

APPLICATION OF OPERATION RESEARCH IN IKEA

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Abstract

Operations Research is the application of scientific methods to improve the effectiveness of operations, decisions and management. By means such as analyzing data, creating mathematical models and proposing innovative approaches, Operations Research professionals develop scientifically based information that gives insight and guides decision making. This study aims to assess the current state of operations research within the context of the unique retail store operations and supply management of IKEA.

Retail operations management requires an understanding of merchandising, logistics and cost control in order to move items from stores or production facilities into the hands of consumers. To tackle with any problem in a manufacturing company like IKEA, an appreciation of the problem is required which requires a clear conception of the function of retailing and how retailing requires operations research and management. It is the function of retailing to provide focal points in which the general public, as consumers, can satisfy their needs, wants and desires. These focal points that we are referring to, cover a wide variety of different types ranging from the market stall to the “universal provider”, which is what IKEA is, universal provider of furniture mainly and several other house-related products as well. They include a range of methods varying from complete “self-service” to highly organised system of credit, after sales service and sometimes even of manufacture of goods to meet special requirements. This study analyses how IKEA has successfully innovated and implemented the tools of operations research. This paper also provides empirical findings and application of relevant theories that will help readers to really understand how the company operates and what relevant theories it applies.

Introduction

IKEA is a Swedish-founded multinational group that designs and sells ready-to-assemble furniture, kitchen appliances and home accessories, among other useful goods and occasionally home services. It has been the world's largest furniture retailer since at least 2008. The company is known for its modernist designs for various types of appliances and furniture, and its interior design work is often associated with an eco-friendly simplicity. In addition, the firm is known for its attention to cost control, operational details, and continuous product development, corporate attributes that allowed IKEA to lower its prices by an average of two to three percent over the decade to 2010 during a period of global expansion.

IKEA **stores** are often designed in a one-way layout, leading customers counter clockwise along what IKEA calls "the long natural way" designed to encourage the customer to see the store in its entirety. There are often shortcuts to other parts of the showroom.

IKEA used to purchase raw materials from manufacturers but after it expanded internationally, it started its own production company. This resulted in saving costs as well as making new designs reach the stores faster with the least amount of compromise on quality

Their process analysis and operational strategies are unique. All of their decisions have been successful and their management of inventory, staff and stores is one of the best in the world.

Objectives

The objective of this study is to:

- 1) Understand the application of Operation research in:
 - a) The operation of IKEA's stores which is built on the basis of consumer behaviour and raises its efficiency.
 - b) Facilitating the supply, improving the quality and reducing the cost of IKEA's merchandise.

Content

Research methodology

We have done secondary research to collect the data which includes:

- Previously published research papers
- Articles
- Blogs

Qualitative method of research methodology has been used to analyse OR techniques such as Network Analysis and Linear Programming.

Data

Inventory management supply chain strategies:

Cost Savings in Furniture Design

IKEA designs unique products that incur low manufacturing costs while meeting strict requirements for function, efficient distribution, quality, and impact on the environment. According to a case study produced by The Times of London, more than 50% of the products are made from sustainable or recycled products. IKEA seeks to use as few materials as possible to make the furniture, without compromising on quality or durability. By using fewer materials, the company cuts down on transportation costs because it uses less fuel and manpower to receive materials and ship products.

Do-It-Yourself Assembly Lowers Packaging Costs

Most IKEA furniture is designed and sold in pieces for the customer to assemble. The pieces are placed into convenient and efficient, flat packages for low-cost transport because they take up less room in

trucks, maximizing the number of products that can be shipped. The unique packaging also takes up less space in warehouse bins and reserve racks, allowing for more room to stock additional items for order fulfilment. What the company saves in fuel and stocking costs is passed on to customers.

Combining Retail and Warehouse Processes

Every IKEA store has a warehouse on the premises. On the main showroom floor, customers can browse for items. They then obtain the products themselves from the floor pallet location with racking as high as the typical person could reach, where furniture can be purchased and taken home. Additional products are stored in reserve racks above these locations.

Inventory is let down to the lower slots at night (forklifts and pallet jacks are not used during store hours for safety reasons). About one third of the lower level is comprised of a warehouse off limits to customers. This space contains items too bulky for customers to load without help from the staff. Since IKEA wants as much self-service as possible, it works to minimize the number of items in this bulk storage area.

Cost-Per-Touch Inventory Tactic

Having customers select the furniture and retrieve the packages themselves is an inventory management tactic called 'cost-per-touch'. As a rule of thumb, companies find that the more hands touch the product, the more costs are associated with it.

For example, imagine when someone selects a piece of furniture to buy. The item is then ordered, shipped from the manufacturer, moved from the delivery truck into storage in the warehouse, moved from the warehouse to the customer's vehicle or delivered by the furniture retailer to the customer's home. Every time the product is shipped, moved, and loaded, it costs money. The fewer times someone moves or touches the item, the fewer costs are associated with it. IKEA saves costs with this guiding principle to minimize touches because it doesn't have to pay the customer to retrieve the furniture and take it home.

In-Store Logistics

IKEA also relies on something rare and unique concerning its logistical management of reordering products – it employs in-store logistics personnel to handle inventory management at its stores. According to the Steve Banker, ARC Advisory Group and Logistics Viewpoints (professionals and consultants on logistical and supply chain operations), there is an in-store logistics manager responsible for the ordering process and a store goods manager responsible for material handling logistics at all IKEA stores.

“There is an in-store logistics manager responsible for the ordering process and a store goods manager responsible for material handling logistics at all IKEA stores” Steve Banker, ARC Advisory Group & Logistics Viewpoints

The duties of the logistics personnel are to monitor and record deliveries, carefully check delivery notices, sort and separate the goods, and get them off to the correct sales area or designated overstock locations. Overall, they ensure an efficient flow of goods within IKEA stores, which is essential to maintaining high sales and enhancing customer loyalty.

Maximum/Minimum Settings as Proprietary System

The in-store logistics managers use an inventory replenishment management process developed by IKEA called 'minimum/maximum settings' to respond to store-level inventory reorder points and reorder products.

Minimum settings: The minimum amount of products available before reordering.

Maximum settings: The maximum amount of a particular product to order at one time.

Due to the fact that all IKEA inventory is only stocked at night after opening hours, the logic of its min/max settings is based on the number of products that will be sold from the reserve stack of bin in a single day or two-day period. The process meets customer demand while minimizing ordering too few or too many products.

This strategy also ensures that IKEA has ready inventory to meet customers' demands, lowering the cost of lost sales.

Using IKEA's proprietary inventory system, logistics managers know what is sold through point-of-sale (POS) data and how much inventory comes into the store through direct shipping and from distribution centres through warehouse management system data. From these data, they can forecast sales for the next couple of days and order in the suitable amount of products to meet that demand.

If the sales data doesn't match the projected number of items that should have been sold that day, the logistics manager goes directly to the pallet and bin to manually count the product stock.

IKEA believes its process and system allows for the right goods to be in the store with greater certainty, and at a lower cost, than the traditional retail forecasting and replenishment process.

Usage of High-Flow & Low-Flow Warehouse Facilities

IKEA's store operations are supported by high-flow facilities (focused on the 20% of SKUs that account for 80% of the volume) and low-flow warehouses that are more manual. In its high-flow warehouses, IKEA employs automatic storage and retrieval systems to drive down its costs-per-touch. Products stocked in a low-flow facility are not in high demand, and operations rely on manual processes since workers will not be shifting and moving inventory around too much.

ANALYSIS AND FINDINGS:

1) Network analysis

Neural Networking of IKEA

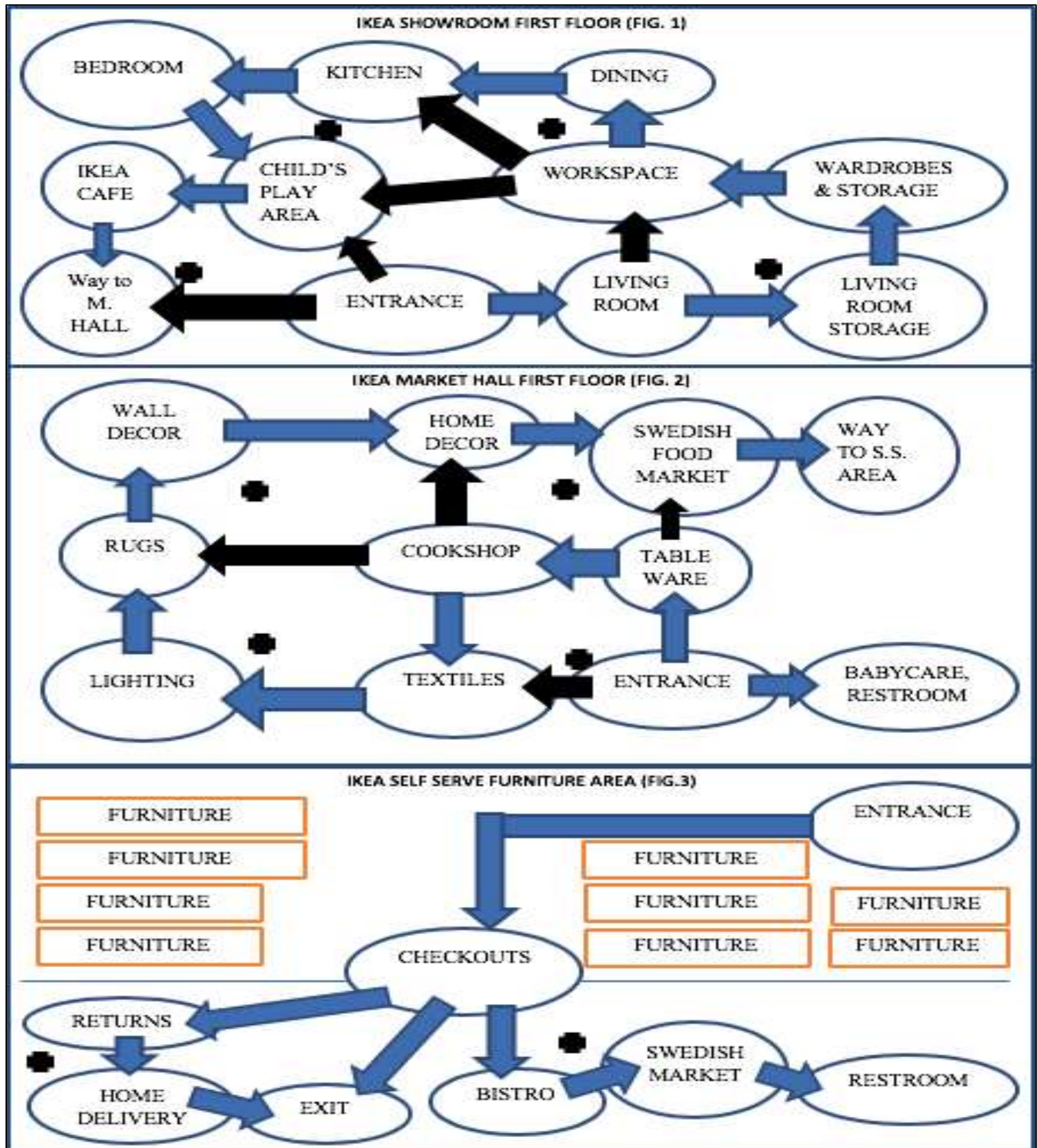
KEY

- NORMAL ROUTE

- SHORT-CUT ROUTE



- HELPER EMPLOYEE



Stores are designed to facilitate the smooth flow of customers, from parking, moving through the store itself, to ordering and picking up goods. At the entrance to each store large notice boards provide advice to shoppers. For young children, there is a supervised children's play area, a small cinema, and a parent and baby room so parents can leave their children in the supervised play area for a time. Parents are recalled via the loudspeaker system if the child has any problems. IKEA 'allow customers to make up their minds in their own time' but 'information points' have staff who can help. All furniture carries a ticket with a code number which indicates its location in the warehouse. (For larger items customers go to the information desks for assistance.) There is also an area where smaller items are displayed, and can be picked directly. Customers then pass through the warehouse where they pick up the items viewed in the showroom. Finally, customers pay at the checkouts, where a ramped conveyor belt moves purchases up to the checkout staff. The exit area has service points, and a loading area that allows customers to bring their cars from the car park and load their purchases.

From the above "Neural Network" we can analyse the various routes that a person has at his disposal. A person either follow the main route or take short cuts to visit the specific sections that they desire.

2) Linear Programming in Manufacturing Process

The problems dealt with in linear programming refer to the optimization of resources of a given object function "Z", which is subject to system and/or environment restrictions. When the problem involves "n" decision-making variables and "m" restrictions, the model can be represented mathematically in the form of either maximization or minimization of the object function

$$\text{MAXIMIZE } Z = C_1X_1 + C_2X_2 + \dots + C_nX_n$$

Subject to restrictions:

$$a_{11}X_1 + a_{12}X_2 + \dots + a_{1n}X_n \leq b_1$$

$$a_{21}X_1 + a_{22}X_2 + \dots + a_{2n}X_n \leq b_2$$

$$a_{m1}X_1 + a_{m2}X_2 + \dots + a_{mn}X_n \leq b_m$$

Being compulsory that:

$$X_1, X_2, \dots, X_n \geq 0 \text{ (note: non-negative figures)}$$

IKEA is known for its affordable pricing a large factor affecting which is the production process. While IKEA has thousands of suppliers, it also has its own production of both raw materials and products.

Manufacturing requires transforming raw materials into products that maximize company revenue. Each step of the manufacturing process must work efficiently to reach that goal. For example, raw materials must pass through various machines for set amounts of time in an assembly line. To maximize profit by reducing cost, IKEA uses a linear expression of how much raw material to use. Constraints include the time spent on each machine. Any machines creating bottlenecks must be addressed. The amount of products made may be affected, in order to maximize profit based on the raw materials and the time needed.

3) Transportation problem used Production & Distribution:

Spreading out production demand allows for suppliers to have a uniform cycle time which ultimately leads to lower production costs per unit. Furthermore, with the help of an Advanced Planning and Scheduling software, IKEA allocates production to suppliers based on each supplier's production capacity and raw material availabilities.

After productions, the products are transported to a network of 47 IKEA-owned, highly-automated distribution centers located in 17 countries. In order to optimize on warehousing and transportation requirements, the finished products are tightly packed into flat packages. This type of packages makes the finished goods easy to transport (leading to decreased transportation costs) and easy to store (leading to decreased warehousing costs).

4) Inventory control Models

We have observed that Ikea has in place an inventory control models for efficient operations relating to warehousing. Minimum and maximum stock requirements are set so that instances of shortage or surplus of stock is reduced. Future stock requirement is forecasted using the data collected of current day sales

Inventory management supply chain strategy of Ikea hence makes use of various tools of Operation Research. The most prominent ones are **Linear Programming** and **Transportation problem** and **Inventory control model**. The stores also use **Network Analysis** to optimally connect various furniture areas, cafes, child play areas etc.

Conclusion

IKEA has a great future ahead. It needs to take an aggressive role in this market because its sales are now stagnant and costs are on a rise. It has used the best method for inventory management along with supply chain management. The company has great potential and a business plan that matches no other organization in the world. Its size and its success by far have been commendable. The company however needs to change into being more web based which would reduce the cost of transportation and logistics.

The use of the tools of OR such as Linear Programming and a unique inventor control model and innovative approach gives IKEA a competitive edge, making it the most successful furniture brand. Not only does this visibly help cut cost drastically, but also plays an important role in defining IKEA's unique operational functioning. The company has not only successfully captured a large market share but it's unique retail store design ensures that an average customer, spends a lot more time in an IKEA store as compared to the competitor's stores and has a unique experience that compels him/her to buy a product from IKEA. IKEA creates additional customer value through its operations.

IKEA has a lot of potential and a goodwill that precedes every country it decides to open a store in. In this current recession however, the only way IKEA can make more sales and grow is through advertising its fundamental business objective: low cost and to achieve this it must continue to innovate its unique operating model.

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