

TQM METHODS APPLIED IN THE HOSHIN KANRI MANAGEMENT SYSTEM

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Abstract. The paper reviews the application of TQM methods used in the hoshin kanri management system based on literature and empirical research. First, the Japanese approach to policy deployment is briefly described. Next, a typical set of management tools proposed by Japanese and American scientists is presented. Research conducted among Japanese subsidiaries operating in Poland reveals the use of different sets of TQM methods and techniques. Hoshin kanri, perceived as a management system, has a superior role compared with other management tools. In this way, the link between it and identified methods was shown and judged against the models presented in literature.

Keywords: TQM methods, hoshin kanri, Japanese subsidiaries in Poland.

1. Introduction

At any given time, companies rely on different methodological approaches. Consequently, a combination of varied management methods is transformed into a unique management system for a given organisation. One of these methods that initiates the process of integration is the hoshin kanri method assisted by various management tools. It is perceived as a means of strategic management in quality management systems that allows for the implementation of various methods in an organisation. It is, therefore, a sort of conveyor belt that facilitates the application of new management methods. This feature enables a practical implementation of the TQM idea and also Lean Management solutions. The perception of this method as a moving spirit suggests its superiority over other approaches to management or treating it as an implementation mechanism.

This article compares the experience of Japanese and American companies in the area of practical application of this method and other ones in the last half a century with the results of research conducted in 2009 amongst Japanese companies operating in Poland. The aim of this paper is to verify the co-occurrence of various methods as a result of application of hoshin kanri.

2. Definition of *hoshin kanri*

Hoshin kanri originated in Japan in the late 1960s and has since become a vital element of a number of organisations effectively implementing TQM. The name of the method is hard to translate into other languages, which is why most authors leave it in its original formulation. The meaning of the Japanese term combines checking, steering, policy

management and the direction pursued by an organisation. The first comprehensive work on the subject published outside Japan was a translation of a work edited in 1991 by Akao and titled *Hoshin Kanri: Policy deployment for successful TQM*. According to Akao (1991), hoshin kanri means striving “for achievement of management’s purpose, a system of enhancement of the company’s overall capability and banding together all capability of the company for improvement of performance through: deployment of a unified policy and plan (implementation, check, action for improvement) established as an annual management plan based on a company motto (basic company management concept). Management strategy is a form of long/medium-term management plan annual management plan, by utilizing major resources for management (people, goods, money) and optimally bonding together quality, volume, cost, and timing (delivery)”.

Accordingly, it is possible to define hoshin kanri as a management system in which different methods are used. Below, follows an explanation of traditional auxiliary techniques (i.e. from the vantage point of this method), as well as its demonstration as a mechanism for the implementation of the Lean Management concept by Toyota Motor Corporation. On that basis the hypotheses was proposed, and next, checked during research.

3. Auxiliary methods in *hoshin kanri*

In hoshin kanri, owing to the development of methods that support the implementation of TQC, the first seven old (basic) TQC tools were used (Akao 1991). It was not until 1978 that a proposal was put forward by the JUSE team headed by. Nayatani titled *Applying QC tools in Policy Man-*

agement, in which seven new TQM tools were used to solve problems and subsequently, for strategic management (Akao 1991). The new 7 TQM tools was proposed by Research Society for the Seven New QC Tools together with assistance of Shigeru Mizuno, from Tokyo Industrial University and Yoshio Kondo, from Kyoto University (Mizuno 1988). Drawing on this proposal, Koura presents the application of the seven new TQM methods in the process of policy deployment. Individual methods are used in various cases to analyse problems, proposals, opinions and provide performance measurements.

Possible applications of the seven new TQM methods at individual phases of hoshin kanri involve the following:

1. Planning of medium- and long-term policy: affinity chart, relation chart, system chart, matrix chart;
2. Decision on this year's president's policy: matrix chart, affinity chart, relations diagram;
3. Deployment to departments: system chart, relations chart, PDPC, arrow diagram;
4. Implementation of policy and dept. policy: arrow diagram, PDPC (Akao 1991).

Seven new TQM tools were perceived as a supporting hoshin kanri.

A different approach to the choice of auxiliary methods in the hoshin kanri method is taken by King (1989). On the basis of Maslow's hierarchy of needs, he developed a hierarchy of needs of an organisation. The achievement of the need occupying the very top of the pyramid is possible through the implementation of phases typical of the implementation of the hoshin kanri method. Fig. 1 offers a graphical representation of this process.



Fig. 1. Hierarchy of organisational needs and corresponding phases of the hoshin kanri method according to B. King (King 1989).

Passing from one phase to another requires the use of auxiliary methods. Thus, in order to pass

from phase zero to phase one, the organisation needs seven classical TQM methods in order to be able to manage processes. Transition to subsequent phases is possible by diagnosing individual and organisational obstacles and weaknesses followed by the undertaking of appropriate actions. In order to progress to the next phase managers must coordinate their individual needs with other managers. It is important that each manager chooses only three main things that they want to achieve as part of their annual plan. Phase four may occur when as a result of organisational diagnosis the most important priorities are defined for the ensuing period of five years and the organisation has been fully integrated (King 1989). The final phase comprises all the partial elements that appear at the lower levels of the hierarchy such as: the vision, the annual plan, development, process management and the annual diagnosis. B. King matches appropriate TQM methods and techniques to each of these elements that constitute phases of the hoshin kanri method.

King's approach is strongly influenced by Japanese researchers and it correlates to proposition appeared in edited by Akao book.

These two presentations of auxiliary tools in hoshin kanri is the most consist and popular amongst other researchers. Similar point of view can be found in Shiba and Walden description of four revolutions in management (2001) and Hutchins's hoshin kanri model (2008).

4. Hoshin kanri vs. Lean Management

The most extensive study of the hoshin kanri and Lean Management methods was presented by Jackson in his book *Hoshin Kanri for the Lean Enterprise* (2006), which was awarded the Shingo prize. What is characteristic of Jackson's work is treating hoshin kanri as a mechanism that permits the implementation of Lean Management as a superior entity. The procedure of hoshin kanri is supplemented by Jackson with various methods and techniques, also mentioned earlier and those characteristic for Lean Management such as: pull system, kanbans, heijunka, Value Stream Mapping, and A3 reports used by Toyota.

Jackson states that "At the heart of lean, six sigma, and lean-six sigma is the same unique business operating system: hoshin kanri" (Jackson 2006). This means that hoshin kanri usually treated as a strategic management method is applied not only in quality management systems, but also in others, including, in this case, Lean Management.

Jackson goes on to note that hoshin kanri may be perceived in various ways. For example,

as a method of strategic planning, a tool for managing complex projects, a quality system that comprises the so-called Voice of the Customer or a system for ensuring profitability (Jackson 2006). Another example of different point of view on hoshin kanri in Lean Management presents Koenigsaecker (2006). According to him the relation between hoshin kanri and Lean Management lies in the setting the metrics of so-called True North, concerning: people, quality, time-cycle, cost/efficiency. But still, hoshin kanri serves as tool for linkage Lean Management and corporate strategy.

In Toyota, hoshin kanri is understood in terms of a “process of cascading transfer of objectives from the top of the company to its progressively lower levels – ending with the work-group level” (Liker 2005). This corresponds to the PDCA cycle.

Dennis, former manager at Toyota Motor Manufacturing Canada, believes that the reason behind Toyota’s success should be sought in the planning and objective achievement system, i.e. in hoshin kanri. In his view, Toyota excels in its capacity to analyse a given situation, to identify two or three obstacles, to formulate plans for overcoming these obstacles and develop them for implementation (Jusko 2007).

Determining where one is going is aided by the understanding and identification of the so-called True North (ideal vision), identification of the organisational DNA (Bowen *et al.* 1999). These two elements may be referred to the company’s vision and mission. According to Basu, Chairman of Toyota Material Handling U.S.A. Inc., the search for organisational identity leads to “an idea, a standard and a guiding beacon for the entire global organization” (Jusko 2007).

The case of Toyota serves to confirm the fact that hoshin kanri fulfils the role of a mechanism that introduces Lean Management solutions into the organisation. Interestingly, Toyota is also treated as a model for the implementation of the TQM concept. As a result, one may conclude that Lean Management appeared in the wake of a quality approach that was implemented in accordance with the idea of hoshin kanri.

In that way, hoshin kanri seems to be indeed an efficient way for implementing new management approach within whole organizations and ensures correlation of action different departments.

5. Hoshin kanri and other methods - empirical findings

5.1. Main premises of research

The cases described in literature and reviewed above permit the formulation of the following hypothesis: hoshin kanri triggers the implementation of other management methods, consequently, it should coexist with other management methods, mainly based on the TQM approach.

The hypothesis that the hoshin kanri method coexists with other methods was verified by a research survey carried out during stage one of the project titled “Adaptation of Japanese management methods to Polish management conditions” financed by the Ministry of National Education conducted by the author of the present article. Research was conducted in the first quarter of 2009 among 51 Japanese companies operating in Poland¹.

Research focussed on a set of selected methods and techniques (tools) used for comprehensive quality management. This set varies depending on author’s professional and educational background and it is not uncommon to find out compendiums with the description of dozens TQM tools (e.g. (Łuczak *et al.* 2007)). Their choice was dictated by literature review describing similar studies conducted in Japan and the United States of America (Akao 1991; King 1989) that comprised the following.

Methods of teamwork: quality circles, innovation circles, efficiency circles and autonomous groups. Teamwork can be treated as one of the general TQM principles (Hamrol *et al.* 1999).

The analysis of research only indicated a general category of teamwork without subdivision into individual methods.

The next set of tools established concerns methods of planning for quality. These are:

- Taguchi methods,
- Shainin methods,
- QFD (Quality Function Deployment),
- FMEA (Failure Mode and Effect Analysis),
- FTA (Fault Tree Analysis).

Listed above methods are mostly used for the first phase of production process and enable preparation the manufacturing goods/services with the minimal risk of failure. They are used both for planning process and products (Hamrol *et al.* 1999).

Based on the first stage of evolution of TQM, originally Quality Control, forced by statistical approach, consequently the next set of tools gathers adequate methods such as:

¹ The actual number of questionnaire surveys returned out of ca. 180 circulated among Japanese companies operating in Poland.

- SPC (Statistical Process Control),
- SAC (Statistical Acceptance Control),
- Processes/machines capability study,
- Shewhart control charts.

This sub-set compromises standard tools for control, developed since 1924. In that year, Shewhart proposed to change the scope of control from product to process applying charts (Massey 1998).

Seven classic (old) TQC tools elaborated by Ishikawa (1982)², was another set of tools taken into consideration during research. The are:

- Ishikawa chart (fishbone chart),
- Pareto analysis,
- Histogram,
- Control chart,
- Graphs (pie charts, bar diagrams etc.),
- Control charts,
- Scatter diagram,
- Flowchart,
- Stratification,
- Run chart.

The purpose of this set was mostly to support manufacturing processes.

Seven new planning and management tools (7 new QC tools), which genesis was previously described, consist of such methods as:

- Relations diagram,
- KJ methods (affinity diagram),
- Systematic chart,
- Matrix chart,
- Matrix Data Analysis,
- PDPC (Process Decision Program Chart),
- Arrow diagram,
- Radar chart.

Moreover, research included general concepts of management such as: Lean Management, World Class Manufacturing, kaizen, Just-In-Time, Six-Sigma, Customer Relations Management (CRM), and, of course, Total Quality Management (TQM). These management approaches are commonly used world-wide, as it is shown in survey conducted by Bain & Company (Rigby 2001).

Respondents of the telephone survey were individuals directly responsible for the area of quality management (quality managers, quality engineers, managers of quality control divisions, management plenipotentiaries for quality management systems etc.).

5.2. Most frequently used methods

On account of the implementation of concepts based among others on teamwork and those referring to the Japanese tradition of management concepts such as Just-in-Time (23.5 % of companies surveyed), TQM (21.6 %), Lean Production (17.6 %), CRM (17.6 %), Six Sigma (9.8 %), Kaizen (3.9 %) and World Class Manufacturing (2.0 %), various methods of teamwork are applied by over 90 % of the surveyed population of companies.

Statistical methods came second. 45 % of all the companies surveyed use at least one method from this group. Substantial interest in them is related not only to the implementation of the above-mentioned concepts and management methods, but also to the use of formalised quality, environment and occupational safety management systems that very often require statistical tools.

Classic TQM tools also attract a considerable interest. Their popularity is related to the fact that most of them are applied in the process of problem solving (especially those involving teamwork). In the case of new quality tools, their application was less widespread. This is related, among others, to the fact that companies use well-known classic quality management tools.

The least frequently used TQM tool in the practice of Japanese companies operating on the Polish market are design quality methods. At least one of them is permanently used by only 22 % of the population surveyed.

6. Verification of the hypothesis

6.1. Assumptions

The companies surveyed were divided into three groups depending on the extent to which they apply hoshin kanri. The first group comprised 5 companies which are familiar with the method and apply it in practice (Gr. 1). The second group includes companies that do not take advantage of this method, but activities such as: cooperation in strategy development and staff participation in the process prove that an approach similar to hoshin does appear in them. 15 companies fall into this group (Gr. 2). These two groups may also be treated as a single one in which the hoshin method appears (Yes hoshin). The third group comprises companies that do not apply hoshin kanri in practice (No hoshin).

Such a division facilitates the chi-square test for independence of application of hoshin kanri methods vs. the others. On this basis the hypothe-

² In literature, usually the following formulations are used: "the seven classic" and "the seven new" quality tools. Owing to differences in assignment of individual methods to groups, their combined total exceeds seven. Research comprised all the possible methods assigned to the "seven" according to different authors.

sis regarding the co-occurrence of the hoshin kanri method and other methods was tested, which answers the question whether or not the application of hoshin kanri is indeed accompanied by other methods.

Below follow the results of the statistical analysis performed using STATISTICA software.

It should be remembered that, given the varying numbers of companies that fall into a given group, the frequency percentages have been calculated accordingly.

6.2. Results

An analysis of interdependencies between the application of hoshin kanri and general concepts of management showed a statistically significant difference only in the case of the Six Sigma method (confidence interval $p < 0.05$). It was the only example of its kind.

Table 1. Hoshin, Lean and WCM

		Lean		WCM	
		No	Yes	No	Yes
Hoshin	Yes	80.00 %	20.00 %	100.00 %	0.00 %
	Gr. 1	60.00 %	40.00 %	100.00 %	0.00 %
	Gr. 2	86.67 %	13.33 %	100.00 %	0.00 %
	No	81.25 %	18.75 %	81.25 %	18.75 %

Lean Management was used more frequently by companies that intentionally apply hoshin kanri, which was not the case with the World Class Manufacturing approach (WCM) (Table 1). However, looking at the distribution of applications, a correlation between companies that use hoshin kanri and those that do not and those approaches does not arise.

A similar relationship occurs in the case of TQM and kaizen. However, for the combined group of companies that apply hoshin kanri in practice, differences among the subgroups are statistically insignificant (Table 2).

Table 2. Hoshin, TQM and Kaizen

		TQM		Kaizen	
		No	Yes	No	Yes
Hoshin	Yes	75.00 %	20.00 %	100.00 %	0.00 %
	Gr. 1	60.00 %	40.00 %	100.00 %	0.00 %
	Gr. 2	80.00 %	13.33 %	100.00 %	0.00 %
	No	96.88 %	18.75 %	93.75 %	6.25 %

Based on the above results one can say that TQM and Lean Management appears equally the same companies. But the detailed analysis of appearance these methods within the company surveyed shows that they are not used together.

The Six Sigma method appeared more frequently in companies that implemented hoshin kanri. Here, the results of the chi-square test for independence was positive, which contrasted with the CRM approach.

Table 3. Hoshin kanri, Six Sigma and CRM

		Six Sigma		CRM	
		No	Yes	No	Yes
Hoshin	Yes	80.00 %	20.00 %	80.00 %	20.00 %
	Gr. 1	60.00 %	40.00 %	80.00 %	20.00 %
	Gr. 2	86.67 %	13.33 %	80.00 %	20.00 %
	No	96.88 %	3.13 %	84.38 %	15.63 %

Just-in-Time was used to a comparable extent both by companies that use the hoshin kanri method and those that do not. As far as teamwork methods were concerned, the hypothesised relationship was not observed (Table 4).

Table 4. Hoshin kanri, JiT and Teamwork methods

		JiT		Team	
		No	Yes	No	Yes
Hoshin	Yes	70.00 %	30.00 %	10.00 %	90.00 %
	Gr. 1	80.00 %	20.00 %	0.00 %	100.00 %
	Gr. 2	66.67 %	33.33 %	13.33 %	86.67 %
	No	81.25 %	18.75 %	9.38 %	90.63 %

In the planning for quality group, respondents indicated only the QFD and FMEA methods. The other ones that belong in this group, namely the Taguchi methods, the Shainin methods and FTA were not used by the companies surveyed. No statistical significance related to the co-occurrence of the hoshin kanri method with QFD and FMEA methods was observed. These methods are more likely to appear in companies that do not use the hoshin kanri method (Table 5).

Table 5. Hoshin kanri, QFD and FMEA

		QFD		FMEA	
		No	Yes	No	Yes
Hoshin	Yes	100.00 %	0.00 %	100.00 %	0.00 %
	Gr. 1	100.00 %	0.00 %	100.00 %	0.00 %
	Gr. 2	100.00 %	0.00 %	100.00 %	0.00 %
	No	96.88 %	3.13 %	96.88 %	3.13 %

As was the case with the former group, the statistical quality control methods group did not reveal statistically significant relationships between hoshin kanri and these methods. The proportions of frequency distribution are similar (Tables 6 and 7).

As was the case with the previous groups, the proportional distribution of frequency of application of the 7 old methods and the 7 new methods TQM groups, respectively, do not support the hypothesis of a significant co-occurrence of the hoshin kanri method with those methods. The fre-

quency distribution in companies that use the hoshin kanri method and those that do not is quite similar. Only in companies that intentionally apply hoshin kanri can a broader application of the 7 classic TQC methods be observed.

Table 6. Hoshin, PC and Shewhart Charts

		Process Capability		Shewhart Charts	
		No	Yes	No	Yes
Hoshin	Yes	80.00 %	20.00 %	80.00 %	20.00 %
	Gr. 1	80.00 %	20.00 %	80.00 %	20.00 %
	Gr. 2	80.00 %	20.00 %	80.00 %	20.00 %
	No	65.63 %	34.38 %	75.00 %	25.00 %

Table 7. Hoshin, SPC and SAC

		SPC		SAC	
		No	Yes	No	Yes
Hoshin	Yes	70.00 %	30.00 %	75.00 %	25.00 %
	Gr. 1	60.00 %	40.00 %	60.00 %	40.00 %
	Gr. 2	73.33 %	26.67 %	80.00 %	20.00 %
	No	56.25 %	43.75 %	75.00 %	25.00 %

Interestingly, despite observations to that effect in literature, there is no correlation between hoshin kanri and the seven new TQM methods. Their proportional distribution in companies that use the hoshin kanri method and in those that do not, is similar (Table 8). That is the most surprisingly finding, because the seven new TQM tools are more frequent mentioned in hoshin kanri literature than other auxiliary methods as it was described in point 3 of the following paper.

Table 8. Hoshin kanri, seven old and seven new TQM tools

		7 old TQC tools		7 new TQM tools	
		No	Yes	No	Yes
Hoshin	Yes	60.00 %	40.00 %	85.00 %	15.00 %
	Gr. 1	40.00 %	60.00 %	80.00 %	20.00 %
	Gr. 2	66.67 %	33.33 %	86.67 %	13.33 %

The above-related survey findings justify the conclusion that Japanese companies operating in Poland to a lesser extent apply the methods that belong to the broadly conceived TQM group of tools. This is supported by the proportion between those that do (40–60 %) and those that do not (60–100 %) apply them in practice.

6. Conclusions

Results of the statistical analysis conducted with the chi-square test for independence have proved that out of the specific management methods only Six Sigma demonstrates a positive correlation with the occurrence of the hoshin kanri method. Clearly, the fact that the hypothesis was not con-

firmed by the confidence interval higher than 0.05 does not mean that such a correlation does not exist. However, the results obtained do not justify an unequivocal conclusion to the effect that the hoshin kanri method is superior to others as an implementation mechanism described in literature. The percentage data concerning the frequency of distribution do not validate the initial hypothesis.

The finding of statistical proves of co-occurrence of Six Sigma and hoshin kanri stands in opposition to Hutchins's conclusion that in traditional hoshin kanri Six Sigma is not considered (Hutchins 2008). The author explains that in Japanese continuous approach Six Sigma tools, like e.g. stratification or histograms, appear in Statistical Process Control, and as such there is no need to consider them separately. The chi-square test for independence of co-occurrence hoshin kanri – SPC did not confirm it. It can be explained by change in perceiving Six Sigma and SPC. Contemporary, Six Sigma is understood broadly as an approach for improving process through statistical analysis with DMAIC methodology (roughly can be compared with PDCA cycle) and is merged with Lean Management. This integration creates Lean Six Sigma concept (Mader 2008).

Nonetheless, the nature of the hoshin kanri method described in the works by Akao, King and Jackson signifies that such a connection may occur even if it is not a characteristic feature of Japanese companies operating in Poland.

Looking at the characteristics of hoshin kanri presented in the literature one may conclude that this method may indeed constitute the conveyor belt that allows for the implementation of such methods as TQM (which is only natural given the development of this method), or else, Lean Management or other management concepts.

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