



## DESIGN OF PRODUCTS WITH BOTH INTERNATIONAL AND LOCAL PERSPECTIVES BASED ON YIN-YANG BALANCE THEORY AND SWARA METHOD

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### ABSTRACT

Producing and designing products are keys of success and have a critical role in industries. This research presents a new framework for special situations using *Yin-Yang* balance (YYB) theory in producing and designing products with new perspectives. This paper considers general situations in producing products for international producers and industries. SWARA method is applied for prioritizing important criteria of this issue. Six criteria of this research based on their priority were considered as important: general features of each product and applications, cost control and final pricing policies, appearance with moderate perspective, marketing researches in details, identifying target markets in details and special attention to production capabilities. This framework can be modified regarding the needs.

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## I. INTRODUCTION

In today's dynamic and competitive market environment, NPD (new product development) managers as well as design managers have had to rethink how best to manage design and to integrate the various disciplines involved throughout the NPD process (marketing, marketing research, research and development (R&D), industrial design, engineering, and so forth) (Veryzer and Borja de Mozota, 2005).

One opportunity for gaining diverse advantages in the marketplace is product design (Lobach, 1976; Kotler and Rath, 1984; Lorenz, 1986; Hammer, 1995; Veryzer, 1995; Creusen and Schoormans, 2005).

Product design influences consumer preference in different ways (Bloch, 1995). Product developing as a costly and time consuming preface to the introduction of new products has been studied by practitioners and academics in both marketing and engineering design (Michaleket *al.*, 2005). In the academic literature, a number of models has been proposed to provide product planners with information relating to consumer needs or "value systems," as well as to capitalize on synergies in the production process itself (Michaleket *al.*, 2005).

It has been long recognized that as competition augments and technological differentiation becomes more difficult, design specifically what is referred to as industrial design offers an efficacious way to position and differentiate products (Borja de Mozota, 1985, 1990; Lorenz, 1986; Hayes, 1990; Hetzel, 1993; Veryzer and Borja de Mozota, 2005).

Some studies enter in to consideration of the influence of good product design on commercial success (Black and Baker, 1987; Bruce and Whitehead, 1988; Roy, 1994; Thackara, 1997; Gemser and Leenders, 2001; Creusen and Schoormans, 2005).

Which product design will lead an organization to commercial success? Being able to outline some guidelines that can be used in NPD, it is necessary to look at the role of product design in consumer evaluation. First, it must be discerned that this role is intricate and different (Creusen and Schoormans, 2005).

The product which looks aesthetically pleasing attracts buyers' attention and since the incitation of product design on consumer evaluation is often complicated, it is difficult to decide upon during the product development process. For example, a product with bright colors may be valued aesthetically, but these same colors may give consumers the idea that the product has a low quality (Creusen and Schoormans, 2005).

It has been realized that effective integration of cross-functional processes has a considerable influence on the success of NPD (Luo *et al.*, 2005). Extant research has shown that effective integration can have a positive impact on product development cycle time (Griffin, 1997; Urban *et al.*, 1997; Sherman *et al.*, 2000), project performance (Griffin and Hauser, 1992; Olson *et al.*, 2001), and overall company and market performance (Griffin and Hauser, 1996; Gemser and Leenders, 2001; Tatikonda and Montoya Weiss, 2001; Luo *et al.*, 2005).

The key characteristic of a cross-functional approach is that a large number of criteria contributed to the design must be considered precisely. Among these criteria, some are specific and unique to individual functions, and some are common across functions. Typically, many of these criteria are interrelated and affect the design decisions that fall under the domain of the different functions. The power of a cross-functional approach cannot be harnessed unless all

these criteria and their interrelationships are systematically considered and are accounted for in the design development. Thus, an effective and efficient method must be utilized for considering and integrating these criteria to decrease the time and cost of developing design prototypes (Luo *et al*, 2005).

This, along with the trends of increasing complexity and aestheticization of everyday products, has made design an important element in the development of products (Bucci, 1998; Cova and Svanfeldt, 1993; Maffesolli, 1993; Borja de Mozota, 2003; Veryzer and Borja de Mozota, 2005). In fact “design is the criterion that will often donate a company its competitive advantage” (Kotler, 2003, p. 321).

Despite design has been widely considered as an important strategic variable, there has not been much studies on the topic of design, and little progress has been made in furthering our understanding of the NPD process with regard to this “potent” marketing variable. Traditionally, industrial design had been viewed as a service either within an organization or as contracted consulting rather than as a strategic business resource (Veryzer and Borja de Mozota, 2005).

As consumer products technologically become increasingly efficient, human behaviour has a weak connection with individual products and services which shows the weak perception of real application and purposes. We buy ‘energy-saving’ lights and then leave them on all night, boil a kettle-full of water even though we only need a mug-full, and stick with the default setting on the washing machine, afraid of investigating the others (Lockton *et al*, 2009a).

Lot of authors (Lilley *et al*. 2005, 2006, 2009; Rodriguez & Boks 2005; Elias *et al*. 2007, 2009; Bhamra *et al*. 2008; Lockton *et al*. 2008b, 2009b; Weveret *et al*. 2008; Pettersen & Boks 2008) have begun to develop the field of ‘design interventions’ applicable by designers as responses to user behaviour ‘problems’, particularly environmental, but also ‘pro-social’ behaviour generally. The Design with Intent method, briefly introduced in this paper, aims to complement and support these approaches, addressing the deficiency mentioned above, by suggesting relevant design techniques for influencing types of behaviour, and bringing examples of how similar problems have been addressed elsewhere (Lockton *et al*, 2009a).

Defining ‘Design with Intent’ (Dwi) as ‘design intended to influence or result in certain user behaviour’, the authors have reviewed examples from a variety of disciplines (Lockton *et al*, 2008a, 2008b), supported by a blog website and more recently an on-going survey of designers, receiving comments, suggestions and examples from readers around the world, and incorporated this analysis into a tool for designers, the Design with Intent Method (Lockton *et al*, 2009a).

*Yin-Yang* is a unique Chinese duality thinking bearing some resemblance to the dialectical thinking in the West. ‘Dialectical thinking is considered to consist of sophisticated approaches toward seeming contradictions and inconsistencies’ (Peng and Nisbett, 1999: 742).

The Chinese have a long-standing reputation for being ‘dialectical thinkers’ (Peng and Nisbett, 1999: 743) whose reasoning differs from the formal logic dominating the Western philosophical tradition (Needham, 1956; Graham, 1986). *Yin-Yang* captures the Chinese view of paradox as independent opposites compared with the Western view of paradox as exclusive opposites (Chen, 2002). Based on the indigenous Chinese philosophy of *Yin-Yang*, I conceptualize culture as possessing inherently paradoxical value orientations, thereby enabling it to embrace opposite traits of any given cultural dimension. I posit that potential paradoxical values coexist in any culture and they give rise to, exist within, reinforce, and complement each other to shape the holistic, dynamic, and dialectical nature of culture (Fang, 2011).

The main aim of this study is to apply YYB theory in product design with new perspective. Some products are presented with different features in internal and external markets while some of them can be produced and introduced and delivered in both markets without any need to change in their features. In regard to this purpose, authors believe that YYB can be useful in product producing and designing. YYB is a powerful theory with high ability to consider issues with two perspectives about localization and globalization. YYB theory can be functional in many industries and can be applied for the aim of decreasing costs and increasing product diversity.

SWARA method is a new and powerful method that was presented in 2010 (Kersulienė *et al*, 2010). SWARA method can be applied to help researchers who don't have access to information for different reasons. In this research SWARA will apply for identifying important criteria that are critical and vital in producing products with YYB perspective. Finally, this research gives a general framework to companies and organizations for applying this research in managing their products.

## II. YIN-YANG BALANCE (YYB)

Against the aforementioned backdrop, a duality (dialectical) thinking embedded in the indigenous Chinese philosophy of *Yin-Yang* is explained to understand culture (Fang, 2011). The Chinese world view is holistic, dynamic, and dialectical (Li, 1998, 2008; Peng and Nisbett, 1999; Chen, 2002). This world view is best embodied by *Yin-Yang*, an ancient Chinese philosophical principle, and arguably the best-known symbol in East Asia (Cooper, 1990). The *Yin-Yang* symbol is denoted by a circle divided into two equal halves by a curvy line, one side of which is black (*Yin*) and the other white (*Yang*). According to the *Yin-Yang* philosophy, all universal phenomena are shaped by the integration of two opposite cosmic energies, namely *Yin* and *Yang*. *Yin* represents the 'female' energy, such as the moon, night, weakness, darkness, softness, and femininity; while *Yang* stands for 'male' energy, such as the sun, day, strength, brightness, hardness, and masculinity (Figure 1). The white dot in the black area and the black dot in the white area connote coexistence and unity of the opposites to form the whole. The curvy line in the symbol signifies that there are no absolute separations between opposites. The *Yin-Yang* principle thus embodies duality, paradox, unity in diversity, change, and harmony, offering a holistic approach to problem-solving (Chen, 2002).



Figure 1. YIN-YANG SYMBOL

There are different views on the origin of the *Yin-Yang* philosophy. Chen (2008) elaborated the historical and philosophical characteristics of *Yin-Yang* in his analysis of the Chinese concept of *bian*(change) in the well-known Chinese classic *I Ching* (also known as the *Book of Changes*), whose history can be traced back over 3000 years ago (Lee, 2000). For centuries the minds of Chinese elites have been fascinated by the question 'What is the fundamental

principle of the universe'? Chen (2008: 7–9) explained that the answer lies in the discourse on the concept of *bian*(change) which relies on the dialectical interaction of *Yin* and *Yang*.

In Chinese intellectual pursuit, the concept of change was mainly stipulated in the ancient Chinese writing, *I Ching*, or the *Book of Changes*. The concept of change not only gives *I Ching* its name but also formulates its system of thought. . . . *I* is comprised of *Sun* and *Moon*. The sun represents the nature of *Yang*, and the moon the nature of *Yin*. Together, the interaction of sun and moon comes to the emphasis of *Yin* and *Yang* in *I Ching*... Change as a fundamental principle of the universe forms ontological assumptions of the Chinese philosophy and was further developed into a set of guidelines for Chinese beliefs and behaviours. *Change discourse* naturally became the central focus in early Chinese discursive practices ... According to *I Ching*, the formation of change relies on the dialectical interaction of *Yin* and *Yang*, the two opposite but complementary forces of the universe, with *Yin* representing the criteria of yieldingness and submissiveness and *yang* representing unyieldingness and dominance ... This discourse of endless, cyclic, and transforming movement of change continues to influence the philosophical discourse and its assumptions never cease to affect Chinese behaviours in the contemporary Chinese world(Fang, 2011).

The YYB is a frame of thinking with scientific implications, especially potent for scientifically exploring highly complex phenomena, as evidenced by the advances in science and technology in the history of China before the late Western modernization (Needham, 1956), and it is further evidenced by the stories of some of the most prominent figures in the history of modern science in the West (e.g., Leibniz, Jung, and Bohr). In particular, the YYB is an open system (Gu, 2005) to accommodate a balance between “either/or” and “both/and.” It is highly distinctive from Aristotle’s formal logic, which is mechanistic and reductionist due to its absolute denial of potential contradictions with a permanent “either/or” (but never “both/and”). It is also different from Hegel’s dialectical logic, which is ultimately mechanistic and reductionist due to its absolute need for the resolution of transitory contradictions with a temporary “both/and” but ultimate “either/or,” so I term it “both/or” (Li, 1998; Peng and Nisbett, 1999; Li, 2011).

In contrast, the YYB integrates “either/or” with “both/and” for permanent “either/and” in relative terms. In this sense, I take the YYB as a duality in contrast to Aristotle’s logic as an explicit dualism, and Hegel’s logic as an implicit dualism (with its temporary tolerance, but ultimate denial, of contradiction with its ultimate goal to resolve all contradictions) (Nisbett, 2003; Li, 2011).

The YYB can be integrated with Aristotle’s formal logic by revising the latter to accommodate the relatively weak form of contradiction (thus permanent yet relative) given the ontological nature of mutual interdependence and interpenetration (e.g., the two sides of the same coin) in contrast to the absolutely strong form of contradiction for mutual negation (thus temporary yet absolute). Finally, the YYB can be integrated with Hegel’s dialectical logic by revising the latter to accommodate the relatively weak form of contradiction given the ontological nature of mutual interdependence and interpenetration in contrast to the absolutely strong form of contradiction. In sum, the YYB can be expected to have the potential to integrate all extant logical systems into a meta-logical or meta-frame of thinking by accommodating both mutual negation and mutual affirmation between two opposites as a duality (Li, 2011).

To further illustrate why and how to apply the YYB, let’s refer to the debate over global-local dual requirements. There are two basic perspectives about the global-local link (Prahalad and Doz, 1987). One view asserts that the two are only contrary so that we can be either global or local in perspective and strategy, but the other view claims that the two are absolutely

complementary rather than contrary. The above two views delineate the prevailing typology with four categories: global, local, neither, and both, all assumed to be the case in all aspects at all times (Bartlett and Ghoshal, 1998). This approach represents the typical “either/or” logic by either denying the contrary tendencies of global and local forces (in the category of “both”) or denying their complementary tendencies (in the categories of “global,” “local,” and “neither”) (Bartlett and Ghoshal, 1998). In contrast, the YYB can help remedy such biases by treating global and local forces as a duality so that they negate and affirm each other in different aspects (more global in basic R&D and market brand, but more local in applied R&D and market channel), at different times (initially more local but more global later), but they negate and affirm each other only to different degrees (always relatively more or less without going to the polarized extremes, see Table 1). In this sense, the YYB can apply to all controversies and debates in the domain of organization and management research (competition-cooperation duality, Chen, 2008; exploitation-exploration duality, Li, 2010, and stability-change duality, Farjoun, 2010) as well as the methods of induction and deduction into abduction (Charmaz, 2006).

**TABLE 1 – THE YIN-YANG BALANCE (YYB) OF GLOBALIZATION AND LOCALIZATION**

To different degrees without polarized extremes	Low-Globalization	High-Globalization
High-localization	1. High localization & low globalization Typical either/or dualism: high localization in all aspects and/or at all times	2. High localization & high globalization Difficult for either/or dualism; difficult for both/or dualism; easy for <i>Yin-Yang</i> Duality: high-localization in some aspects and/or at some times; high globalization in other aspects and/or at other times
Low-localization	3. Low localization & low globalization Difficult for either/or dualism; Easy for both/or dualism; Easy for <i>Yin-Yang</i> Duality: low-localization in some aspects and/or at some times; low-globalization in other aspects and/or at other times	4. Low localization & high globalization Typical either/or dualism: high globalization in all aspects and/or at all times

Source: Li (2011)

This is a typical one-dimensional dichotomy split into two low-high sub-dimensions (Li, 2011)

### III. A STEP-WISE WEIGHT ASSESSMENT RATIO ANALYSIS (SWARA) METHOD (Keršulienė *et al.* 2010)

There are various approaches for assessing weights (Zavadskas *et al.* 2010a, b), e.g. the eigenvector method, SWARA (Keršulienė *et al.* 2010), expert method (Zavadskas, Vilutienė 2006), analytic hierarchy process (AHP) (Saaty 1977, 1980), Entropy method, etc (Kersulienė and Turskis, 2011).

In SWARA method each of experts first of all ranks criteria. The most significant criterion is given rank 1, and the least significant criterion is given rank last. The overall ranks to the group of experts are determined according to the mediocre value of ranks (Kersulienė and Turskis,

2011). The step-wise weight assessment ratio analysis (SWARA) (Keršuliene *et al.* 2010) methodology is developed in 2010 and applied for the selection of rational dispute resolution method (Kersuliene and Turskis, 2011). The procedure for the criteria weights determination is presented in Fig. 2.

The main feature of SWARA method is the possibility to estimate experts or interest groups opinion about significance ratio of the criteria in the process of their weights determination (Kersuliene *et al.*, 2010).

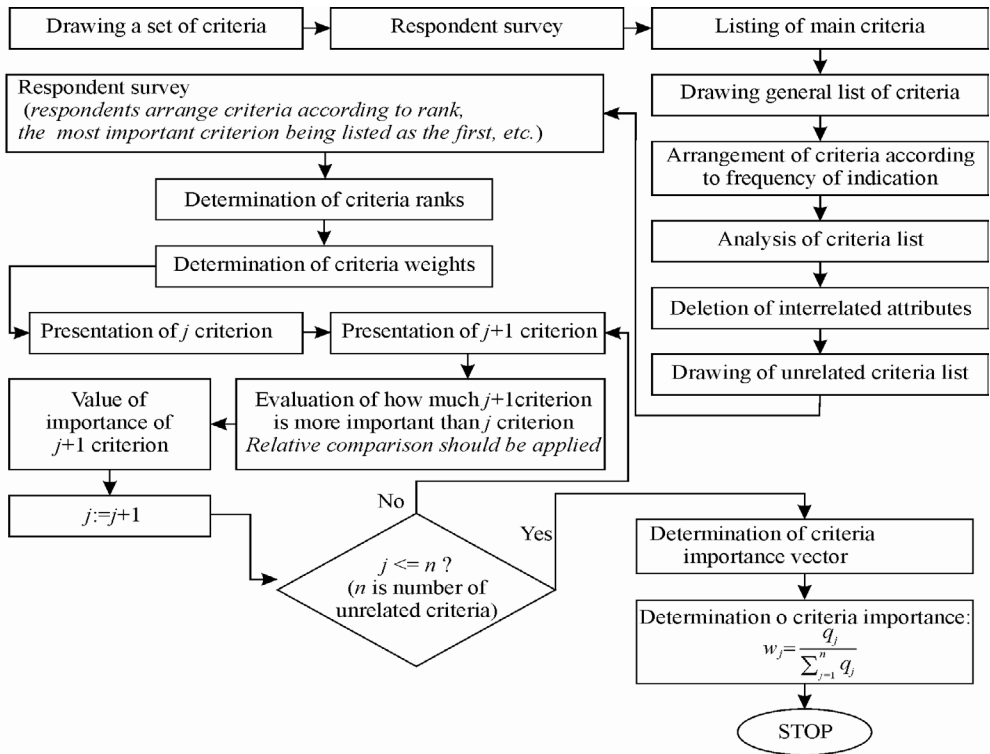


Figure 2.DETERMINING OF THE CRITERIA WEIGHTS BASED ON SWARA

Source: Kersuliene and Turskis, (2011)

### A. IDENTIFYING IMPORTANT CRITERIA IN DESIGN PRODUCTS

According to main idea of this research which is designing and producing products with both internal and external perspectives based on YYB theory. There are many important criteria in this regard but this research wants to identify criteria that have higher importance in this area.



For this purpose, conference meetings were taken place in two parts and five experts participated in. At the first part of the meeting, the experts discussed about different kinds of problems in industries and then presented their ideas and shared their opinions with others and finally six important criteria were selected due to group ideas. Selected criteria of this research are shown in Table 2.

**TABLE 2 - SELECTED CRITERIA**

Important Criteria	
C <sub>1</sub>	Considering important general features of each product and applications
C <sub>2</sub>	Cost control and finally pricing policies
C <sub>3</sub>	Appearance considering with moderate perspective
C <sub>4</sub>	Marketing researches in details
C <sub>5</sub>	Identifying target markets in details
C <sub>6</sub>	Special attention to production capabilities

Source: Authors Calculation

Information about experts is shown in Table 3. Three of the experts are in management and business field and two other experts are in engineering field; one of them is in mechanical engineering and the other one is in industrial engineering. All of the experts were interested in this topic and had experiences of this issue.

**TABLE 3 - BACKGROUND INFORMATION OF EXPERTS**

Variable	Items	NO	Variable	Items	NO
1) Education background	Bachelor	0	3)Sex	Male	4
	Master	1		Female	1
	PhD	4			
2)Fields	Management	3	4)Age	31-40	3
	Engineering	2		41-50	2

Source: Authors Calculation

At the second meeting, the experts stated their opinions in identifying relative importance of each criterion and finally calculating weights of each criterion. Procedure of this section was based on SWARA method and the result is shown in Table 4.

**TABLE 4 - FINAL RESULTS OF SWARA METHOD IN WEIGHTING CRITERIA**

Criterion	Comparative importance of average value $S_j$	Coefficient $k_j = S_j + 1$	Recalculated weight $w_j = \frac{x_{j-1}}{k_j}$	Weight $q_j = \frac{w_j}{\sum w_j}$
C <sub>1</sub>		1	1	0.21
C <sub>2</sub>	0.09	1.09	0.92	0.19
C <sub>3</sub>	0.06	1.06	0.87	0.18
C <sub>4</sub>	0.12	1.12	0.78	0.16
C <sub>5</sub>	0.18	1.18	0.67	0.14
C <sub>6</sub>	0.1	1.1	0.61	0.12

Source: Authors Calculation



Due to SWARA method results weight and relative importance of each criterion was calculated.

## B. MANAGERIAL TIPS

Producing and designing products with the perspective of YYB theory can be useful in industries but producer should pay attention to the design of their products and attempt to produce products that cover expectations. SWARA is a new and powerful method which is applied in this research for identifying relative importance of criteria selected at conference meeting. Considering these criteria will help producers to decrease the risk of their production and introduction of their products and they also can apply this research as a framework. It is suggested that factories establish a team proposed by authors for this purpose and authors believe that a team can decrease the risks, too. This research is useful for industries which have the possibility of developing their products based on YYB theory.

## V. CONCLUSION

The main new idea of this research was producing and designing products based on new perspective, while YYB theory has a historical perspective but it is a powerful perspective and has a special effect in this area. In this research, YYB theory was applied for describing goals of this research and the influence of this historical perspective in business and marketing and even engineering.

In this research, five experts participated and they were in management and engineering fields whose detailed information is illustrated in Table 3. Experts participated in a conference meeting in two sections for analysing features of this research. Six important criteria were selected at the first section and then in section two five experts participated in calculating relative importance and weight of each criterion based on the structure of SWARA method.

Based on SWARA method, criteria were selected due to priorities and their importance. Six criteria of this research based on their priority were considered as important general features of each product and applications, cost control and final pricing policies, appearance with moderate perspective, marketing researches in details, identifying target markets in details and special attention to production capabilities.

Based on the results of SWARA method, the weight of each criterion was calculated and the results were shown in Table 4.

This research can be useful as a general framework for producers and industries but it must be mentioned that this research was done in a general form and its goal was introducing this new perspective to the world of business and engineering. This research should adjust based on each industry and business position in each region and area.

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## **DIZAJN PROIZVODA S ISTOVREMENO MEĐUNARODNOM I LOKALNOM PERSPEKTIVOM NA OSNOVI YIN-YANG TEORIJE RAVNOTEŽE I SWARA METODE**

### SAŽETAK

Proizvodnja i dizajn proizvoda su ključevi uspjeha te imaju ključnu ulogu u industriji. Proizvođači bi morali biti pažljivi što se tiče njihovih proizvoda, ciljanih tržišta kao i mnogih kriterija koje pri tome moraju uzeti u obzir. Ovo istraživanje predstavlja novi okvir za posebne situacije koristeći teoriju *Yin-Yang* ravnoteže (YYB) pri proizvodnji i dizajnu proizvoda s novim perspektivama. Ovaj rad proučava opće situacije u proizvodnji proizvoda za međunarodne proizvođače i industrije. Proizvođači mogu smanjiti trošak i rizik proizvodnje proizvoda uzimajući u obzir kako unutarnje tako i međunarodne karakteristike proizvoda. U tome smislu se koristi SWARA metoda kako bi se odredio prioritet važnih kriterija u ovom pitanju. Pet stručnjaka je sudjelovalo na konferenciji u dvije sekcije i odabrali su važne kriterije. Prioritet kriterija je baziran na stupanjskoj (stepwise) metodi analize omjera težine. Šest kriterija ovog istraživanja na bazi prioriteta je određeno kao važno: opće karakteristike svakog proizvoda i aplikacije, kontrola troškova i politike finalnih cijena, pojavnost s umjerenom perspektivom, detaljna marketinška istraživanja, utvrđivanje ciljanih tržišta u detalje i posebna pažnja proizvodnim kapacitetima. Najvažniji kriterij među njima jesu opće karakteristike svakog proizvoda i aplikacije. Ovaj okvir se može modificirati s obzirom na potrebe svake industrije te se može primijeniti kao model potpore općem odlučivanju za proizvođače i industriju

Ključne riječi: dizajn proizvoda, Yin-Yang teorija ravnoteže, SWARA metoda