

Using Kansei Engineering with New JIT to Accomplish Cost Advantage

Jay Rajasekera and Shantanu Dayal
Graduate School of International Management
International University of Japan and
Britannia Industries Limited, India

February 2009

Using Kansei Engineering with New JIT to Accomplish Cost Advantage

Jay Rajasekera* and Shantanu Dayal**

*International University of Japan and

** Britannia Industries Limited, India

Contact e-mail: jrr@iuj.ac.jp

Abstract

In the present unstable and highly competitive global environment, trying to find a way to stay in business and grow is not always simple. With the shift from a 'product-out' to a 'market-in' approach, the demands of today's consumer for high quality goods and service, has forced producers and service providers to apply quality management practice throughout industry. The purpose of this paper is to explore the new opportunities for the companies to maintain a competitive edge in a market by taking into account psychological and emotional needs of the consumers who are making the purchasing decision based on their psychological and emotional needs called "Kansei" in Japanese. We explore how Kansei Engineering can be used along with New JIT, employed by Toyota, to gain a manufacturing cost advantage. The effect of our approach and cost advantages are demonstrated through a simulated experiment.

Key Words: Kansei Engineering, Just In Time, New JIT, Toyota Marketing Manufacturing System, Toyota Production System, Toyota Development System. Information Technology

1. New JIT and Kansei Engineering

New JIT System is a manufacturing concept pioneered by Toyota, by using IT as a binding force, is shown in Figure 1.

Is it also possible for companies to use IT as a string which will bind Kansei Engineering (KE) and New JIT System so that companies can develop new products which will satisfy their customers emotionally and physically?

KE is an individual subjective impression from a certain artifact, environment or situation using all the senses of sight, hearing, feeling, smell, taste, recognition and balance (Schütte, 2005), which incorporates the meaning of the words: sensitivity, sense, aesthetics, feelings, emotions affection and intuition (Lee, 2002). KE is closely related to sophisticated human abilities such as sensibility, recognition, identification, relationship, making and creative action where the process of biding together these concepts also is part of the Kansei (Shimizu, 2004). Combining the above three definitions we can say that:

Kansei = F (Emotions)

Or, Kansei is a function of emotions.

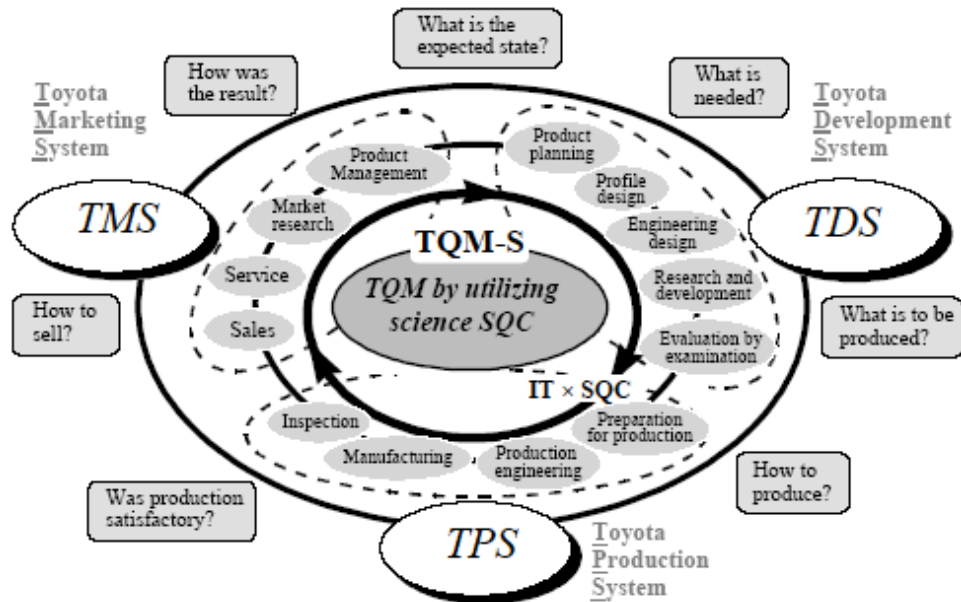


Figure 1: Toyota's New JIT System (Source: Amasaka, 2002)

The characteristics of New JIT System which can be relevant to KE are:

1. TMS (Toyota Marketing System): First Principle
 - a) Exploring new markets through gathering more customer information
 - b) Understand the key fundamentals to increase the product value
 - c) Developing customer satisfaction (CS), customers delight (CD), customer retention (CR), and networks by adopting corporate attitude.
2. TDS (Toyota Development System): Second Principle
 - a) Emphasizing the importance of design philosophy through collection and analysis of updated internal and external information
 - b) Development of design process
 - c) Design method that incorporates enhanced design technology for obtaining general solutions
 - d) Design guidelines for designer development (theory, action, decision-making).
3. TPS (Toyota Production System): Third Principle
 - a) Giving top priority to quality information through customer-oriented production control systems

2. New JIT System Complementing KE using IT

Before we proceed to the use of IT, it may be important to see how New JIT System can complement Kansei Engineering. The basic structure of the concept is described in Figure 2:

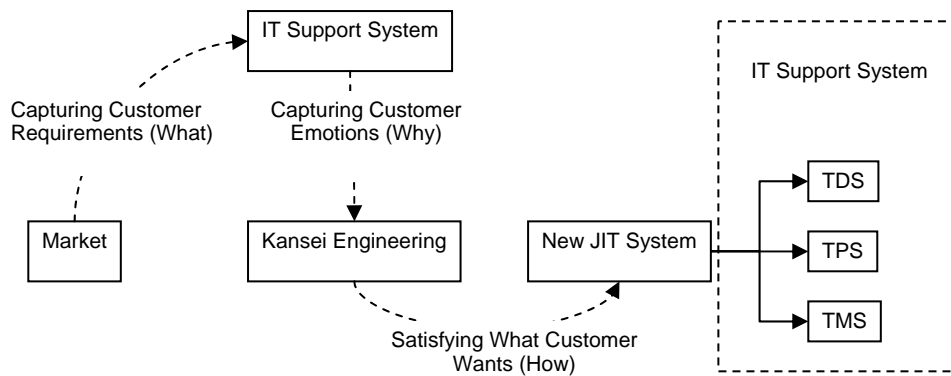


Figure 2: Concept of KE and JIT integration via IT

One of the major challenges what most of the companies face today is to find out what customer wants. Even though the functionality of the product may remain same, some parts may differ from other. A successful company differentiates its product from others by not just meeting the customer's requirements but also by exceeding their expectations. It is this ability that helps a company to gain competitive advantage over its competitors.

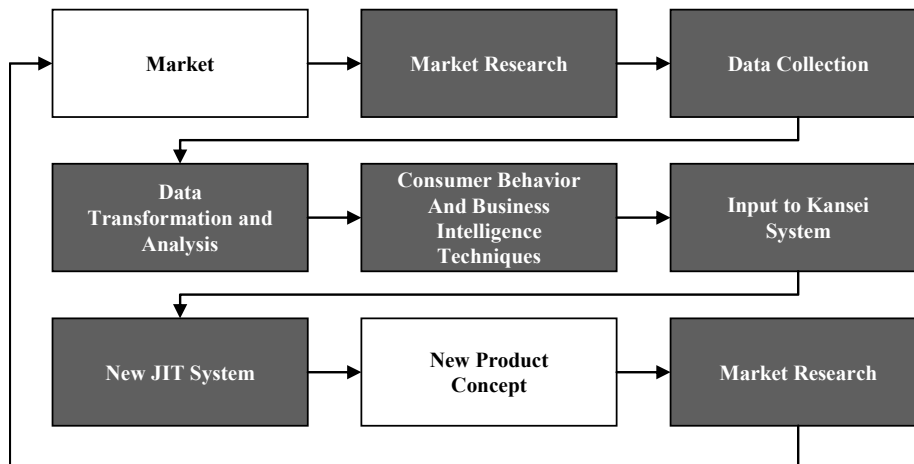


Figure 3: Where IT can be used in customer requirement planning

We can have an idea how IT can be useful in capturing the customer requirements by referring to the Figure 3:

The system shown in the Figure 3, when applied to manufacturing, can be further broken down into two approaches namely:

- Market Driven Approach
- Company Driven Approach

As the name suggests, market driven approach focuses on the market demand and requirement to launch a new product. For this, first it is important to understand the needs of customers and what are the essential features a product must have.

Company driven approach is quite common for most companies who believe in continuous innovation to maintain their competitive advantage in the market. In other words we can say that this is followed by the companies whose main strategy is to introduce a totally new product or a product with substantial change in the existing product. A good example for this could be Apple's launch of iPod and Macbook Air.

Once the company has identified the kind of product required, the next step is how to capture the emotions of the customer relevant to that particular product. The major challenge for the company at this stage is how to transform the intangible emotions into the quantitative parameters. Few ways of measuring Kansei are:

- Words (Most common method)
- Physiological response (Heart rate, EMG, EEG)
- People's behaviour and actions
- Facial and body expressions

Once the requirement, in terms of product satisfaction and emotional satisfaction of the customer has been determined, the next big challenge is to transform the determined parameters into actual product and make it available to the market.

The major components and basic framework of the New JIT System is shown below:

New JIT System		
TMS	TDS	TPS

Further breaking down each component gives us the specific areas which are included in TMS, TDS and TPS.

Using Kansei Engineering with New JIT to Accomplish Cost Advantage

The shaded cells in the following figure show the areas where Kansei Engineering can be applied effectively to deliver the product to the market.

As we can see from Figure 4, TDS as an area where Kansei Engineering may have a significant impact, along with TMS.

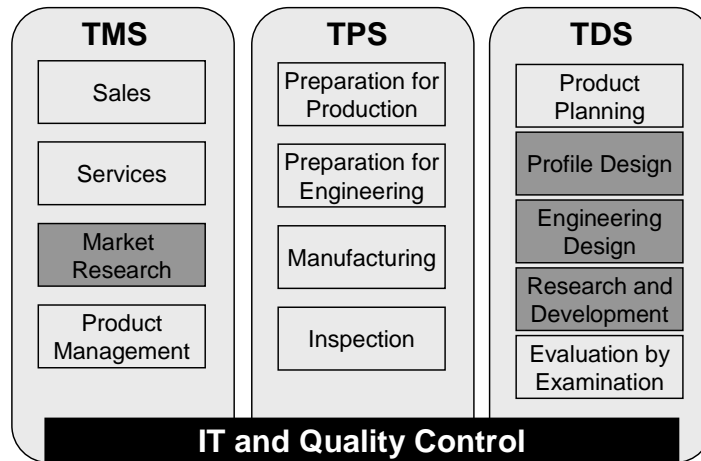


Figure 4: Areas of New JIT where KE has impact

Once the relevant Kansei has been identified, the next step is to quantify those abstract attributes into the parameters which can be incorporated in the product. From this process onwards, TDS takes the lead and plays the vital role in transforming the concept into reality. Obviously research and development plays a crucial role at this step.

3. Cost Considerations

In today's highly dynamic and competitive business environment pricing plays a crucial role in determining the success and failure of any product. A part of price also reflects the cost involved in manufacturing a particular product. The higher the cost involved, the higher the price. Though a company may use various cost lowering techniques but if the product is not appealing to the customer, these techniques often fail to convert the costs into the profits. To stay competitive, it's not enough to satisfy the customer's needs. In the long run a company will survive if and only if it delights its customers and deliver higher than expected. For a long time companies were manufacturing goods depending on the parameters and characteristics which have maximum appeal to their entire customer base. But they had to quit because, it is impossible to satisfy the needs of the entire customer base, though every unsatisfied customer means a missed opportunity for a company.

To elaborate this point more we consider an example where we survey (300 samples) data to analyze customer needs, on three variants:

Rajasekera and Dayal

- Look (modern)
- Reliability
- Economy

In this example the product to be developed is a car. The idea behind this is to show how different Kansei can be linked with the product attributes.

The Parameters (P) to be rated are assumed to be:

Modern: P1	Reliable: P8	Economy: P15
Freedom: P2	Safe: P9	Maintenance: P16
Elegant: P3	Fun: P10	Pick up: P17
Lifestyle: P4	Power: P11	Handling: P18
Professional: P5	Aggressive: P12	Power train: P19
Sporty: P6	Fresh: P13	Electrical: P20
Confidence: P7	Speed: P14	Mechanical: P21

Rating Scale:

- 1: Least Desirable
- 10: Most Desirable

We assume that the company can approach in two ways to develop the product:

Approach 1: Select the parameters which have high score in majority of the samples and ignore the parameters which have low rating or which are rated high but the number of respondents is low

Approach 2: Divide the whole sample into segments based on the ratings of parameters. In this case parameters which were rated high but the number of respondents was low will form another segment and thus will be included, which were completely ignored in the first approach.

The table below lists the differences of the two approaches:

Approach 1	Approach 2
Quick and fast	Time consuming
Mass appeal products	Products appealing to particular segments
Number of unsatisfied customer is high	Number of unsatisfied customer is less

Using Kansei Engineering with New JIT to Accomplish Cost Advantage

From the cost point of view, following are the benefits of using Kansei Engineering and New JIT together, in new product development:

- Proper resource allocation: Using the proposed method companies can better utilize their resources as only the products truly required by the customers will be manufactured
- Inventory Cost: Since only desired goods will be manufactured (or assembled), unnecessary inventory holding cost will be less
- Cost of Loosing Customers: Since the proposed methodology doesn't ignore any customer and tries to cater the needs of each segment, the cost of loosing customers will be reduced drastically

Once the ratings for the samples are obtained, we used the following statistical tools:

- Cluster Analysis -- Clusters show potential market segments
- Factor Analysis -- Chosen factors show potential product attributes for determined clusters

Since the number of customers considered in Approach 1 is 252 and Approach 2 is 300 (explanation given in the previous section) we assume that the demand for each case is 252 and 300 respectively. Also since we have assumed that no major investment is required to produce (or assemble) the three variants for Approach 2, it is fair to consider the assembling cost (10,000 USD) to be same for both the cases. Also the fixed cost is assumed to be same at 5,000 USD. Further the cost of holding inventory for one year is assumed to be 20% of production (or assembling) cost.

To analyze cost, we use Total Annual Cost, familiar in inventory management:

$$\text{Total Annual Cost} = DC + DS/Q + QCi/2$$

Where,

D = Annual demand for the item

C = Unit purchase cost. In this case it is taken to be 10,000 USD

S = Fixed cost of placing order. (5,000 USD)

i = Cost of holding inventory for 1 year expressed as percentage of C (20%)

Q = Order Quantity

Also optimal order quantity is given by Economic Order Quantity (EOQ) formula as:

$$Q^* = \sqrt{(2DS/Ci)}$$

Plugging the value of Q^* from the above formula to Total Annual Cost formula we get:

$$\text{Total Annual Cost}/D = C + S/Q^* + Q^*Ci/2D$$

Rajasekera and Dayal

$$= C + S/\sqrt{(2DS/Ci)} + \sqrt{(2DS/Ci)} (Ci/2D)$$

$$\text{Total Annual Cost/Demand} = C + \sqrt{(CiS/2D)} + \sqrt{(CiS/2D)}$$

	Approach 1	Approach 2
Demand	252	300
Assembling Cost	\$10,000.00	\$10,000.00
Fixed Cost	\$ 5,000.00	\$ 5,000.00
Cost of Holding Inventory for 1 Year (% of Manufacturing Cost) = 20%	\$ 2,000.00	\$ 2,000.00
Cost/Demand	<u>\$ 10281.72</u>	<u>\$ 10018.26</u>

The last line in the table show the cost advantage that can be gained by adopting Kansei Engineering based approach. The item (Cost/Demand) take into account compounded cost associated with assembling, inventory holding, and fixed costs.

In order to understand the cost advantage as the demand increase, we computed the compounded cost (i.e. Cost/Demand) for different demand levels, as seen in Figure 5.

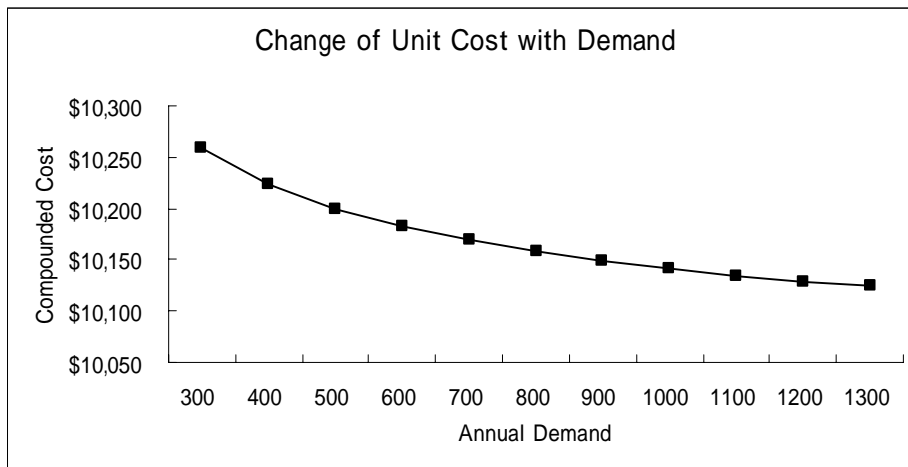


Figure 5: Increased Demand Result in More Cost Advantages

While one can make a point that such cost advantage, as seen the figure, is a result of the demand elasticity, it can be argued that KE is one such approach that makes it possible to achieve such demand by adhering to customer preferences through KE application.

4. Conclusion

The main purpose of this paper was to show how Kansei Engineering and New JIT System can be used together in new product development and manufacturing stages. Though there is a slight difference between Kansei Approach and New JIT System, this can be easily overcome by using IT as an additional tool to overcome these differences and gain some manufacturing cost advantage as well.

References:

1. K.Amasaka, (2002) "New JIT, A New Management Technology Principle at Toyota", *International Journal of Production Economics*, Vol.80, pp.135-144.
2. Lee, S., Harada, A. and Stappers, P. J. (2002). *Pleasure with Products: Design based Kansei*. *Pleasure with Products: Beyond usability*, Green, W. and Jordan, P. (ed.), Taylor & Francis, London, pp. 219-229.
3. Schütte, S. (2005), "Engineering emotional values in product design – Kansei engineering in development", *Linköping Studies in Science and Technology, Dissertation 951*
4. Shimizu, Y., Sadoyama, T., Kamijo, M., Hosoya, S., Hashimoto, M., Otani, T., Yokoi, K., Horiba, Y., Takatera, M., Honywood, M. and Inui, S. (2004). On-demand production system of apparel on basis of Kansei engineering. *International Journal of Clothing Science and Technology*, vol. 16, p. 32-42.