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PRODUCT DEVELOPMENT BY HOSHIN KANRI APPROACH: AN APPLICATION IN RETAIL SECTOR

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ABSTRACT

Organizations have to pay attention on increasing customer expectations in a competitive environment. While product variety is increasing, in parallel product life cycles are decreasing. Customers also expect custom features on products. To handle with all these compelling challenges; organizations try to guarantee that every action taken on operational and tactical levels are just for strategic goals. Influence on total product cost at early design phase is another way of coping. Strategic planning and integrated product and process design and development issues are considered together in this paper. A road map is developed which begins from generation of strategic goals and ends with selection of alternative concept design phase. Finally first part of this road map is implemented for a retail organization.
Keywords: Hoshin kanri, integrated product and process design and development, retail.

HOSHİN KANRİ SİSTEMATİĞİ YARDIMIYLA ÜRÜN GELİŞTİRME: PERAKENDE SEKTÖRÜNDE BİR UYGULAMA

ÖZ

Artan müşteri beklentileri ve ürün çeşidi ile kısalan ürün ömürleri günümüz organizasyonlarının çözüm üretmesi gereken birincil problemlerdendir. Organizasyonun her aşamasında yapılan her türlü faaliyetin şirketin stratejik amaçlarına hizmet etmesini garantilemek ve ürün maliyetlerine daha tasarım aşamasındayken etki etmek bu problemle başa çıkma yollarındandır. Bu çalışmada şirketin stratejik planları ile ürün geliştirme yönetimi konusu birlikte ele alınmıştır. Şirketin stratejik amaçlarının oluşturulmasından, bu amaçlarla konuşan ürün ve süreç geliştirme projesi için üretilmiş alternatif tasarımlardan birinin seçimi aşamasını da kapsayan bir yol haritası tasarlanmıştır. Son olarak tasarlanan bu yol haritasının birinci aşaması perakende sektörü için uygulanmıştır. Metodolojinin diğer aşamaları ise proje planı şeklinde gösterilmiştir.
Anahtar Sözcükler: Hoshin kanri, entegre ürün ve süreç tasarım ve yönetimi, perakende sektörü.

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1. INTRODUCTION

Organizations have to pay attention on increasing customer expectations and have to focus on customer experience [1]. In industry 4.0 world, they also care about their customers one by one instead of customer segmentation. Because just one negative experienced customer may reach at millions. One of the most influenced sector is retail. In retail's competitive environment; penetration to customers, requires much more than lowering prices. Major factors as economic climate and other factors which are controlled by the retail organization in terms of promotions, location, merchandise, price, supply chain etc. are directly determines the retail customer experience and so the success of that organization [2]. Also, the quality of retail service is a determinative factor on customer behavior which leads loyalty and the perception of corporate image [3]. Retailers try to reach different segments of customers by serving them with several store formats and by influencing their shopping habits.

Almost in every sector, product variety is increasing due to customized features on products that customers want. Moreover, product life cycles are shortening [4]. Magrab et al. [5], have mentioned that, at the early stages of product life cycle, approximately 10% of it, product design processes are occurring. During this stage, very large number of decisions are made and about 85% of total project cost (TPC) is determined. In addition to this, about 15% of TPC is actually spent. Another point of view is that the cost of performing changes at process design or production phases will be multiples of the cost of performing changes at product design phase [5]. An integrated framework is studied by Magrab et al., called the integrated product and process design and development team method (IP2D2) [5].A vital way to stand out from competitors is the launch of a new product or new feature of an existing product at the right time. Therefore, product development process should be managed by the strategic goals of an organization. These goals definitely determine the direction of the company.

A strategic approach called *hoshin kanri* (HK) which is common in Japan, is briefly about the deployment of organization strategies to both tactical and operational levels. HK is also named as policy deployment (PD) mostly at western companies [6]–[8]. The most authoritative text about HK is Yoji Akao's text and translated into English in 1991; in Turkish 1999 [9]. HK can be defined as *a strategic tool that maintains the linkage between top management's strategic goals and daily measurable performance indicators* [6], [7], [9]. Nicholas [10], determines HK as "*Management control of a company's direction*". Jolayemi [8], reviewed the literature about hoshin kanri and he mentioned that the rate of publications and books about HK is somehow slow and irregular. According to his findings; pre-planning analysis which are made before hoshin kanri implementation are mentioned or done only at 50% of literature surveyed. Besides this; the mission and value statement are taken place about 30% of literature surveyed.

To the best of author's knowledge, HK and retail are not studied together. In this paper, the issue of IP2D2 is also examined by HK's point of view and a methodology is developed. This methodology is in the form of a road map which begins from the phase where the definition of strategic goals of a company are done, to the selection of an alternative new product design phase. Finally developed methodology applied in a retail organization. The paper is arranged as follows. Section 2 briefly reviews the literature about HK and retail. Section 3 presents the new road map which covers both IP2D2 and HK. Section 4 exemplifies the first stage of methodology which is about the construction of hoshin strategic plan. Also the project planning is figured in this section. Finally, last section consists of the future directions about the developed methodology and conclusion remarks.

2. LITERATURE SURVEY

Similar with statistical process control and total quality management; *hoshin kanri* (HK) has been begun to be implemented in Japan by 1960s. HK is a systems approach which is about the

management of changes in core& critical processes. HK begins with the vision statement of organization; continuous with the strategic plan for three to five years and this plan turns into goals for one-year view. These goals which are for one-year period are monitored periodically. HK is also a business management system that aims to ensure the world-class excellence in customer satisfaction. Voice of customer is the first input of this system and forces to improve the quality, cost and lead time parameters continuously. Directly solves the problems of "management's resistance to change" and "under-utilized resources" [11]. HK is also referred in lean leadership approaches [12], [13]. Briefly, HK has four main phases as below [7],[14]:

- *Focus:* Prioritization of strategic goals
- *Alignment:* Deployment of organization's strategic goals to department/directorate level
- *Integration:* Alignment to projects and daily management
- *Review:* Monitoring periodically and daily

The hoshin planning stages FAIR (Focus-Alignment-Integration-Review) are very similar to Shewart's continuous improvement cycle called PDCA (Plan-do-check-act) [7], [14], [13]. A process called "*catchball*" is recommended to provide an effective link between corporate strategy and annual planning. Gaining a consensus on *deployment of Hoshin targets and measures in team environment* is maintained by this key process. Main differentiation between Japanese HK and western policy deployment is also about catchball process which creates a cross-functional management environment, a continuous and iterative communication [7]. HK is not just a top-down flow, is also a bottom-up type process. A five-phase implementation methodology is illustrated by Cudnev [15]. It basically integrates the value stream mapping tool with HK. She also introduces 5 hoshin methods and corresponding hoshin planning steps as at Table 2.1.

Table 2.1. HK five-phase implementation methodology [15]

Hoshin methods	**Hoshin planning step**
Hoshin strategic plan summary	5-year vision and 1-year plan
Hoshin plan summary	Deployment
Hoshin action plan	Implementation
Hoshin implementation plan	Monthly reviews
Hoshin implementation review	Annual reviews

When, "Hoshin kanri", "Policy deployment" and "Retail" phrases are searched at literature and neither HK&Retail nor PD&Retail were encountered in the same article. Survey shows that HK is a tool which is used by lean enterprises in common. In retail, instead of overall organizational strategy; focused strategies stand out like pricing strategy, store format strategy. Gauri et al. [16], studied the joint effects of considering both pricing and store format decisions in the same framework. Andajani [1] studied about retail strategies in order to increase customer satisfaction level.

Basically, HK articles can be grouped by three types; framework generated ones, review articles and case study based ones (Shown at Table 2.2.). In the first group, Tennant and Roberts [7], presented a methodology about adaptation of the Delphi technique for the effective implementation of catchball process which is the key element of HK. Then they implemented the new technique at the Rover Group, a UK-based automotive company. Finally they claim that three main outcomes are achieved at Rover Group, as "individual thinking", "reinforcement of individual thinking by wider contribution" and "a greater acceptance of the planning outcomes". Su and Yang [17], introduced a framework as extension of HK called EIDPER (envision-identify-diagnose-prioritise-execute-review). They applied the framework at the recruitment process in a high-tech manufacturing firm. Also shared the information that by the framework

they have improved the recruitment cycle time by 40%. Villalba et al. [18], presented a method called "hoshin kanri tree" which tries to standardize the communication patterns of process owners at shop floor among the PDCA (plan-do-check-act). They refer to industry 4.0 and learning organizations by their novel lean shop floor management method. Masai et al. [19] proposed the KREM model (knowledge-rules-experience-meta data) which is a formal model of a lean enterprise. They illustrated their model for HK process. Jiménez et al. [20], presented a new technology which is developed at Neo4j graph database. This tool is based on Check-Plan-Do-Act paradigm and aims to visualize HK. Pun et al. [21], developed a generic 13 step-guideline for quality strategy deployment. They employed quality function deployment tool in the quality strategy development phase. Then they drive hoshin tools in order to deploy these strategies. Finally they have implemented this 13 step-guideline at a service organization called Manufacturing Engineering Laboratory of City University of Hong Kong.

In the second group, Jolayemi [8] made a comprehensive literature review about HK. He found many findings like shortcomings about modern HK in his words Western-type HK. He also classified the publications about HK into 3 categories, namely "Papers that focus on its historical developments and basic theories", "Based on literature survey and reviews", "Based on reports of its applications by western companies". In this class, Nicholas [10] reviewed the empirical literature to find the success factors about total quality management/lean production (TQM/LP), and he claimed that many of them are contained in HK methodology and practices. He found that HK practices vary by company and impacts of HK on TQM/LP success and company performance is practically non-existent (Shown at Table 2.2.). Consequently, a study which covers both HK and retail will fill the gap in the literature.

Table 2.2. Literature review about Hoshin Kanri

Authors and publication year	Manufacturing	General (Both manufacturing and service)	Framework	Case Study	Literature Review	Methods Used
(B. J. Witcher et al., 2008)	x			x		HK and Top executive auditing
(Masai, Parrend, & Zanni-Merk, 2015)		x	x			HK and Lean enterprise models
(Toma & Marinescu, 2013)		x		x		HK and Global strategies
(Tennant & Roberts, 2001)	x		x	x		HK and Catchball process
(B. Witcher & Butterworth, 1999)	x			x		Key features of HK implementation
(Nicholas, 2014)		x			x	HK and Quality management /Lean production
(Su & Yang, 2013)	x		x	x		HK and Human resource management
(Jolayemi, 2008)		x			x	HK and Hoshin process
(Villalba Diez, Ordieres-Mere, & Nuber, 2015)	x		x			HK and Lean shopfloor management
(Jolayemi, 2009)	x			x		HK and Policy deployment
(Jiménez et al., 2016)	x		x			HK and Lean structural networks
(Pun et al. 2006)		x	x	x		HK and Quality function deployment, Service management
Total number of articles	**7**	**5**	**6**	**7**	**2**	**12**

In the third group, Witcher and Butterworth [14] presented a case study of HK practice in Xerox. Witcher et al.[6], examined the use of top executive audits about HK at Nissan South Africa. Jolayemi [22], reviews and compares the Xerox's and Hewlettt-Packard's policy deployment models. He qualifies these two models as "two best practice models about policy deployment and also emphasizes that other organizations can learn from these two organizations'

models. Toma and Marinescu [23], investigated the main features of global strategy at Nissan Motor Company. They aimed to offer a better knowledge about global strategy concept, its design and implementation.

3. DEVELOPED METHODOLOGY

A methodology developed as a road map which begins from the determination of corporate strategic goals and deployment of these strategies to departments; then continuous with the new product development decisions. In order to manage new product designs, a team is built which is responsible for the determination of product family attributes and finally selection of the best concept design alternative is done. This methodology ensures the linkage between corporate strategic goals and new product design projects. Figure 3.1., briefly describes the flow.

Dekkers [24], mentioned that a corporate strategy should consist of three main categories but it could be detailed as well. These three are; marketing strategy, product development strategy and manufacturing strategy. This study is also based on these three main strategies. Since the production term includes both manufacturing and services terms, we preferred to use "production development strategy" instead of manufacturing strategy".

Figure 3.1. Developed methodology

First of all, top management should specify the corporate strategic goals by considering company vision& mission and environmental conditions. This output called "Hoshin Strategic Plan Summary" in HK terminology. Then respectively, deployment of hoshin strategic plan summary to departments is done and a product development team is built. This team is encouraged to determination of the key product features which reflects the customer expectations and top management target cost. Presentation of these features and estimated cost ranges data to the decision makers are suggested in this phase. A spot of alternative concept product designs is generated and team recommends the best one to the top management. The decision makers may want to see some revision on the design alternative. A loop can happen between the team and top management till they reach a consensus. The methodology ends up with the selection of best

concept design. Prototyping, pilot production, serial production and so on till disposal stage are the basic processes which are coming from ahead the developed methodology.

3.1. Determination of Corporate Strategic Goals

The first stage of the developed frame work is determination of corporate strategic goals. Primary input can be remarked as company vision, company mission, market conditions, environmental conditions, technology constraints and key performance indicators. The hoshin strategic plan summary, which surrounds the whole company, includes the strategic goals in a systematic view and determined by the top management. Tangible output of this stage is the document of hoshin strategic plan summary. Generation of hoshin strategic plan summary is detailed in 7 phases:

1. Determine the strategic goals
2. Determine the core objectives
3. Determine the relationship between strategic goals and core objectives
4. Determine the KPIs in order to deploy core objectives to directorates
5. Determine the relationship between core objectives and KPIs
6. Determine the relationship between directorates and KPIs
7. Assign a management responsible for every strategic goal

3.2. Deployment of Hoshin Strategic Plan Summary

Second part of the methodology is the deployment of corporate strategic goals which are mentioned in hoshin strategic plan summary in a systematic way to departments. Each and every department develops and executes their own strategic plan which is called “Hoshin Plan Summary”. For instance, hoshin strategic plan summary for marketing department should include “data about customer” and “data about products” which are also input for both “product development strategy” and “production development strategy”. Customer data mainly consists of numeric data about the target customer information, customer expectations and customer complaints. Data about products refers the main product features, benchmark results, features of competitor’s products, customized features which are expected by target customer, target selling price, target profit margin and estimated sales volume. Finally target cost can be calculated roughly. Creation of product development strategy and process development strategy are done respectively. The key of this stage is the fact that the sum of departments’ individual KPI results, should meet the overall target value which is mentioned in Hoshin Strategic Plan Summary.

3.3. Team Building and Oobeya

After all hoshin strategic plans are done, teams can be formed whose focus point is to design and develop new products and processes. It is suggested that the members of these teams should allocate his/her 100% of their working time to this projects [25]. Production engineers, research and development engineers, finance staff, marketing staff, purchasing staff and process engineers should be the members of teams. Suppliers and customers also could be the members of this team. It is all about the degree of innovation and a strategic decision. An effective way of working with team is the oobeya rooms which integrate both project management and visual management [26]. Visual components trigger the creativity and also advances the communication level between members.

3.4. Determination of Product Family Features

Created team kicks off the project and tries to determine the main features of the products family according to their common goals. Analysis of customer expectations and quality function

deployment (QFD) tools are performed with value engineering operations in parallel. QFD matrix created by customer expectation with corresponding product features. Value engineering results are used for levelling the technical attributes which are settled in QFD. They also can be designated as supporting items for trade off decisions. When QFD and value engineering results are gathered, the target cost can be calculated again in detail as a tactical decision. This part of framework is inspired by Jariri and Zegordi's [27] study which considers QFD, value engineering and target costing tools. They also established a mathematical model and that model gives the optimum result which points out the product key features and the process items to be developed.

3.5. Concept Design Development Phase

Creation of concept design is somehow a process where the creative thinking becomes significant. We recommend that the staff who is responsible from product design may work themselves within in the predetermined product features by the whole team. By the type of product/service, the team should clearly identify the boundaries of product features like the raw material of the part. For instance a raw material could be plastic or metal. Design staff should present alternative concepts designs to other team members.

3.6. Selection of Best Alternative Concept Design

The last stage of developed framework is the selection of the best alternative concept design. Every single team member should reflect his/her certain idea about developed concept design features. This phase is the stage of product life where the total product costs are determined. Because of this cost effective situation, result should be presented to the top management. After top management's approval, process engineers should identify the affected parts of value stream according to new alternative concept design results. Due to this facts, customer order entry points may change and the production types as "make to stock", "make to assemble" or "engineering to order" etc. should be studied. While customer order entry points are determining, make or buy analysis should be initiated. Make or buy analysis may result in three ways; make exactly with internal sources (Case one); buy exactly from outsources (Case two); make with internal sources or buy from outsources (Case three).

After categorization of parts by make or buy analysis; two parallel actions are taken. First one is the generation of "Concept design of production processes" which is feasible only for the parts which are classified in case one or case two. Second one is the "Concept supply chain design" which is created for the parts assigned to case two or case three. Future state maps should show the possible lead time. Using lean accounting methodology, cost and value effective future state map should be chosen. Cost analyzes may be beneficial and based on these profitability analyzes should be performed. The most critical point is that results of these analyzes should be linked with the KPIs which are mentioned on the Hoshin Strategic Plan Summary. According to the top management's final decisions, team may change some details in product or process design and revise the results till a consensus is reached.

4. AN APPLICATION OF METHODOLOGY TO A RETAIL ORGANIZATION

The first stage of developed methodology which is the determination of corporate strategic goals is adapted to the pioneer of food retail industry in Turkey which is Migros Ticaret A.Ş, and also could be seen at Figure 3.2. step by step flow. The following stages of the developed methodology are not included in the scope of manuscript. They are depicted in Appendix A as a project plan. In the consideration of mission and vision statements issued on Migros Ticaret A.Ş. official web site, we fictionalized the Migros Hoshin Strategic Plan Summary for the year 2016. This summary does not reflect the original strategic plan of the company as a whole.

Vision: To be an organized retailer who remains the closest to customers by serving them in a variety of formats through a strategy of pursuing expansion both in its own and in neighboring national markets and always exceeding customer expectations [28].

Mission: To play a leading role in improving the quality of life at home and abroad with a business structure that is as innovative and productive as it is customer-focused, trusted, and mindful of people, the community, and the environment; to generate long-term, satisfying returns for its employees, business partners, and shareholders; to maintain its sectorial leadership in growth and operational profitability [28].

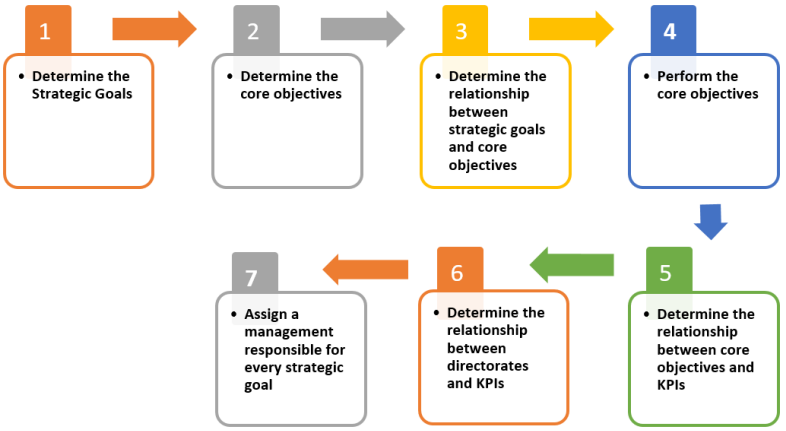


Figure 3.2. Flowchart of "Determination of corporate strategic goals" phase

A few strategic goals are determined by the top management (Figure 3.2. – 1). These could focus on; i) waste elimination; ii) expansion of market share based on vision statement; iii) voice of customer based product/service portfolio creation and iv) making the high-performance sustainable issues.

Four strategic goals are determined based on mission and vision statements and placed on Hoshin Strategic Plan Summary (Figure 3.3.)

- Develop new business/marketing in Turkey and neighboring national markets
- Be the closest retailer to customer by serving them in a variety of formats
- Perform innovative and increasing revenue& efficiency focused projects
- Make high-performance sustainable

Determination of the core objectives can be met with selected and quantified targets (Figure 3.2. – 2). This stage identifies the quantitative targets to perform the corporate strategic goals in the long term. Long term phrase changes by industry and by company. In general where the strategic goals are determined for three to five years, the core objectives are just for one to two years along. All departments have a role during realization of these core objectives. The most critical issue is that all have to address a quantitative value. Top management assign this values by considering current and future conditions of market, environmental facts and vision statement of company. In this study, three core objectives are determined in order to meet four strategic goals.

- Be the pioneer company and raise the bar of retailing standards in the markets where you are active by 2018.
- Grow sales by 400 million $ by 2018.
- Improve financial returns by 7% by 2018.

Third phase of developed road map is the determination of relationship between strategic goals and core objectives (Figure 3.2. – 3). HK aims to provide linkage between every phase and its successor. So HK ensures the most operational function serves for strategic goals at top. Relationships can be expressed by three ways; strong, weak and no relationship. Every strategic goal should be linked by strong relationship with at least one core objective (Figure 3.3.). "Grow sales by 400 million $ by 2018" core objective has three relationship between three strategic goals but has a strong relationship with "Be the closest retailer to customer by serving them in a variety of formats" strategic goal. This strategic goal could be met more possibly when "Grow sales by 400 million $ by 2018" is performed. Another critical issue is that the year 2018 is announced to whole company as a target year. Other relationships are shown at Figure 3.3.

The next stage is the performing the core objectives (Figure 3.2. – 4). In order to maintain this requirement, KPI's are determined. KPIs can be both industry specific and universal, or can be formed by company priorities. KPIs have to mention measureable and quantified values. At Figure 3.3., KPIs are listed for a food retailer. While "%100 kaizen participation" is an example of universal KPI type; the KPI as "Improve sales per square meter by %7 by 2017" illustrates the industry specific type of KPIs.

As HK logic, linkage between KPI's and core objectives must be established (Figure 3.2. – 5). A relationship matrix is integrated to Hoshin Strategic Plan Summary Figure 3.3. The success of the core objectives highly depends on KPIs with strong relationship. A weak relationship indicates a secondary importance of that KPI on the core objective linked on the matrix.

Till this stage, Hoshin Strategic Plan Summary is prepared without directorate/department distinction. From now on, strategic goals, core objectives and KPIs should link with departments (Figure 3.2. – 6). Every single KPI must assign to a department with strong relationship. This process also leads the deployment of strategic goals to department level. Relationship matrix between KPIs and departments are shown at Figure 3.3.

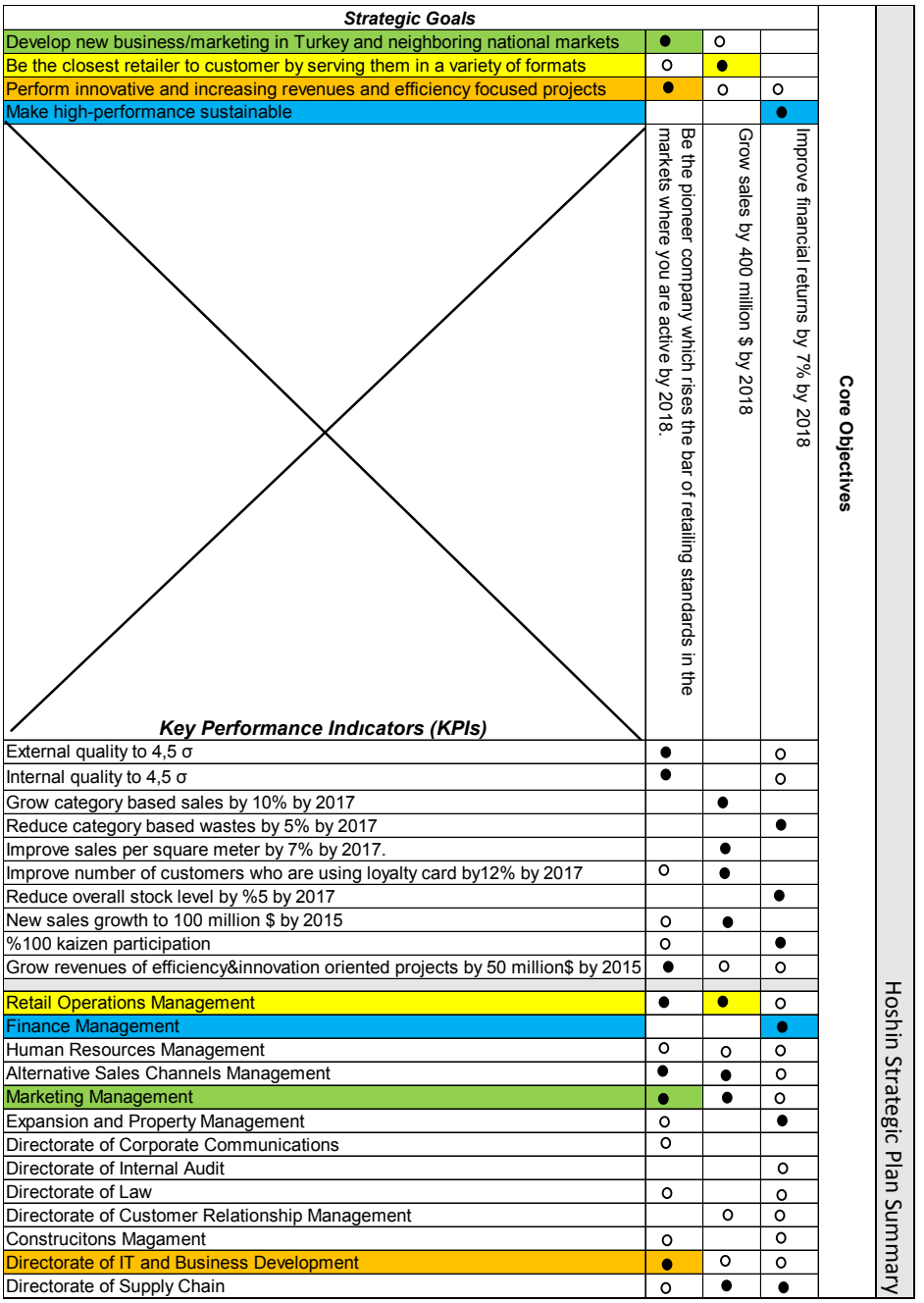
Strategic goals must have a management responsible (Figure 3.2. – 7). While periodic reviews are performing all these responsible should inform the top management. Color coding method as shown in Figure 3.3., is integrated to framework finally.

5. CONCLUSION

In this study, we presented a systematic road map which links organization's strategic goals with product/process development projects. Where the product lifecycles are shortening, customers may want customized features on products that they pay for. As a fact that the total project costs are mostly determined at early design stages of the product development process, IP2D2 approach is used to reduce total project cost. By the help of this methodology, we ensure that these product/process development projects are serve directly for the organization's strategic goals.

Here in, a strategic tool called Hoshin Kanri (HK) constitutes the skeleton of the developed methodology. By HK's point of view each and every movement occurred in both tactical and operational levels could be linked the strategic goals of organization. These facts are valid for service organizations as manufacturing companies. Finally, proposed methodology applied for a retail organization and first stage is described in detail. Following stages are also showed in project plan.

Future research should include the other stages of a product life cycle; prototyping, pilot production, serial production till disposal. All other stages should give feedbacks to previous stages. So continuous improvement can be met for product life cycle. Another issue is that, these tools heavily used by manufacturing firms but also service companies should take the advantages of these approaches. So, developed methodology can be adapt for other service sectors.



o Weak relationship
● Strong relationship

Figure 3.3. Migros T.A.Ş. Hoshin Strategic Plan Summary

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APPENDIX A: Project Plan for Following Stages of Methodology

Stages	Activity	Output	Months														
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Stage 1	Determination of corporate strategic goals	Hoshin Strategic Plan Summary																
Stage 2.1	Determination of marketing strategy	Hoshin Plan Summary for Marketing Department																
Stage 2.2	Determination of business development strategy (Covers both product and production development strategies)	Hoshin Plan Summary for IT and Business Development Directorate																
Stage 3	Determination of product/process development project and formation of project team	Project definition with its target cost and target profit Members of project team with assigned tasks																
Stage 4	Determination of product/process key features	QFD matrix, finalized target cost, features of product or process which will be developed																
Stage 5	Generation of alternative concept designs	Alternative concepts designs																
Stage 6	Selection of best alternative concept design	Best alternative concept design with the documents of Future state value stream map, cost analyzes, capacity analyzes																