

Root Cause Analysis for a Manufacturing Unit Problem Through Naze-Naze Analysis Technique

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Abstract - This research paper reveals the concept of problem solving tool i.e. Naze-Naze analysis - a cornerstone of Kaizen and the Toyota Production System which is used to systematically eliminate bottlenecks in manufacturing processes which affect productivity. The study carried out in refrigerator manufacturing plant at Faridabad (Hr). Two critical issues were identified through direct shop-floor observation and these are regular detachment of paper tape, leading to repeated replacements and foam leakage at the front-top corner due to notching tool problem. The technique is used to solve both the problems by asking 5-Naze to reach at root cause of the problem which further helps in increasing the productivity.

Key Words: kaizen, manufacturing unit, cabinet forming section, foam leakage, root cause analysis, productivity.

1. INTRODUCTION

Kaizen is much more than just an 'employee's ideas' box that then gives out a big reward for some huge cost saving idea. Kaizen is about Continuous Improvement of every little aspect of the organization that staff can improve. The effectiveness of the Kaizen system lies in the fact that it motivates by rewarding a much larger percentage of the workforce on a more frequent basis and helps create dialogue between staff and management about problems. This has the cumulative behavioral effect of improving attitudes, building trust, and boosting morale, which then becomes the foundation of an ever increasingly productive workforce. Various analysis act under the principle of KAIZEN these are :-

- ✓ Pokayoke
- ✓ **Why-why analysis or Naze-Naze analysis**
- ✓ Kanban
- ✓ Just in time (JIT)
- ✓ Fish-bone diagram

NAZE-NAZE ANALYSIS:- The **5 Nazes** is a questions-asking method used to explore the cause/effect relationships underlying a particular problem. Ultimately, the goal of applying the 5 Nazes method is to determine a root cause of a defect or problem. The technique was originally developed by Sakichi Toyoda and was later used within Toyota Motor Corporation during the evolution of their manufacturing methodologies. It is a critical component of problem

solving training delivered as part of the induction into the Toyota Production System. The architect of the Toyota Production System, Taiichi Ohno, described the 5 whys method as "the basis of Toyota's scientific approach by repeating why five times, the nature of the problem as well as its solution becomes clear." The tool has seen widespread use beyond Toyota, and is now used within Kaizen, lean manufacturing". The term **root cause** has been used in professional journals as early as 1905, but the lack of a widely accepted definition after all this time indicates that there are significantly different interpretations of exactly what constitutes a root cause. A root cause is an initiating cause of a causal chain which leads to an outcome or effect of interest. Commonly, root cause is used to describe the depth in the causal chain where an intervention could reasonably be implemented to change performance and prevent an undesirable outcome. The main goal of Why-Why Analysis is to achieve minimum defects, minimum breakdown and to increase the productivity and overall efficiency of the plant. The industry is a global manufacturer and India's largest exporter of home appliances. Refrigerator is one of the product

2. LITERATURE REVIEW

In this chapter the existing or available published literature on why why analysis technique and various types other techniques for the productivity improvement is presented with an aim to be apprised of the status of the subject, the focus on the latest work being carried out by researcher.

[1] Mishra, D. and Sinha, V. (2010) studied the polyol for the correlation of its composition and structure with its properties different approaches such as MALDI (matrix assisted laser desorption ionisation), TOF (time of flight), ESI-MS (electro-spray ionisation mass spectrometry) provides compositional information. This study carried by two example, in first example one of sample has a small variation in co-polymer composition leading to its abnormal activity in second example bring light on deformation of complex polyol result was that two samples has similar properties and activities were found to be two different polymer blends.

[2] Wang, K., Eisele, M., Hwang Y. and Radermacher, R. (2010) discussed the environmental damage which

are caused by hydro-flouorocarbon(HFC) refrigerant, there is an increasing universal interest to research environmentally friendly fluids in refrigerant these refrigerant include ammonia, carbon di oxide, hydro carbon. Main drawback of these refrigerant are there potential flammability and safety hazard to avoid these affect secondary loop refrigeration can be employed. Benefits of secondary loop refrigeration system are leakage reduction potential maintenance and low operating cost

[3] Anand, G., ward P., Tatikonda, M. & Schilling, D (2009) studied the content of continous improvement strategy and identify infrastructure decision areas that are important for continous improvement we present a framework of infrastructure based on the idea that continous improvement can serve as a dynamic capabilities. We study continous improvement to investigate the practices used by them in each of the decision area of our framework

[4] Araki, K., kamoto. D., and Matsuoko, S., (2009) studied that energy saving regulation vacuum insulation panels(VIP) have been used in refrigerator. VIP for low temperature application are constructed from laminated plastic film which are heat welded together to maintain a vacuum inside at a high temperature vacuum is lost and performance of these panels degrades sharply. Now a days for efficient insulation material for use in hot water equipment require study of laminated plastic field VIPs are long term reliability was evaluated by measuring thermal conductivity.

[5] Ferries J., Aken, E., Doolen T., and Worley, June (2009) Studied the kaizen are an increased in the common organizational improvement mechanism aimed at work area transformation and employed development. There is little empirical evidence of which input and process factor are most strongly related to KAIZEN event outcome in practice. The factor that most strongly relate to the development of employee attitudinal outcomes problem solving capabilities in KAIZEN event.

[6] Idrissi –youbi, M. and Bounjour, J. (2008) discussed the lubrication agent is necessary in almost all the refrigeration particularly for the correct operation of compressor. However, a certain portion of oil always circulate with the refrigerant to review the oil related research in the field of refrigeration the typical methods and approaches require sound tools for the evaluation of thermodynamic property of refrigerant oil mixture and critical views of these tools and focus particularly on the liquid vapour equilibrium and adsorption diffusion

[7] Allahverdi A., Ng C.T. , Cheng T.C.E. and Kovalyov M. (2008) studied the models with setup time from then to date covering there are cases where different research at the same problem and sometime using even the same

technique so the technique were identify such area were independently develop need to be compare to classify scheduling problems into those with batching and non-batching consideration it further categorized according to shop environment including single machine, parallel machine, flow shop, no weight flow shop, open shop and others

[8] Herron, C. and Braiden P. (2006) studied the methodology have been developed which a consist of three clearly defined steps starting with a productivity analysis(PNA) which gives an overview of current manufacture condition of company. Identify the key productivity measures for the plant and form the basis for a detailed study of producton efficiency. Manufacturing need analysis(MNA) which generate an initial one year improvement for manufacturing unit in order to ensure that the tools which are found to be efficient in the company PNA and MNA are combined with TNA(training need analysis)

[9] Stratman, J., Roth, A. and Gilland, W. (2004) studied to present a discreet event model inspired and validated in an actual manufacturing setting that is include life cycle mid-volume production quantities inspection and testing. The manufacturer cost assessed include labour inspection. The cost of reworking a defect is recaptured as an increase in labour consumption. It is assume that temporary worker have relatively less skill and therefore have high average production times.

[10] MCintosh, R.I., Culley, S.J., Mileham, A.R. and Owen, G.W. (2001) discussed the current assesses on machine maintenance in the context of recent work to improve changeover performance. It argued that technique employed to improve changeover equally might be applied in maintenance situation. Items involved during a changeover change parts product, fixed machine component and consumable in satisfactory condition

3. METHODOLOGY

The 5-Naze analysis method is used to move past symptoms and understand the true root cause of a problem. It is said that only by asking "Naze?" five times, successively, can you delve into a problem deeply enough to understand the ultimate root cause. By the time you get to the 4th or 5th Naze, you will likely be looking squarely at management practices.

This study employs the 5 Nazes, a root cause analysis technique to solve the identified problem in refrigerator manufacturing unit which was regular detachment of paper tape in cabinet foaming section and foam leakage from front top corner. The flow charts of different section of manufacturing unit are shown in Figure1 and given below:

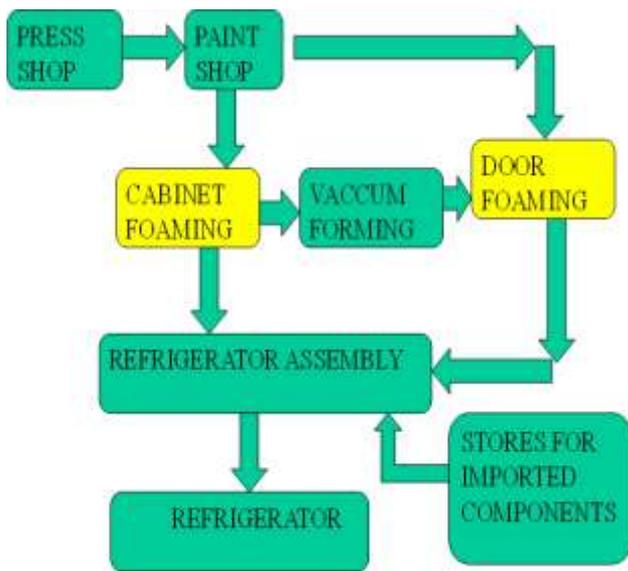


Figure 1. Flow chart of manufacturing unit

The detachment of paper tape from cabinet shell edge is shown in Figure 2.

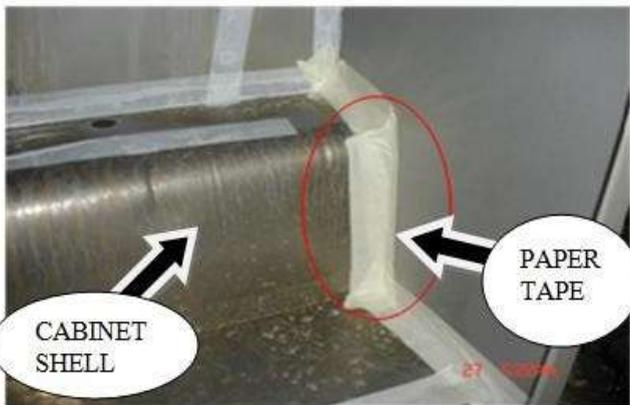


Figure 2. Tape pasting at corner

Table 1. Naze –Naze Analysis for identified problem

5-Naze	Question (Problem)	Answer	Action taken
Naze 01	Productivity reduced due to more rejection in cabinet foaming section	Less adhesion time of paper tap at corners of shell and door during curving time.	
Naze 02	Less adhesion time of paper tap at corners of shell and door	Detachment of paper tape from cabinet	

	during curving time.	shell edges.	
Naze 03	Detachment of paper tape from cabinet shell edges.	Less adhesive and weak strength of paper tape.	
Naze 04	Less adhesive and weak strength of paper tape.	Negligence at manufacturer end.	
Naze 05	Negligence at manufacturer end.	Trial taken with new type tape and succeed.	Biaxially oriented polypropylene tape utilized instead of previous tape.

The analysis helped in reaching at the root cause of problem and shown in figure below

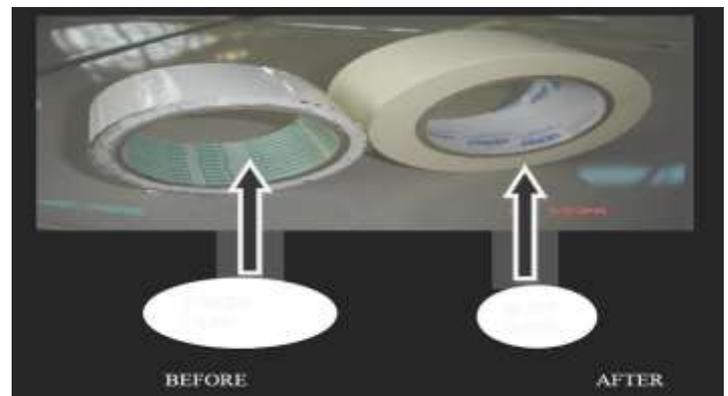


Figure 3. Tape used before and after analysis

Table 2. Parameters for both type of tapes

Parameter	Paper tape	BOPP tape
Width	60 mm	60 mm
Adhesive strength (time)	2-3 hrs	24 hrs
Purchasing Cost	0.45 p/mtr	0.60 p/mtr
Appearance	Transparent	Milky-White opaque

The second problem observed in the section i.e., foam leakage from front top corner of the shell.



Figure 4. Foam leakage from corners

Table 3. Naze- Naze analysis for identified problem

5-Naze	Question (Problem)	Answer	Action taken
Naze 01	More rejection and productivity reduced.	Foam leakage	
Naze 02	Foam leakage	Due to gap between two joining surfaces.	
Naze 03	Due to gap between two joining surfaces.	It remains during joining the surfaces.	
Naze 04	It remains during joining the surfaces.	Variation in dimension during operations.	
Naze 05	Variation in dimension during operations.	Notching tool wear out after producing few components	Old notching tool replaced with modified notching tool

The analysis helped in reaching at the root cause of problem given below:



Before

After

Figure 5. Before and After countermeasure

4. RESULT & DISCUSSION

The detachment problem of paper tape from shell and door in cabinet foaming section and foam leakage from front top corner rectified with Naze-Naze analysis tool and tremendous results has been observed as shown in Table 4.

Table 4. Outcomes after implementing technique

Problems	Before counter-measure	After counter-measure	Final result
1. Regular detachment of paper tape	(7.5 mtr/piece) paper tape was used.	(2.5 mtr/piece) BOPP tape is used	(5mtr/piece) tape has been saved. & 1.85 rs/ref saved
2. Foam leakage from front top corner	(2.920 kg/piece) fluid was used	(2.870 kg/piece) fluid is used	Total saving of fluid is 2kg/shift

5. CONCLUSIONS & FUTURE SCOPE

The use of 5- Nazes, a root cause analysis tool resolved the problem of cabinet foaming section successfully. The adhesive time increased from 2-3hrs. to 24 hrs and modified notching tool invented. Productivity increased after both result implementations. Further, the concept can be utilized in another section of the unit for solving the problems.

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