control (SPC), Ishikawa diagrams, and Interpretive Structural Modeling (ISM) to improve control quality. SPC makes it possible to monitor and control production processes in real-time, identify deviations, and repair deviations. However, the SPC limitations include a focus on quantitative data and post-incident detection problems. To overcome root problems, the Ishikawa diagram categorizes the reasons for potency as material, machine, method, power work, and environment. ISM prioritizes action repair based on impact and relationship. Approach This integrated approach provides comprehensive solutions to improve the quality of knowledge. In this study, the control process quality was evaluated using SPC, the cause of defects was identified using Ishikawa diagrams, and priority action repair was performed via ISM. Findings show that SPC directly effectively monitors process control, the Ishikawa diagram identifies main defects, and ISM prioritizes impactful action improvements, emphasizes excessive additions to subtraction materials, and improves health workers' and mixing process material standards. Approach integrated possible identification of additional problems and improved the quality strategic makes a significant contribution to enhancing product quality knowledge.

Keywords : Statistical Process Control (SPC), Ishikawa diagram, Interpretive Structural Modeling (ISM) , defects , control quality; JIEHIS

INTRODUCTION

Tight market competition currently demands companies to look after quality, high quality products, maintain customer satisfaction, and maintain customer. Producers are famous in East Java and face the challenge of ensuring the consistency and quality of products through the implementation of strict production processes. According to Kamizake et al., (2018), a product is easy to break and soft, and it needs to be meticulously controlled to meet consumer expectations regarding freshness, texture, and quality. In their research, Colledani et al., (2014) stated that traditional methods, although effective, often fail to overcome complex problem production and cause products to be disabled. Therefore, it is necessary to identify the right solution to overcome this challenge is useful repair quality product. One effective way to repair a quality product is to implement control more quality sophisticated and integrated (Zaloga et al., 2020)

Thus, Tsenev, (2021) argued that one method to improve repair quality products is to use statistical process control (SPC) and Interpretive Structural Modeling (ISM) methods (Dahlan et al., 2023). This approach is not the only possible way to monitor and control production processes; it is also helpful to understand and organize connections between factors affecting product quality (Attri & Grover, 2017). This is in line with research (Zan et al., (2019) who stated that SPC allows companies to monitor and control the production process in a way that statistics, identifies, and corrects deviations in real time. Likewise, Skorupińska et al., (2024) stated that using SPC, a company can guard consistency in products and reduce product variability.

However, although SPC is effective for monitoring and evaluating the production process, which is within control limits, this method has several limitations. SPC focuses especially on detection and correction deviation after occurrence and may not always prevent problem quality (Alves De Melo et al., 2022). Additionally, SPC is more effective in managing quantitative data and possible not enough capable handle factors qualitative or connection complex factors between variables that influence the production process (Zan et al., 2019). To overcome these limitations, are necessary approaches for adding possible additions to obtain deeper and more structured. The Ishikawa diagram or fishbone diagram is used to identify factors that cause defects, such as problems with raw materials, methods, labor, the environment. (Wittenberger & Teplicá, 2024). This diagram helps to break down the various possible causes of product defects and provides a more comprehensive picture of the factors that contribute to product defects (Knop & Gejdoš, 2024).

In addition, an approach is required that can determine priorities for corrective actions effectively. One of the trusted methods can provide this solution is Interpretive Structural Modeling (ISM) (Kazancoglu et al., 2021). ISM is believed capable of compiling connections between variables that influence the production process and determining actions that are most impactful. With ISM, the company can understand complexity interaction between factors and designing more improvement strategies effectively (Veltmeyer & Mohamed, 2017). Approach integrated system that combines SPC, Ishikawa diagram, and ISM makes it possible for producers to identify root problems more effectively and take strategic steps to improve quality products. By using the strengths of each method, a company can achieve more comprehensive control over quality and is responsive to complex production challenges.

Therefore, this research will integrate a third method. This is the first aim to evaluate the control process quality using the SPC method, second, analyze the reason for damage product using the Ishikawa diagram, and third, determine priority action repair using the ISM method. This study will give comprehensively and step-by-step description of repair quality products. Therefore, research is expected to make a significant contribution to increasing quality product knowledge by applying an approach that is more integrated, comprehensive, and effective.

This research consists from four parts main. Section 1 explains the Background and Research Objectives. Section 2 reviews the related literature on the SPC method, Ishikawa diagram, and deep ISM increase the quality of products. Section 3, Research Methods, explains the steps involved in integrating SPC, the Ishikawa diagram, and ISM. Section 4, Results and Discussion, presents the research and analysis findings. Finally, Section 5, Conclusion, summarizes the research results and discusses possible limitations that may arise during the research process.

Integration of Statistical Process Control (SPC), Ishikawa diagrams, and Interpretive Structural Modeling (ISM). offer approach in a way comprehensive to control quality. SPC provides the quantitative data required for monitoring and control in real time, the Ishikawa diagram helps identify and organize problem quality (Pal et al., 2020), and ISM facilitates determination priority action repair based on impacts and relationships. (Dahlan et al., 2023)

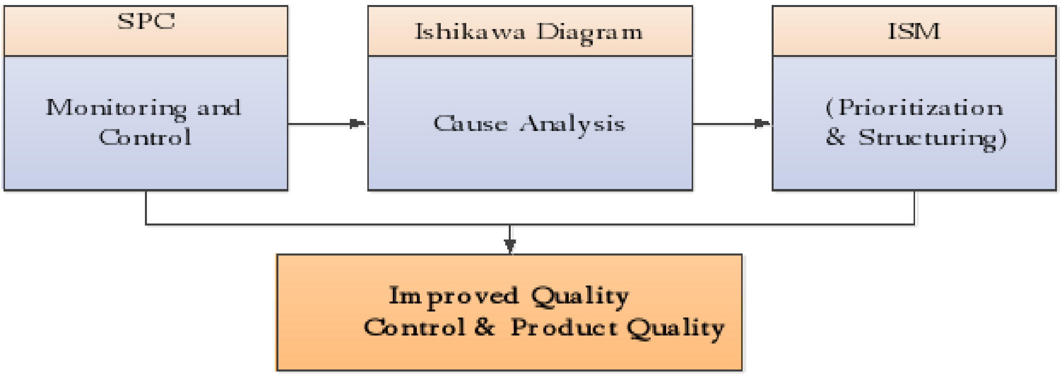

Figure 1. Integration of SPC, Ishikawa diagram, and ISM

Given diagram outlines the upgrade process quality product through series mutual relate. Following explanation in a way short:

1. SPC (Statistical Process Control) is step beginning Where process monitoring and control occurs. SPC uses method statistics to observe and manage the production process to use ensure this process operate in a way efficient and productive product quality (Wiederhold et al., 2016).

2. Ishikawa diagram (Analysis Cause), following the SPC, every identified problem led to the creation of the Ishikawa diagram, which is also known as a fishbone diagram. This tool helps identify potency reason problem with categorizing them, so makes it easier analysis and discover root reason disabled quality (Khaba, 2023).
3. ISM (Prioritization &Arrangement). after root reason identified, ISM involves making priority these causes and arrange them to create decision about where to focus effort repair. This step helps determine which problem should be overcome moreover formerly based on impact to quality.
4. Round Feedback: Connecting arrows these components show Genre information and rounds bait come back. Findings from the Ishikawa diagram gives information to SPC, so create cycle continuous monitoring and improvement.
5. Results - Improvement Control Quality & Quality Product: Final destination from the whole process is to improve control quality in process and quality whole products produced. By monitoring in a way effective, analyzing causes, and prioritization action, organization can produce products with better quality.

METHODS

This research provides description comprehensive and steps for improvement quality product know by integrating SPC method, Ishikawa diagram, and ISM. With this approach, it is expected factory know can identify and overcome problem quality with more effective and efficient, as well increase consistency and satisfaction customer to product know what is produced. As for the stages his research more details in Figure 2.

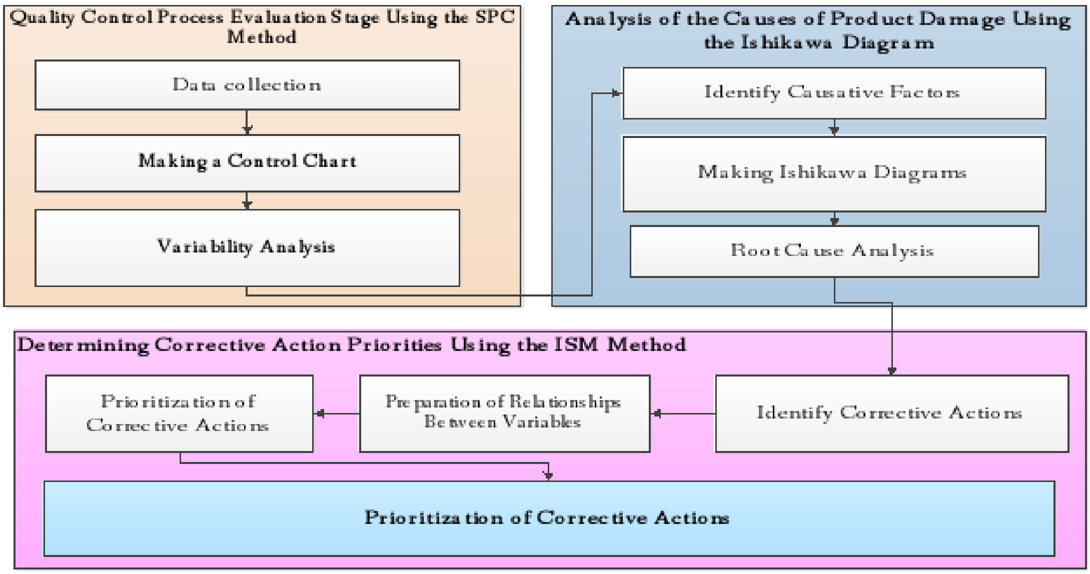

Figure 2. Stages Study

Stage 1. Evaluation of the Control Process Quality Using the SPC Method

This stage does Data collection such as: production and quality data know from factory, including important parameters like temperature, time production, materials standards, and final results. Furthermore, create a Control Map with using existing data collected for monitoring production process variability. The next stage is to carry out variability analysis by analyzing the control chart to identify whether the production process is within control limits or not. Identify deviations and anomalies in the production process.

Stage 2. Analysis Reason Damage Product Using the Ishikawa Diagram

Identify causal factors by collecting team expert for brainstorming and identifying possible factors cause damage or defects in the product knows. Furthermore, done making Ishikawa Diagrams, Wherein create an Ishikawa diagram (fishbone diagram) grouping factors reason based on category like material standard, method, energy work, machines, and the environment. with the Ishikawa diagram is carried out Deep root causes identify reason main (root) of damage product.

Stage 3. Determination Corrective Action Priority Using the ISM Method

This stage does Identify Corrective Actions Based on the results of Ishikawa's analysis, identify action possible improvements done for each reason main that has been identified. Next arrangement Relationship between variables using ISM method. Deep goals This stage is for compiling connection between variables that influence the production process. Identification interaction between variables and their impacts to quality product. This stage uses smart ISM software

Stage 4: Prioritization of Corrective Actions

This stage uses the results of the ISM analysis to determine priority action the most impactful improvements. Arrange matrix prioritize and determine necessary steps taken moreover formerly.

RESULT AND DISCUSSION

Tofu Product Quality Control

Quality control of tofu products is carried out through initial inspection of production results. This inspection aims to ensure that the tofu produced meets established quality standards and identifies any product defects. The following are general criteria for knowing which conforms to quality standards and product defect criteria:

1. Know the Quality Standards

a. Color Know

Know what meets the standards quality must own color white clean. Dull color or yellowish show exists nonconformity in the production process or use material less standard Good. Color you know must uniform white without exists stain or change striking colors.

b. Texture or Tofu Density

Know what's well must own the texture is dense and not soft. Dense texture ensure that I know it's not easy destroyed moment processed become various type dish. Texture know must Enough strong to defend the shape moment held and processed.

c. Water Rate

Internal water content know must balance, not so much and not so much A little. Too much water content tall make knows watery and lacking crunchy after processed, temporarily too much water content low make knows dry and lacking enjoyment. Know you have to own sufficient water content to maintain softness but it didn't arrive releasing water when sliced or cooked.

2. Product Defects

a. Firm Tofu, tofu with too much texture hard happens because the pressing process is too long or too much pressure tall. Tofu hard difficult to process and not fulfilling standard expected softness. Hard texture can be reducing enjoyment consumer moment consume it.

b. Soft Tofu, Soft Tofu caused by too much water content tall. Inappropriate manufacturing processes, such as less pressing or material too standard lots of water, cause know become soft. You know soft can't maintain the shape is good, easy destroyed moment held or processed and produced product less ending satisfying.

Analysis Graphics Disability Tofu Products

Chart stem show amount disability product know for two types disabled main, Hard and Soft. Every stem represents amount disability per day in One month. Frequency disability know hard tend constant every day, with some significant pea. Whereas frequency disability knows mushy similar to disability know hard, deformed know mushy also shows pattern constant, but with more fluctuations low. There is pattern that when disability know hard increased, disability know it also tends to be soft increased on the same date. This shows exists possibility factors production or material influencing standards second type disability in a way simultaneously.

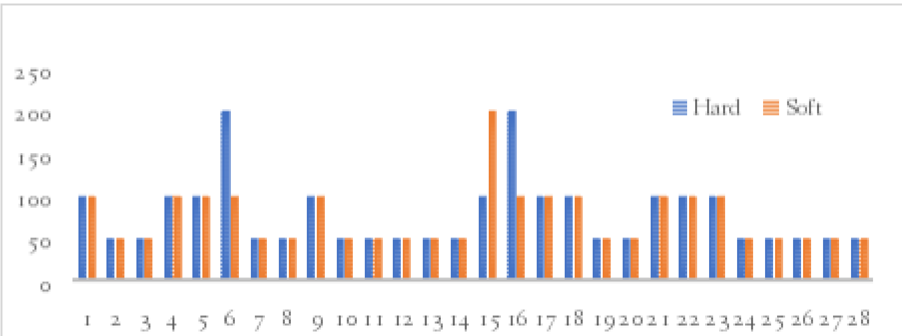

Figure 3. Number of product disabled

Figure 3. shows that although part big day production is at in control, there is a number of days with significant disable. To increase quality product, know, necessary there is investigation more carry on to factors production on dates it and implementation action appropriate corrective.

P Control Chart (P-Chart)

control chart (p-chart) is used to see is control quality at the manufacturer I know this is under control or not yet. P-charts are type chart controls used to monitor proportion disabled in a production process. The steps involved are 1) Counting percentage damage . 2) Counting line center / *Central Line* (CL). 3) Counting limit control on / *Upper Controls Limits* (UCL). 4) Counting limit control lower / *Lower Control Limits* (LCL). The calculation results can show in Table 1

Table 1 Results calculation UCL, CL And LCL

Date	Production quantity (Unit)	Type (Unit) Disabled		Number of Defective Products (Unit)	Proportion of Defective Products	UCL	CL	LCL
		Hard	Mushy					
1	1,900	100	100	200	0,04651163	0,165905	0,102138	0,002487
2	1.200	50	50	100	0,02325581	0,108703	0,102138	0,005319
3	1.200	50	50	100	0,02325581	0,108703	0,102138	0,005319
4	1.200	100	100	200	0,04651163	0,165905	0,102138	0,005319
5	1.200	100	100	200	0,04651163	0,165905	0,102138	0,005319
6	2.400	200	100	300	0,06976744	0,214199	0,102138	0,008775
7	1.200	50	50	100	0,02325581	0,108703	0,102138	0,005319
8	1.200	50	50	100	0,02325581	0,108703	0,102138	0,005319
9	1.900	100	100	200	0,04651163	0,165905	0,102138	0,002487
10	1.200	50	50	100	0,02325581	0,108703	0,102138	0,005319
11	1.200	50	50	100	0,02325581	0,108703	0,102138	0,005319
12	1.200	50	50	100	0,02325581	0,108703	0,102138	0,005319
13	1.200	50	50	100	0,02325581	0,108703	0,102138	0,005319
14	1.200	50	50	100	0,02325581	0,108703	0,102138	0,005319
15	2.400	100	200	300	0,06976744	0,214199	0,102138	0,008775
16	2.400	200	100	300	0,06976744	0,214199	0,102138	0,008775
17	1.900	100	100	200	0,04651163	0,165905	0,102138	0,002487
18	1.900	100	100	200	0,04651163	0,165905	0,102138	0,002487
19	1.200	50	50	100	0,02325581	0,108703	0,102138	0,005319
20	1.200	50	50	100	0,02325581	0,108703	0,102138	0,005319
21	1.900	100	100	200	0,04651163	0,165905	0,102138	0,002487
22	1.900	100	100	200	0,04651163	0,165905	0,102138	0,002487
23	1.900	100	100	200	0,04651163	0,165905	0,102138	0,002487
24	1.200	50	50	100	0,02325581	0,108703	0,102138	0,005319
25	1.200	50	50	100	0,02325581	0,108703	0,102138	0,005319
26	1.200	50	50	100	0,02325581	0,108703	0,102138	0,005319
27	1.200	50	50	100	0,02325581	0,108703	0,102138	0,005319
28	1.200	50	50	100	0,02325581	0,108703	0,102138	0,005319
TOTAL	42,100	2,200	2100	4,300	0.03571429	0.1383925	0.102138	0.0049813
FLAT-FLAT	150.35714	50.85714	38.10714	88.25				

Map Graphics Control P (P-*Chart*) Quality Tofu Products

Control chart (p-chart) shows proportion damage product know during One month, used for monitoring what is the production process know is at in control statistics. Component main This graph includes: Center Line (CL): Horizontal green line at the value 0.102138 which shows the percentage average damage from all sample. Limit Upper Control (UCL): The horizontal red line above at the value 0.1383925, indicates the maximum limit expected variations. Lower Control Limit (LCL): The horizontal red line below at the value 0.004981286, indicates the minimum limit of expected variation. Data Points (Proportion Damage per Day): Black line moving that shows proportion damage for each day production. Process Stability: All data points are within the upper control limit (UCL) and lower control limit (LCL), indicating that the tofu production process is within statistical control. No data point is outside the control limits.

Process Variability is the proportion of damage that varies from day to day, but remains within control limits. The data points show some fluctuations, but no patterns or trends that would indicate a systemic problem. The peak of damage occurred on the 5th and 15th days, while the low point occurred around the 9th and 17th days. These fluctuations are consistent with natural variations in the production process. Based on this control chart (p-chart), the tofu production process in one month is under statistical control. There is no indication of major deviations requiring immediate corrective action. However, manufacturers should continue to monitor control charts regularly to ensure that processes remain under control and promptly investigate any changes in defect patterns or trends to identify and correct potential causes.

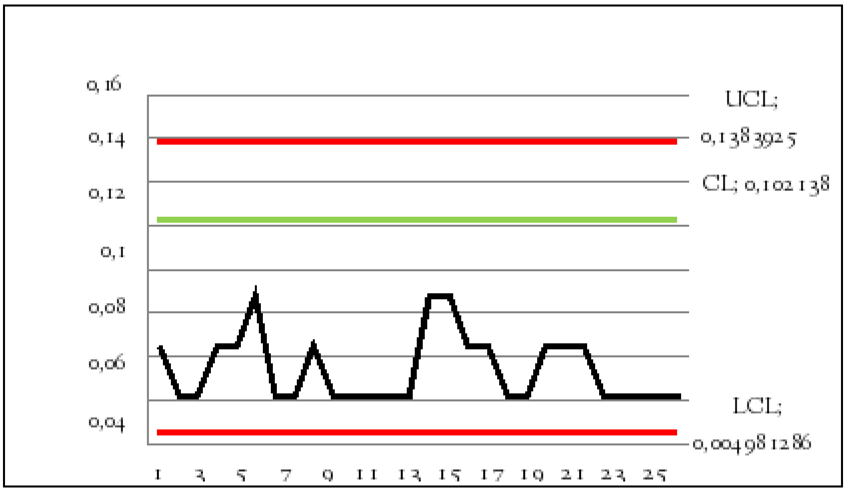

Figure 4. Map Control P (P- *Chart)*

Fishbone Diagram

Fishbone Diagram is used to analyze the causes of defects that are difficult to identify. These factors are categorized as following: a) Workers, workers involved direct in the production process. b) Raw materials, components used in produce product. c) Machines, machines and equipment used during the production process. d) Methods, instructions or order work that must be done followed in the production process. e) environment, circumstances around place production that affects the production process good in a way direct or indirectly(Laghouag et al., 2024). Figure 2 shows the graph identify two types disability main in the production process know, that is texture know loud and knowing soft. Firm tofu will find for cause using a cause-and-effect diagram. This is because of the cause-and-effect diagram help identify and group contributing factors to disability product, deliver clear guide to overcome problems and improve quality product know.

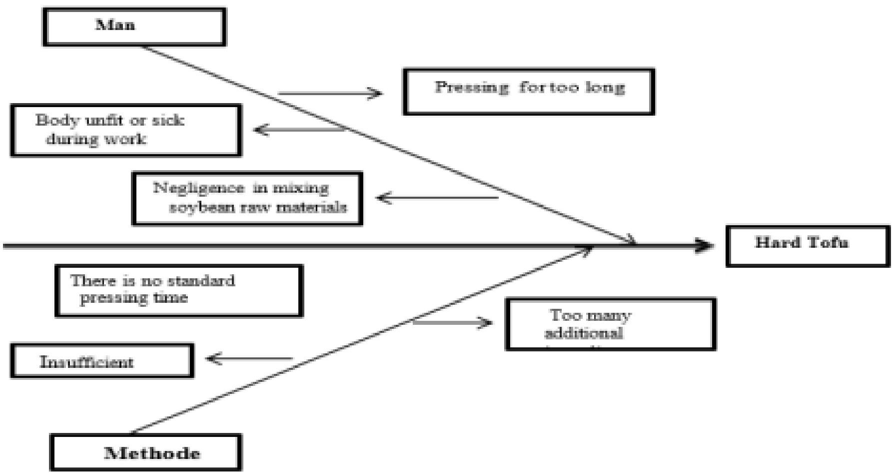

Figure 5. Fishbone Diagram

Texture tough tofu caused by several factors, mainly related to workers and methods processing. Worker often less notice forever time pressing, where the longer you know pressed, increasingly hard the texture. Without standard time clear pressing, workers only depend on intuition. Other factors contribute including negligence in mix material standard soybeans, condition physique unfit workers or sick, lacking stir, and use material excessive additions.

Corrective action Using the ISM Method

In this research, corrective action was used Interpretive Structural Modeling (ISM) to understand connection between element in something complex system. ISM helps identify and map interaction between various variable, so makes it easier in determine priority action most effective repair. To obtain the dominant variables influencing the quality of tofu, this was done by interviewing experts. Connection between variable repair discussed to determine level linkages between influential element. The results of this discussion are used as the basis for determining SSIM.

Drafting matrix Structural Self-Interaction Matrix (SSIM)

SSIM was formed based on the results of interviews and discussions to determine connection linkages between variable. This matrix describes how one variable influence variable other.

Table 2. Structural Self-Interaction Matrix (SSIM)

No	Variable	5	4	3	2
1	Setting Pressing Time Standards	A	A	O	A
2	Improve Worker Supervision and Training	O	A	O	
3	Improving the Raw Material Mixing Process	A	O		
4	Regulating Workers' Health and Welfare	A			
5	Reducing Excessive Use of Additives				

Reachability Matrix

Based on the results of Structural Self-Interaction Matrix (SSIM) processing, step second in Interpretive Structural Modeling (ISM) methodology is compiling a Reachability Matrix (RM). RM is obtained by changing the symbols V, A, reach other elements in the system. Driver Power (DP): Measures how much Lots other elements that are influenced by elements. Dependence (D): Measuring how much Lots something element influenced by the elements other.(Singh et al., 2021) By using RM, producers know can determine elements key that has influence large (high Driver Power) and vulnerable elements to influence from other elements (high dependency). This helps in taking more decisions precise and effective in the process of repair quality product.

Table 3. Reachability Matrix

No	Variable	1	2	3	4	5	Driving Power
1	Setting Pressing Time Standards	1	0	0	0	0	1
2	Improve Worker Supervision and Training	1	1	0	0	0	2
3	Improving the Raw Material Mixing Process	1	0	1	0	0	2
4	Regulating Workers' Health and Welfare	0	1	1	1	0	3
5	Reducing Excessive Use of Additives	1	0	0	1	1	3
Dependence Power		4	2	2	2	1	

Based on Table 3, there are variable key that is reduce use material superfluous and controlling additions health and well-being workers with the highest Driving Power (DP = 3), shows that this variable has influence significant to variable others and must become priority main in action repair. Whereas Variable Depends that is set standard time pressing which has dependence power (D = 4) and is most influenced by variables others, shows that standard time pressing is greatly influenced by action repair other. By analyzing this RM, the company can determine priority action the most effective fix to improve quality product know in a way whole.

Final Reachability Matrix (FRM)

In FRM, there are a number of adjustments marked with a sign asterisk (*), indicates that variable managing Health and Wellbeing Workers and Reduce Excessive Use of Additives own influence addition or modification connection based on analysis more carry on. These changes reflect the results of more discussion processes in - depth and revealing interviews influence addition from variable to variable other.

Table 4. Final Reachability Matrix

No	Variable	1	2	3	4	5	Driving Power
1	Setting Pressing Time Standards	1	0	0	0	0	1
2	Improve Worker Supervision and Training	1	1	0	0	0	2
3	Improving the Raw Material Mixing Process	1	0	1	0	0	2
4	Regulating Workers' Health and Welfare	1*	1	1	1	0	4
5	Reducing Excessive Use of Additives	1	1*	1*	1	1	5
Dependence Power		5	3	3	2	1	

Driving Power (DP) and Dependence Power (D)

Driving Power (DP), Available change in influence variable, where Reduce Excessive Use of Additional Ingredients, has the highest DP on FRM (DP = 5), this shows that this variable is key main influence another variable. whereas Dependence Power (D) is dependency variable still consistent with Establish Standard Pressing Time which has dependency highest (D = 5) in the second matrix, shows that This variable is strongly influenced by action repair other. The Final Reachability Matrix (FRM) strengthens and validates the results of the initial Reachability Matrix (RM) slightly adjustments to reflect more analysis deep(Ahmad & Qahmash, 2021). Focus main must give to reducing action use material excessive additions as the variable with the highest Driving Power, followed by Managing Health and Well-being Worker.

Level Partitioning

Ahmad, N., & Qahmash, A. (2021). SmartISM: Implementation and Assessment of Interpretive Structural Modeling. *Sustainability*, *13*(16), 8801. https://doi.org/10.3390/su13168801
Handayani, D. I., Masudin, I., Susanty, A., & Anna, I. D. (2023). Modeling of halal supplier flexibility criteria in the food supply chain using hybrid ISM-MICMAC: A dynamic perspective. *Cogent Engineering*, *10*(1), 2219106. https://doi.org/10.1080/23311916.2023.2219106
Kumar, A., & Dixit, G. (2018). An analysis of barriers affecting the implementation of e-waste management practices in India: A novel ISM-DEMATEL approach. *Sustainable Production and Consumption*, *14*, 36–52. https://doi.org/10.1016/j.spc.2018.01.002
Laghouag, A., Zafrah, F. B., Qureshi, M. R. N. M., & Sahli, A. A. (2024). Eliminating Non-Value-Added Activities and Optimizing Manufacturing Processes Using Process Mining: A Stock of Challenges for Family SMEs. *Sustainability*, *16*(4), 1694. https://doi.org/10.3390/su16041694
Singh, S., Barve, A., & Shanker, S. (2021). An ISM-gDEMATEL framework for assessing barriers to green freight transportation: *A case of Indian logistics system*. *International Journal of Sustainable Engineering*, *14*(6), 1871–1892. https://doi.org/10.1080/19397038.2021.1982063

Level Partitioning helps in identifying the hierarchy or levels of variables in the system. Variables with lower levels are basic variables that are influenced by many other variables, while variables with higher levels have a greater influence on other variables (Handayani et al., 2023). Tables 5 and 6 show the Partitioning results.

Table 5 Level Partitioning Iterations

Variable	Reachability	Antecedents	Intersection	Levels
1	1,	1,2,3,4,5,	1,	1
2	1,2,	2,4,5,	2,	
3	1,3,	3,4,5,	3,	
4	1,2,3,4,	4,5,	4,	
5	1,2,3,4,5,	5,	5,	

Tabel 6. Level Partitioning (LP)

Variabel	Reachibility	Antecedent	Intersection	Level
1	1,	1,2,3,4,5,	1,	1
2	2,	2,4,5,	2,	2
3	3,	3,4,5,	3,	2

4	4,	4,5,	4,	3
5	5,	5,	5,	4

By understanding hierarchy variable, company can determine priority action repair. variables at a higher level low usually need attention quick Because they are foundation from system and is influenced by many variable other.

Diagraph Analysis

Digraph is a graphical representation of the relationship between variables in a system based on the Conical Matrix(Kumar & Dixit, 2018). Analysis of the Relationship between Variables is shown in Figure 6.

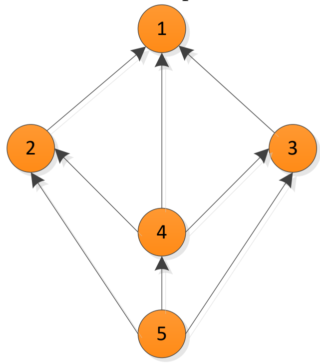

Figure 6. Diagraph analysis

Node 1 (Assign Standard Pressing Time) which is influenced by all variable others (2, 3, 4, 5). This shows standard time pressing is highly dependent on action repair variable other. Node 2 (Improving Supervision and Training Workers) which is influenced by variable 4 (Managing Health and Welfare Workers) and variable 5 (Reduce Excessive Use of Additional Ingredients). Node 3 (Improving the Raw Material Mixing Process), is influenced by variable 4 (Managing Health and Welfare Workers) and variable 5 (Reduce Excessive Use of Additional Ingredients). Node 4 (Managing Health and Welfare Workers), influenced by variable 5 (Reducing Excessive Use of Additional Ingredients). Node 5 (Reduce Excessive Use of Additional Ingredients), Not influenced by variables another, shows this variable is the most independent and has influence big to variable other.

Final Model of Prioritization of Corrective Actions

Final model above describes hierarchies and relationships between variable in system based on the level you have reached determined previously. This model delivers more visualization structured about priority and sequence action necessary repairs done.

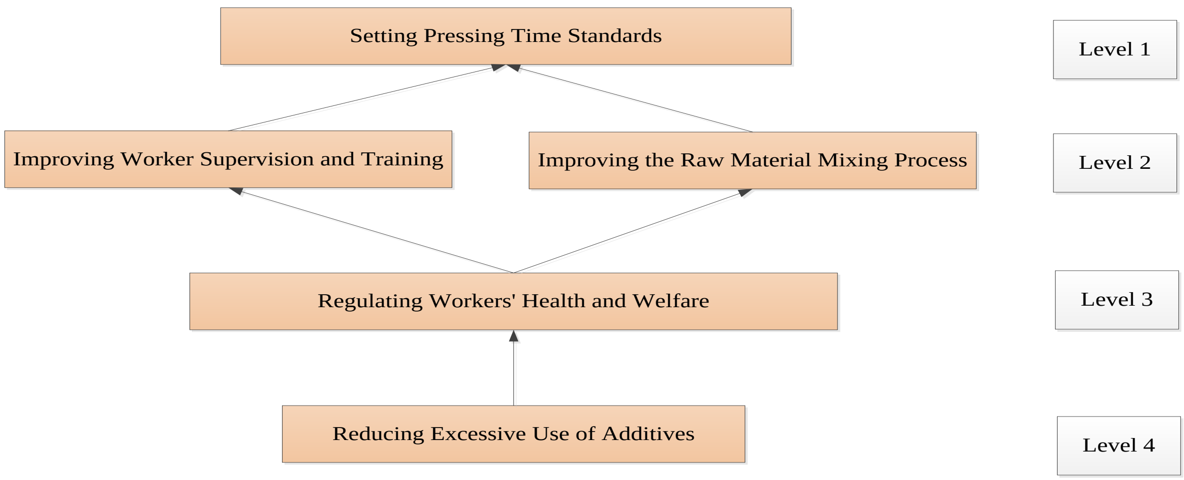

Figure 7. Prioritization of Corrective Actions

Based on Figure 7 there are four levels, namely: Level 1 determines standard time this level pressing step first thing to do taken to make sure that production process know go well. Standard time proper pressing help reduce variability in quality product and ensure that know own consistent texture. Necessary action done in this level by doing research to determine time optimal pressing creating and implementing standard time pressing in SOP (Standard Operating Procedures) and Training worker about importance follow standard time pressing. Level 2: Improving Worker Supervision and Training and Improving the Raw Material Mixing Process, where second these variables are at the same level Because they directly influenced by the determination standard time pressing. Increase supervision and training worker as well as improve the mixing process material standard is step, the next important thing to make sure consistency and quality product. Necessary action done in this level is upgrade on - line supervision production to ensure obedience to standard time pressing. hold regular training for worker about technique pressing and mixing material correct standard. Apply system incentives for workers who follow procedure correctly. Do evaluate and improve method mixture using a lot or machine more mixer efficient is required. Do regular testing to be sure quality mixing material standard.

Level 3 is Regulating Workers' Health and Welfare, at this level regulates health and well-being worker is at this level because health and well-being worker influence ability them to follow established standards and procedures set. Well-being worker is key to be sure that worker can work optimally and comply procedure work that has been done set. Necessary action done that is give time adequate rest and environment healthy work. Implement health and fitness programs to improve condition physique worker. Level 4: Reducing Excessive Use of Additives

At this level it reduces use material excessive additions is the most complex and affecting action all variable other. this thing is the most independent variable and has impact big to quality end product. Use material The right additions are critical to maintaining quality and safety product know. Necessary action done that is evaluate quantity and type material additions used in the production process, determine usage limits material add and implement in the SOP, testing quality in a way periodically to make sure there are none material addition excessive. With understand meaning from each of these levels, the company can plan and implement action more improvements effective and directed, ensuring that every aspect from production know optimized to achieve quality best.

CONCLUSION

This research shows that integration third method the give comprehensive and effective approach in control and improve quality product know. By using SPC, the company can monitor the production process in real time. SPC is effective for monitoring and evaluating what is known about the production process within the limits of control and the necessary corrections. The evaluation results demonstrate that the production process knows a part big is at in control statistics, though a number of fluctuations need attention more carry on. The Ishikawa diagram helps identify and analyze factors reason damage product know, give understanding deep about root reason problem quality. The ISM method is used to determine priority action repair based on connection between complex variables, shows that reduce use material superfluous extras, set health and well-being workers, as well improve the mixing process material standard is action the most impactful improvements. Approach This integration makes it possible producer know to identify root problem with more effective and take steps strategic to improve quality product.

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