

KRZYSZTOF KNOP\*, KRZYSZTOF MIELCZAREK\*

## SIGNIFICANCE OF VISUAL CONTROL TYPES IN AUTOMOTIVE INDUSTRY

---

## ZNACZENIE RODZAJÓW KONTROLI WIZUALNEJ W BRANŻY MOTORYZACYJNEJ

### Abstract

The results of the assessment of visual control (VC) types in 10 enterprises from the Silesian province which operate in the automotive industry were presented in this article. These enterprises specialize in production for the automotive industry and constitute companies from Tier 1 and Tier 2 groups in the supply chain. The meaning of visual control was presented in TPS, research methodology and research results. Importance series were used as the basic tool of data analysis. A comparison of importance series was made for the purpose of stating characteristic relations in the scope of importance of the analyses types of VC.

*Keywords: visual control, BOST method, importance series, automotive industry*

### Streszczenie

W artykule przedstawiono wyniki z zakresu oceny rodzajów kontroli wizualnej (zarządzania wizualnego) w 10 przedsiębiorstwach z branży motoryzacyjnej z województwa śląskiego. Były to przedsiębiorstwa stanowiące w łańcuchu dostaw firmy z grupy Tier 1 i Tier 2. Przedstawiono znaczenie kontroli wizualnej w TPS, metodykę badawczą oraz wyniki badań. Jako podstawowe narzędzie analizy danych wykorzystano szeregi ważności. Dokonano porównania szeregów ważności w celu stwierdzenia charakterystycznych zależności w zakresie ważności badanych rodzajów kontroli wizualnej.

*Słowa kluczowe: kontrola wizualna, metoda BOST, szeregi ważności, branża motoryzacyjna*

**DOI: 10.4467/2353737XCT.16.122.5733**

---

\* M.Sc. Eng. Krzysztof Knop, M.Sc. Eng. Krzysztof Mielczarek, Institute of Production Engineering, Faculty of Management, Czestochowa University of Technology.

## 1. Introduction. Visual control in the Toyota Production System

Visual control in the Toyota Production System is known as visual management, visual communication or *mieruka* (見える化). Visual control is the process of translating live information into visible information so that both problems and kaizen opportunities are identified immediately [7]. Visual control is any communication device used in the work environment that tells us at a glance how work should be done and whether it is deviating from the standard [9].

Visual control is often understood in Toyota with 5S practice [8]. 5S is a tool for workplace organization so that everything has a place and everything is identified. The main intent of 5S is the same as the visual control system – to make problems visible immediately. The most important fact in visual control is that it leads to undertaking a specific action, which in Toyota indicates problem-solving process [11].

Visual control has a special place in the Toyota Motor Company. It is one of the production techniques connected with company's perfection that is integrated with the process of increasing added values [9]. Visual control is a heart of the Toyota Production System [6], it is a very important element which completes and intensifies other elements of this system. Visual control is a fundamental element in Toyota's production system, a particularly important tool in the "pillar" named Jidoka [9]. Toyota plants use in Jidoka visual control tools such as a problem display board system called andon. Other examples of visual control in TPS include kanban, daily production boards, signs classifying sections, coloured lines on the floor indicating how a product is to be stacked, metal clipboards, containing information that is needed at your fingertips [10]. Two kinds of visual control which are deeply rooted in the Toyota culture, are: visual indicators that contain graphs, charts, andon and kanban systems and the A-3 report standard. One of the greatest innovations of Toyota in the field of visual control is obeya [9]. TPS visual controls system have four main goals: informative, instructional, identification and planning.

The 7<sup>th</sup> rule of the Toyota management claims is "use visual control so that no problems remain hidden" which means:

- use simple visual signals to help employees continuously check whether the process is a standard that differs from the standard;
- avoid using computer screens if you distract the worker in the workplace;
- design simple visual inspection systems in the workplace to support movement and "pulling";
- whenever possible, limit the report to a single page - even if it concerns the most important financial decisions [9].

The implementation of the visual control system brought Toyota specific and notable benefits in the form of increased productivity, reduced number of defects and errors, help in meeting dates, facilitation of communication, improvements in safety, reduction of costs, and providing employees with greater control over their own environment [9, 11].

## 2. Research methodology

The BOST survey was the basic tool used to evaluate the significance of visual control types. The full name of this method is BOST – Toyota’s management principles in questions [1, 2]. It is a tool of transformation of Toyota’s management principles into questions. It serves to assess the practical use of management approach subscribed at Toyota among manufacturing and service companies in Poland. The BOST research aimed at proving that in companies operating in Poland, regardless of the ownership form, the crew subconsciously uses the elements of management principles, which they may have never heard before. These principles are Toyota’s management principles (14). Toyota’s management principles in the BOST method are described by characteristic factors. The sets of factors are called areas. Toyota’s management principles are divided into four parts, while the BOST survey has two versions: a version for employees and superiors [3].

The issue of visual control types evaluation in the BOST questionnaire form appears in the E7 area. The content of E7 area is the answer to the seventh principle of Toyota management. The question in E7 area is the following: *What is the most important element in the visual control?* In the box, types 1, 2, 3, 4, 5, 6 are presented (6 as the most important factor) [4, 5].

CS		Cleanness/Order
EP		Flow
TI		Information board
UP		Participation in production places
ME		Monitoring
GW		Graphic presentation of results

To assess the significance of visual control types in the BOST survey, a six ordinal scale described numerically is used [6].

The BOST survey was carried out in 10 companies from the automotive industry in order to obtain the opinion about the significance of visual control types. The researched companies from the automotive industry specialize in delivering products to the automotive industry, dealing with delivering products for the first or second assembly (Tier 1 and Tier 2 suppliers). These companies conduct their activity in the area of the Silesian province. This research area was chosen due to the crucial meaning of this business for the economic development of this part of Poland, which is confirmed by statistical data. Producing companies, among others, motor vehicles, located in the Silesia province generated in 2014 the highest value of production sold in million zloty, more than mining and extractive industry [12]. A sample of enterprises was selected in the quasi-random way. An essential condition of the selection of enterprises from the automotive industry was a confirmed use of visual control (in the course of preliminary analyses). Next, 10 enterprises were drawn from among the rated enterprises from the examined businesses and a sample of production workers was examined by means of the BOST survey. The sample of workers from the population was selected also in the quasi-random way. For BOST examinations, a proven contact with

the system of visual control was an essential criterion for the selection of production workers (on the basis of preliminary analyses). Altogether, 356 production workers were examined from 10 researched enterprises and their opinions about the importance of visual control types were collected.

An essential tool of results analysis in the scope of the meaning of visual control types was the scale of Thrustone comparative assessments [13] (result of applying the method of Thrustone comparative assessments). It was used for the purpose of creating importance series for the types of visual control (Fig. 1).

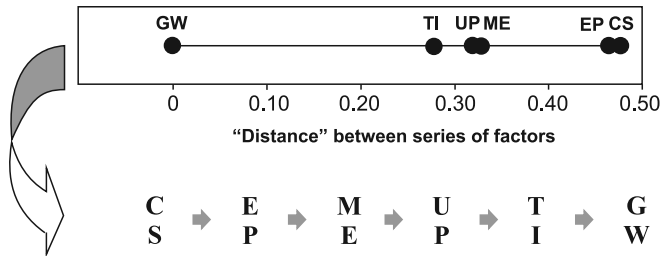


Fig. 1. Scale of Thrustone comparative assessments and importance series created on its base

The examined numbers of importance series were subjected to a detailed analysis on account of the place of appearing of visual control types in these individual series.

### 3. Research results

As a result of the assessment of visual control types made by production workers in 10 examined enterprises from the automotive industry, importance series were created. It results from the preliminary analysis of the importance series of visual control types that numbers of the examined types of visual control are individual and specific for the examined enterprises from the automotive industry – the lack repeats (at least one) of arrangement of the importance of visual control types in the half set (in the scope of places 1–3 and 4–6) and total (examining all places in the importance series) in the range of 10 enterprises.

A summing up analysis was made in the scope of the location of individual factors of the seventh principle of Toyota (visual control types) in the importance series for 10 enterprises from the automotive industry. The most important type of visual control in 3 enterprises was cleanness/order (CS) and flow (EP). Participation in production places (UP) was among the most important types of visual control in 5 enterprises. Information board (TI) and graphic presentation of results (GW) were the less important types of visual control (in 5 enterprises). Graphic presentation of results (GW) was the least important type of visual control in 5 enterprises. Generally, cleanness/order (CS) and participation in production places (UP) were the more important types of visual control (in 7 enterprises). In all the examined enterprises from the automotive industry, graphic presentation of results (GW) was the less important type of visual control.

The summarized importance series of visual control types for the automotive industry (in 10 enterprises) are presented by the following model:

$$\begin{array}{ccccccccc} \mathbf{C} & \rightarrow & \mathbf{E} & \rightarrow & \mathbf{M} & \rightarrow & \mathbf{U} & \rightarrow & \mathbf{T} & \rightarrow & \mathbf{G} \\ \mathbf{S} & & \mathbf{P} & & \mathbf{E} & & \mathbf{P} & & \mathbf{I} & & \mathbf{W} \end{array} \quad (1)$$

Cleanness/order (CS), flow (EP) and monitoring (ME) there are the most important types of visual control in the automotive industry. Graphic presentation of results is the least important type of visual control (GW), in the second order there are information boards (TI) and participation in production places (UP).

#### 4. Conclusions

How big is the meaning of visual control tools in the scope of keeping cleanness and order in the automotive industry? Such a big meaning of that type of visual control tools could not be related to without 5S Practises. Visual control is connected with 5S Practises and inversely, these two systems support each other (synergy effects). The need for implementing visual management results from the desire for effective application of 5S practices in the production. After workers get accustomed to actions connected with the maintenance of cleanness and order in “gemba”, they become a part of their everyday duties. Workers apparently noticed some benefits in having a well-organised and tidy place of employment and pride in the fact that their workstations and surroundings are clean and tidy. Such changes are easily noticeable by everyone in the surroundings, not only by workers from the 5S practices area. Keeping a place of employment constantly in neatness and order requires a lot of effort from workers. Involving workers in keeping cleanness in their workstations and surroundings that is supported by the use of visual control tools, contributes to the increasing meaning of 5S practises and the visual control system. It should also be emphasized that 5S practices are one of the most often implemented tools of the Lean manufacturing conception among enterprises from production branches. The process of the introduction of changes in a company which consists in implementing less or more advanced conception of both improving the quality and the production often starts with implementing 5S practices. The measurability benefit of 5S practices, general universality of this program in the examined production companies, major effort connected with the maintenance of cleanness and order (trainings, audits, complicity in implementation and maintenance), easiness of noticing such changes by all workers, were undoubtedly the aspects that contributed to the highest assessments of the importance of 5S practices and visual control tools connected with them in the automotive industry.

Flow (EP) and monitoring (ME) are tools that were recognised as essential in the visual control system in the examined enterprises from the automotive industry. Different types of visual tools were used in the examined enterprises for the purpose of passing products from one position to another in a systematic, unchanging and incessant way: kanban cards, colourful lines, Hejiunka boards, so-called one piece cells of the flow, i.e. lines in the shape of the “U” letter at a large stake of assembly works. An important element of equipping the factory floors was also luminous showing parameters of the course of the process, the size

of the production plan, current number of produced goods, pointing at places of problems appearance what monitoring and steering the course of a production process. The system of monitoring in chosen enterprises included also applying cameras in the critical areas of the process that created the value added.

Superiors actively joined the process of problem solving in the production places by identifying problems, using the sense of sight and available for this purpose tools of visual control – participation in production places (UP).

Information board (TI) and graphic presentation of results (GW) are comparatively the least important types of visual control. Their role in revealing problems in the workshop and their meaning in the system of visual control was relatively smaller according to the workers.

## References

- [1] Borkowski S., *Toyotaryzm. Wyniki badań BOST*, Wydawnictwo Menedżerskie PTM, Warszawa 2012 [in Polish].
- [2] Borkowski S., *Toyotaryzm. Zasady zarządzania Toyoty w pytaniach*, Wydawnictwo Menedżerskie PTM, Warszawa 2012 [in Polish].
- [3] Borkowski S., Ingaldi M. (red.), *Toyotaryzm. Zagadnienia kontroli w metodzie BOST*, Oficyna Wydawnicza Stowarzyszenia Menedżerów Jakości i Produkcji, Częstochowa 2012 [in Polish].
- [4] Borkowski S., Knop K., *Measurement and Analysis of Visual Control Importance in a Company of Automotive Branch*, Proc. of CO-MAT-TECH 2012 “Global Crises – Opportunities and Threats, 20th International Scientific Conference”, October 10<sup>th</sup>–12<sup>th</sup>, 2012, Trnava, Slovak Republic, Vydavateľstvo Alumnipress, Trnava, 64-75.
- [5] Borkowski S., Knop K., *Visual Control as a Key Factor in a Production Process of a Company from Automotive Branch*, Production Engineering Archives, **1**, 2013, 2528.
- [6] Borkowski S., Knop K., Rutkowski T., *Meaning of Visual Control Types in Production Improvement. Chapter 9*, [in:] Borkowski S., Konstanciak M. (eds.), *Production Improvement*, Tripsoft, Trnava, 2011, 117-128.
- [7] Hirano H., *5 Pillars of the Visual Workplace: The Sourcebook for 5S Implementation*, Productivity Press, Portland, OR, 1995.
- [8] Knop K., Borkowski S., *Evaluation of Visual Control in 5S and 5M*, Proc. of “Ekonomika a manazment podnikov 2011. Medzinarodna vedecka konferencia. 4 a 5 oktobra, 2011”, Zvolen 2011, 118-126.
- [9] Liker J.K., *Droga Toyoty. 14 zasad zarządzania wiodącej firmy produkcyjnej świata*, MT Biznes, Warszawa 2005 [in Polish].
- [10] Mann D., *Creating a Lean Culture Tools to Sustain Lean Conversion*, Productivity Press, New York 2005.
- [11] Moulding E., *5S: A Visual Control System for the Workplace*, AuthorHouse, Central Milton Keynes 2010.
- [12] *Rocznik Statystyczny Województwa Śląskiego*, GUS, Warszawa 2015 [in Polish].
- [13] Sagan A., *Analiza preferencji konsumentów z wykorzystaniem programu Statistica – analiza Conjoint i skalowanie wielowymiarowe*, StatSoft, Kraków 2009 [in Polish].