

SOLVING PROBLEMS IN HOSHIN KANRI SYSTEM APPROACH USING QUALITY MANAGEMENT TOOLS – CASE STUDY

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Purpose: The main goal of the article is to present quality management tools that help solve problems in the functioning hoshin kanri system.

Design/methodology/approach: In this article described practical aspects of quality focusing on solving problems in foundation system of hoshin kanri. Operation of this system means a systematic process of planning and achieving long-term goals, by developing organization's strategy for all its departments and units. In addition, the article discusses analytical research in relation to Toyota Motor Corporation. This analysis included evaluation of the most popular quality tools for solving problems such as DMAIC, 8D, A3, 5-Why and Ishikawa diagram.

Findings: The case study presented in the article showed that the most applicable and useful is A3 Report but it is possible to use 8D and 5-Why however, the results are less useful than in the case of previous ones.

Originality/value: The results of the considerations are very useful for small and large companies. The application of the presented method in article is mainly for better strategic planning and as a tool in quality management systems and management of complex projects.

Keywords: hoshin kanri, quality management, quality tools, solving problems.

Category of the paper: literature review.

1. Introduction

Nowadays, companies are constantly competing with each other to attract as many customers as possible. To this end, they must ensure the highest quality of products and services and constantly improve their processes and strategy of operation. They can do this using different methods, techniques and tools used in management.

Quality management in manufacturing enterprises has its foundation in quality theory, which deals with building systems of general definitions, theorems and models describing and explaining qualitative phenomena. Uses the achievements of broadly understood management, uses cost accounting. It is based on the methods of such fields of knowledge as management sciences, computer science, economics, sociology, psychology, statistics and other systems related to the functioning of human behavior, etc. This knowledge is a pillar for the correct use of quality management instruments. This article focuses on quality management tools that are used to solve problems not only at the management and executive level of enterprises. These tools support activities by providing properly processed data and information, enriching knowledge of processes, are characterized by some universalism, but at the same time they must be properly selected (Hamrol, 2008).

A key problem for enterprises is also the effective translation of strategies, including vision, mission, values and strategic goals into a simple language, so that they are understandable to all employees and can be cascaded effectively down the organization and linked to daily management. One concept that explains this issue in a systemic way and proposes effective problem solving is hoshin kanri – a 7-stage lean system for implementing coherent strategic goals in an organization (Głowicki, Kowalewski, 2016).

As part of this article, the individual steps of the hoshin kanri system were presented with an indication of the operation of the system based on the PDCA cycle and planning. The PDCA cycle is its basic mental model and gives structure to activities at every level of management. After a long part of planning in HK system comes time to achieve goals, which is not easy, because that is where problems arise. Hoshin kanri is patience and the right resources. Instead of frustrating and bothering companies should use proven, valued, standard quality tools to solve these problems.

2. Characteristics and applicability of hoshin kanri system

The hoshin kanri method was developed in Japan by Yokogawa Hewlett-Packard in the early 1970s. Some western companies in the mid-1980s began to implement their own versions of HK (Hewlett-Packard, Porter and Gamble, AT&T, Xerox Corporation, IBM, Florida Power

and Light and Texas Instruments). Furthermore, different authors have given different literal interpretations of HK, but the following is considered to be the most accurate definition (Dale, Bamford, 2016).

“hoshin” = a compass, a course, a policy, a plan, an aim

“kanri” = management control of the company’s focus

Hoshin kanri is a 7 steps process used as part of strategic planning in which goals are communicated and shared throughout the company, and then put into action (Jolayemi, 2008).

The steps below:

Establish the Vision and Assess the Current State – analyze current mission, vision and values, review existing processes and procedures to achieve future goals.

Develop Breakthrough Objectives – requirement for organization to be open to new and demanding ways. It usually takes three to five years.

Define Annual Objectives – state what needs to happen this year to ensure that three to five years old goals are achieved.

Cascade Goals Throughout the Organization – set goals should be measurable, detailed with specific key performance indicators, monitored by management.

Execute Annual Objectives – actions to achieve the goals for the year. It is advisable to use problem solving techniques, including DMAIC, 5WHY, A3.

Monthly Reviews – monthly checking of each person's progress in achieving goals to ensure that progress is maintained.

Annual Review – comprehensive assessment of organization's progress, adjusting goals or time estimates, ensuring adequate resources to achieve goals in the following year.

The purpose of hoshin planning **is to improve communications throughout the company, whilst also reducing the waste created by poor direction or bad management** at any level. The key to acquiring organizational knowledge is ability to discover problems and solve them. Hoshin kanri helps meet this requirement by using the Deming cycle (Plan-Do-Check-Act, PDCA) to manage and improve every detail in company. PDCA is an abbreviation for management method based on the scientific method, which includes four successive stages:

- Plan – developing a better method of operation and planning its implementation.
- Do – testing a new method.
- Check – verification of the results of the experiment.
- Act – introducing the tested method as a new standard of work.

Thanks to the systematic use of PDCA, hoshin allows to combine planning and implementation at all levels of organization. This can be achieved by means of a complex information exchange process called “catchball”, which results in interconnection and interlocking of subsequent PDCA cycles as well as transfer of the strategic plan to the next levels of the organization (Watson, 2005).

The application of the presented method is mainly for better strategic planning and as a tool in quality management systems and management of complex projects. It also serves to motivate employees and join in the process of change. The hoshin kanri facilitates the understanding of strategic goals by the entire enterprise community and the creation of what can be described as strategic awareness, i.e. a shared vision of the future. Supports the creation of short- and long-term plans. Thanks to it, the company is able to produce products that meet the individual needs of customers and steadily increase its profits. The hoshin kanri method is also used to manage and integrate supply chains.

3. Quality management tools for solving problems in the theoretical concept

Quality management tools help to improve the quality of products, services and processes. Quality tool is a tool designed to perform a specific task, according to a defined procedure. It enables direct and support the activities of improvement and change. The complementary tools are less used or are used only to solve a specific problem.

Based on analysis of the functions of extensive set of tools, those that correspond to the assumed problem solving were selected. These are: Ishikawa diagram, 8D report, A3, 5-why and DMAIC.

The first of these quality tools to solve problems is the tool 8D (Eight Disciplines). The 8D report is a systematic form of problem solving and continuous improvement of the organization. The standard 8 points of analysis allow to effectively find the cause and determine corrective actions. The 8D report follows the logic of Edwards Deming or PDCA. It is an extensive tool that uses some of the other well-known quality assurance tools. It corresponds to their readiness to solve complex problems for continuous improvement of a product or a process. The tool is processed in eight disciplines and emphasizes the synergy of the people involved. It was originally developed by Ford Motor Company, where it combined various elements of other techniques for problem solving to shape the eight disciplines, which it was introduced in Ford manual titled: Team Oriented Problem Solving. The 8D tool can be represented in steps as in Table 1.

Table 1.
Steps 8D

Nr	Step	Explanation
D1	Initial Data	Establish a small group of people with knowledge, time availability, authority and competence to solve the problem and implement corrective actions. The group must select a team leader.
D2	Description of the problem	Describe the problem in measurable terms. Specify clearly and objectively the problems that occurred both internal and outside the company.
D3	Immediate countermeasures	Define and implement actions that will provide protection for the customer to faulty, not causing a significant loss of the same, until permanent corrective action is implemented. Check with the data of the effectiveness of those actions.
D4	Root causes	Identify all potential causes that could explain why the problem occurred. Apply and test each potential cause against the problem description and data. Identify alternative corrective actions to eliminate the root cause.
D5	Corrective and preventive actions	Confirm that the corrective actions implemented will solve the problem for the customer or supplier and will not cause undesirable side effects. Define other actions, if necessary, based on the potential severity of the problem.
D6	Effectiveness of actions	Define and implement the necessary corrective actions for the permanent elimination of the root cause of the problem. Choose controls to ensure that the cause is eliminated. Monitor the long-term effects and implement additional controls, if necessary.
D7	D7. Updating of standards	Modify the specifications, training of employees, work flow, improve practices and procedures to prevent recurrence of this and all similar problems
D8	D8. Closing	Recognize the collective efforts of the staff. Promote your accomplishment and share knowledge and learning with the whole team, to assist in possible failures or similar errors that may occur.

Note: source Broday E.E., Andare P.P., 2013.

The Ishikawa diagram is another quality tool analyzed that helps focus energy on the root cause of the problem, rather than dealing with and wasting time on symptoms. Ishikawa is cause and effect diagram, allows to rank the causes of occurring irregularities and to link these causes to each other using the chart. Its essence is a graphical presentation of the analysis of interrelationships of causes causing a specific problem. (Smith, 1998). Perfect for team work, in combination with other quality management tools and techniques, such as brainstorming. It is referred to as a hierarchical tool whose main purpose is to help locate the causes of the problem that bothers us. The Ishikawa diagram is also often called the herringbone diagram or the fish bone diagram, because it resembles its shape. The Ishikawa cause and effect diagram should be constantly updated depending on how many and which of the causes of current errors have been removed or resolved.

Problems can be grouped based on several principles. For the less experienced working groups, the 5 M rule is the most popular of those used. Other rules used are: 5M + E, 7M, 8M, standards.

Grouping problems based on the 5M rule. The 5M rule is to use the (5M) system when performing the analysis. Five groups of reasons are proposed here:

Manpower (people, workforce) – qualifications, habits, satisfaction with work, internship, well-being, etc.

Method – procedures, instructions, scope of duties, specifications, standards, law, rules, know how, technology etc.

Machine – license, durability, modernity, efficiency, precision, security living, working conditions etc.

Material – input materials, semi-finished products, elements, substitutes, etc.

Management – organizational structure, work organization, change work conditions, etc.

Ishikawa is cause and effect diagram has many uses, the main one is to solve quality problems in which there is an extensive chain of causes. It is also considered one of the basic quality tools used in the analysis phase of Six Sigma's DMAIC approach to problem solving.

DMAIC is an acronym from the words Define-Measure-Analyze-Improve-Control. This method is based on process improvement according to Deming cycle. It is a process improvement of many different areas in the enterprise. DMAIC cycle consists of five stages which are connected with each other (Smętkowska, Mrugalska, 2017):

Defining the goal and its requirements. The main purpose of this stage is to verify if the actions, which should be taken in order to solve the problems, are connected with the priorities in the organization and that there is support from management and availability of required resources.

Measuring the current process. The measure stage concerns gathering information about processes which are going to be improved. It focuses on information which is needed in order to better understand all the processes in organization, customers' expectations, suppliers' specifications and identification of the possible places where a problem may occur.

Analysing the results of measurements, determining the causes of process imperfections and possible solutions for them. In the analyse stage different tools and methods are used to find root causes, assess the risk and analyse data. To confirm the analysis some samples should be performed and potential problems have to be proven to be real problems.

Improving the process, implementing the changes, which eliminates the imperfections. The goal of this stage is to take necessary information to create and develop an action plan in order to improve the functioning of the organization, financial aspects and customer relationship issues.

Controlling of the improved process, monitoring the results in a continuous way. The control stage is about confirmation if changes implemented at the improve stage are sufficient and continuous by verifying the quality of the improved process.

The next tool analysed is A3 Report – the simplest and most effective method of communicating what is important in an enterprise in a structured way. The A3 report took its name from a 297 mm by 420 mm sheet of paper. The report is based on the PDCA principle – Plan (Do), Do (do), Check (verify), Act (improve, act). The Deming Wheel is used in many methods of problem solving or continuous improvement. Therefore, the main recommendation of this method is primarily to solve problems where they occur (Shock, 2020).

The A3 Report usually consists of multiple steps following a PDCA structure of Plan, Do, Check, Act. The number of steps can vary due to the different formats being used for the A3 Report. The exact number of steps used is not as important as the end result. The A3 Report

can utilize various forms depending upon the organizations needs and preferences. The following paragraphs provide information regarding the basic steps and some tools used to complete the A3. One thing that all of the forms seem to have in common is that they follow the PDCA problem solving process. The basic steps and where they fall into the PDCA structure are listed below (Bassuk, Washington, 2013):

Plan – the first step is to define the problem or identify the need for improvement. Define the ideal state, the operational standard or the desired condition, describe the current situation or status and identify the Gap or problem.

Containment – in some A3 formats, a section is included for immediate countermeasures or containment actions. The purpose of containment is to prevent further problems from occurring or prevent the current problem from causing negative effects to other processes, products or departments.

Breakdown the problem – may be more than one issue contributing to the problem or more detail required to properly address the problem. Prioritize the issues and identify the point of occurrence or escape point.

Define goals – set goals regarding the improvement desired as a result of the exercise. This could include a percentage of improvement in process throughput, reduction in number of defects per unit or processing time. The goals should be specific, measureable, realistic, achievable and timely.

Root Cause Analysis of the problem by using various quality tools. Whatever method selected, it is important to get past the symptoms of the problem and down to the root cause.

Countermeasures – determined to address the root cause. The countermeasures must be clearly defined, achievable by the person responsible and have a due date. Corrective actions that do not have an owner or due date are seldom achieved.

Implementation of the corrective actions should be developed. The plan should include the team members, resources and time required to complete each task. In some cases, support from outside resources or test facilities are required. Some countermeasures may require repair or replacement of tooling or other capital expenditures. Therefore, proper levels of management should be kept informed throughout the process to assure adequate resources are available for implementing any corrective actions.

Monitoring and Validation the A3 team should next confirm the effectiveness of the countermeasures. This can be accomplished in many ways, including but not limited to additional quality checks, Statistical Process Control (SPC) data, process or product audits and customer feedback.

Standardize and Improve – during this phase of the A3, the team should take action to standardize the process changes or improvements. The team must update all standard work, work instructions and process control plans, etc. The management team should also promote continuous improvement of the A3 tool within the organization.

The last of these problem-solving tools is the 5-Why tool, which allows to find out the causes of a given problem. It is a method that raises two aspects. The first concerns the causes of the problem – why did the problem arise? The second aspect concerns the detection of the problem – why our current system/process control/supervision methods did not detect the problem once it appeared. Diagram 5-Why, also called the why-why diagram is one of the methods used to check and control the production process. It is based on the assumption that each subsequent statement is determined by asking the question "why?". The tool is very similar to a cause and effect diagram. It is helpful when assessing the network of problems and the relationship between these causes. By using the diagram, organizations can develop short- and long-term solutions.

4. Tool verification for solving problems in the hoshin kanri system on the example of Toyota Motor Corporation

One of the companies using hoshin kanri is Toyota Motor Corporation, which is currently the largest and one of the most technologically advanced car manufacturers in the world. Toyota currently sells almost 11 million cars a year and is famous for developing the concept of cars that guide the development of the global automotive market. In the last 70 years, Toyota has developed one of the most effective management and production systems, and concepts such as the Toyota Production System, Toyota Way, Toyota Philosophy or Lean Management. Toyota is also an excellent exemplification of the integration of the lean management concept and the hoshin kanri method (Głowicki, Kowalewski, 2016).

Indicators driving problem solving and supporting process orientation are important for Toyota. Most important educational measures track progress in achieving stretch improvement goals, which is the process described above – hoshin kanri (Choi, Liker, 1995).

The hoshin kanri systematically uses the PDCA cycle, also called the Deming cycle. PDCA is a management method aimed at discovering problems, solving them and constantly improving every aspect of the organization's functioning. Each of the analyzed problem-solving tools is also based on the Deming cycle. Quality tools for solving problems in system hoshin kanri are used in step 5, to enforcement of annual targets.

Summary of results from the analyzed quality management tools for solving problems in hoshin kanri system in Table 2.

Table 2.
Quality tools for solving problems in HK

Quality tool for solving problems			Hoshin Kanri System	
Name	Purpose	Results	Input	Output
Ishikawa diagram	Pointing out and grouping the causes of the problem.	Graphical presentation of the relationship between factors that affect a given problem and effects	The causes of problems that annual goals have not been met.	Corrective and preventive actions against similar problems.
DMAIC	Improving process productivity, project finances, quality and time.	Analysis of the current state and the desired state.		
5-Why	Inspect a certain problem in depth until it shows the real cause.	Finding the answer to the cause of the problem.		
A3 Report	Document the learning, decisions, and planning involved with solving a problem, facilitate communication with people in other departments, provide structure to problem-solving so as to maximize learning.	The report tells the whole story, the details, description of the situation, objectives, problem analysis, plan further action.		
8D	Effective finding the cause and establishing corrective actions.	Problem analysis in the form of a report.	Completed data sheets in accordance with the guidelines in the reports.	Solving problems in a standard and systematic way, very detailed data, a systematic approach to solving emerging problems and stimulating the process of continuous improvement of the enterprise. The analysis is based on standard steps. They provide the opportunity to determine the cause of the problem and the required corrective actions.

Note: source – own study.

The analysis showed that the best way to solve problems in hoshin kanri is to report A3. This report appeared at Toyota Motor Corporation as a method combining two important management processes: hoshin kanri and problem solving. At the enterprise's macro-scale, hoshin kanri leads to setting operational goals and actions in line with higher organizational goals, at the micro level, at the individual level, the formalized problem-solving process provides the organization with the possibility of continuous learning. The A3 process combines both scales. Therefore, companies that are looking for a way to discipline the hoshin kanri process and an effective problem-solving process, can find a great challenge and powerful possibilities in A3. Organizations use this tool to make decisions, achieve goals and implement actions, ensure proper understanding of team goals, and above all to teach for better efficiency, efficiency and improvement. A3 is both a problem-solving tool and a structured process of educating employees in solving these problems. It helps to promote a scientific method that forces to observe reality, present specific data, determine feasible remedies geared to achieving the previously set goal, and describes ways to check later whether the selected remedies really do the job.

Using the 8D tool allows to identify the cause of the problem and apply effective measures to prevent it from reoccurring. The popularity of 8D is associated with a long list of measurable benefits of its implementation. On the advantages side, the 8D method should include a simple and logical structure showing the next steps of the procedure and a wide range of application.

In case of 5-Whys technique is an effective way to sort through a wide range of problems. Keep in mind that some problems have more than one root cause, so for complex issues, it may need to be repeated by asking several different starting “why” questions.

The DMAIC cycle can be quick and easy for simple problems with clear root causes, or it can involve many improvement tools and cross-functional collaboration for more difficult challenges. In either case, it requires discipline and attention to detail, two very important elements of continuous improvement. Organizations that get very good at DMAIC put themselves in the position to respond quickly to problems and achieve benefits that last but usually works for a relatively short time. Often, DMAIC is an ideal starting point to solving problems, but is hardly a substitute for a personalized and well-thoughtout manufacturing strategy.

5. Summary and conclusions

In summary, presented in the article troubleshooting methods used in system hoshin kanri are unique and useful mainly because of its scientific basis. This is confirmed by example of Toyota Motor Corporation, which uses solutions based on the key PDCA cycle. The tools discussed in the article were divided into two groups, those more useful for solving problems occurring in the HK system and those less helpful. Those from the second group are used and it is recommended to use them as components of Report A3 and 8D, which are more complex.

The choice of the most accurate tools was determined by their relevance and complexity. One of the arguments was to focus on multifaceted root causes instead of the problem or selected first order cause. Another argument was a significant and stable improvement effect due to multi-faceted analysis and elimination of root causes. The last advantage was the ease of use at every level of the organization. These tools are simple, logical, fast and clearly define next steps in solving problems. What is more, they are transparent and understandable, making communication easier. In this way, A3 and Report 8D most accurately entered the subject matter analyzed in the article.

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