



Enhancing Productivity Using Flow Process Charts and Value Stream Mapping

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Abstract. In the present scenario, markets are becoming highly volatile, and organizations aspire to flourish in an ever-changing and dynamic environment. Due to the rapid change in the current market, the products and services offered by firms should keep up with the pace of technological advancement. While combining customer co-creation with process planning and operations, this paper analyzes the flow processes of the Swedish-based home-furnishing retailer, IKEA. It studies the effects of flow process charts at IKEA and explores how the planning processes and systems along with organizational planning together form a centralized planning approach. This paper is based on an in-depth exploratory case study that implements flow process charts, value stream mapping and modified layout to organize and classify a time framework of everyday operations about man and equipment handling. Eventually, the paper also reflects upon the refined framework to increase efficiency in process times and minimize customer billing time. This is a first-of-a-kind approach to include an extensive investigation of the time and motion study of operational activities at IKEA that provides a detailed analysis of the work study and process planning. Our study contributes to research in operations and value adding strategies and demonstrates the importance of minimizing time with inter-sectional movements. The findings show a refined flow process network in the form of spaghetti diagrams of layout modification as a necessity to ease the number of operations, lower production costs, and maximize efficiency.

Keywords: Flow Process Charts · Supply Chain · Work Study · Work Measurement · Method Study

1 Introduction

As the world's renowned furniture retail company founded by Ingvar Kamprad in 1943, IKEA initially only sold accessories like pencils and watches. Gradually, Ingvar ventured into home furniture and opened a retail outlet in Älmhult in a span of ten years. As he developed ways of shipping furniture, he realized that it is indeed more expensive to ship bulky goods as they occupy more space and incur higher transportation costs. This enabled him to develop flat packaging techniques that eventually saved a huge amount of space by minimizing the overall costs and the risk of damage. The customer is

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required to assemble the furniture parts himself by going through the instruction manual. Any organization must function effectively and efficiently. Today, with advances in globalization and technological prowess, organizations must deeply understand the role of their potential businesses and risks. Such global competition and changing economic conditions lead business organizations to strengthen their operations management and strategy; waste management; revenue management, process and quality improvement; agility, and most importantly, lean production and management. IKEA, the Swedish-based home-furnishing retailer, which is popular for selling a variety of furniture through modular design, is one of the few organizations in the world that keeps a tight-knit around its costs, and customer needs by understanding their requirements to deliver the best possible service and maximize the value for money. IKEA's vast network of supply chain networks, distribution centers, retail networks, and warehouse networks has set an example to leading businesses in the world for their success in managing operations effectively. Today, the supply chain is far more complex with the introduction of different players into the network. This convoluted combination of systems makes it harder to manage the supply chain and understand how it's working. Every organization is keen on sharply defining their core competence to flourish in the volatile-as-ever markets. In such scenarios, mapping is a constructive way to understand and evaluate the organization's supply chain. The map would function as a basis for process modification that would also help to visualize the business and identify the areas that need improvement.

2 Literature Review

This study has been conducted at IKEA Hyderabad which is spread across an area of 400,000 square feet and showcases over 7500 products. The facility consists of customer distribution centers (CDC) and distribution centers (DC). Fröding & Lawrence et al. [1] mentioned that IKEA's vision of sustainability translates not only to its infamous "flat" packaging but also to its resolution to recycle, to the maximum extent, the waste collected from materials like wood, metals, plastics, polymers, and even water in the case of the water-scarce regions like India Ugan et al. [2] in his showed the various sequences of processes and mapped them according to certain order. He described this process of mapping as a graphical representation of operations in the form of flowcharts, Gantt charts and schematic maps and diagrams. Davenport et al. [3] defines a process as "a specific ordering of work activities across time and place with a beginning, an end, and clearly identified inputs and outputs: a structure for action". The inputs and outputs of different processes are assessed through their usefulness, variability, form defects, consistency of throughput, and several other factors. These factors are essential to weigh the worth of innovation among such programs. Stevenson W. J [4] describes in his textbook that one of the widely used techniques to tackle the efficiency of overall operations that is used by self-reliant and self-directed teams is method study or method analysis. The main agenda of method study is to be focused on productivity improvements and its need comes from changes in tools, equipment, product design materials, procedures, factory layouts, government bylaws, contract-based agreements, and quality issues. Carefully selecting a job to study is the first step of method analysis to increase productivity and reduce costs, which is followed by the documentation of the selected method viz. graphs

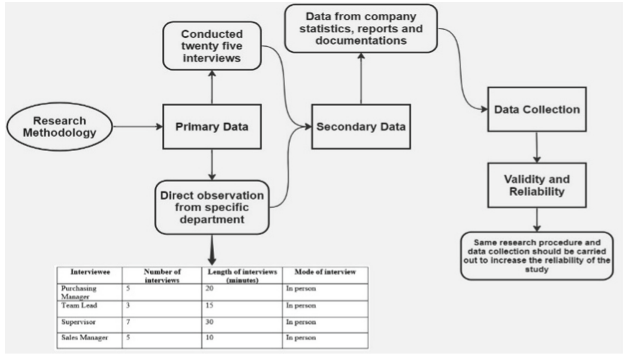


Fig. 1. Research Methodology

and charts. One of the best-known methods is flow process charts that examine critically the sequences of operations and the flow of materials. Ultimately, in the creation of value by the producer to the customer, IKEA is significantly involved in providing customized solutions keeping all the elements in mind. According to Womack et al. [5], the starting point for value stream mapping is to define value that is created by the producer. Whicker et al. [6] defined value as the property of a product or service that the customer cares and would be willing to pay for. From the definition, the value of home furniture and décor create values that boost high quality and safe products with customized size and functions. The process of combining all the elements of home décor requires expertise in how they should be organized. The processes taking place at IKEA with regard to the customer have been mapped and analyzed to find the problems arising in the flow.

3 Methodology

The following is an exploratory case study that has been chosen due to its exemplary vision on sustainability. The objective of this work is to understand deeply the flow processes and distance travelled through data analysis from charts, diagrams and hypothetical understanding to analyze productivity. To approach this problem practically and explore the nuances of efficiencies of flow operations, an in-depth empirical analysis of the IKEA supply chain was carried out experimentally. Comprehensive interviews were conducted across various hierarchy of managers to better understand the supply network of IKEA and its effects on the competitive advantage of IKEA products. A brief map (Fig. 1) of the distribution processes in each system has been drafted to understand the functions of different departments, material, and information flow. Based on the interviews and observations, the process flow charts have been mapped. The processes were then evaluated with the aid of mapping tools.

4 Process Mapping of Inbound and Outbound Activities

To identify and eliminate waste (Muda), it is crucial to engage in a comprehensive process improvement approach with a designated value stream mapping. Carefully mapping out each process from the entire network helps to find Muda and know where exactly the

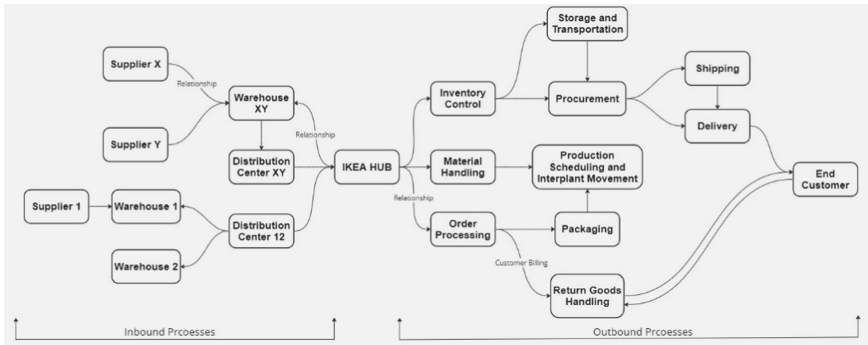


Fig. 2. Value Stream Map (or) Process Map

elimination of waste is required. According to the value stream mapping (VSM) theory, it is essential to define the flow of activities to track the journey of the home décor items from their origin at the manufacturer to their final stage with the consumers. As shown in Fig. 2, the process design consists of several flows, but the focus will be on Warehouse XY with suppliers X and Y. Although the suppliers supply the same items, they are differently named to distinguish their customers. The process begins with the products arriving at warehouse XY by rail, road (trucks, vans, etc.), air and vessels from a consolidated location that is primarily set up to collect the goods from the manufacturer. From warehouse XY, they are delivered to the IKEA warehouse (IKEA Hub), where the transport documents are handed over to the registrar and administration department notes down the number of items received with their details. Before entry, the driver receives confirmation on his mobile application on which gate to enter and at what time to unload the goods. This helps the optimization of procurement, handling, and storing.

Figure 3 shows the movement of goods and products from the Sweden and China manufacturing locations to various distribution centers across the world. This paper covers the Asiatic region, specific to Indian regions. While some of the products originate from Sweden plants, majority of them are shipped from China and spread across East Asian countries. The freight arrives at Mumbai Port from Singapore's Ports and reach Pune's DC (distribution center) warehouses. The goods are then transported by land to the retail warehouse in Hyderabad. This is the cycle in which the distribution takes place.

5 Process Flow Chart and Time-Based Mapping

Time based maps essentially represent data collected in a clear and concise manner so that all the aspects of the ongoing activities in a supply chain network are easily accessible. The main objective is to represent a process in one go so that the personnel involved in the organization can analyze the data and solve the pertaining issues.

A number of requirements emerge from the examination of the principles of the holistic supply chain and its interconnections with the new product introduction process via the theme of design for logistics [7]. The time metric provides an intrinsic measure that is practical to apply in such a broad area, so the key is to track one order, on product

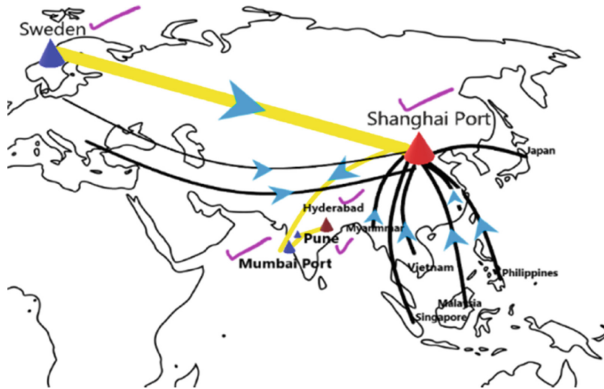


Fig. 3. IKEA Hyderabad Value Chain and Distribution Centers on Map (Approximate)

or one person through the process with respect to time [8]. The key purpose of the time-based process map or Gantt chart is to provide a rather straightforward understanding of current performance. It has been constructed using the real-live data on a spreadsheet and by creating a chart. Wasted time can be found out from the chart's layout which would aid in the removal of unnecessary processes. Such methodologies have the ability to provide a process-based approach to complex supply chain analysis. They have a proven ability to determine the major areas of waste within processes and consequently the opportunity for cost reduction, where waste is any activity that does not add value to the product [9].

The time-based methodology explained with Gantt chart in Fig. 2 has been developed to account for both value adding time and non-value adding time in each activity. According to Gregory and Rawling [10], value is added to products or services only when the following three criteria are met:

1. Customer cares about change
2. Physically change the item
3. Right from first

Taking note of the rack numbers to locate products and long billing time due to higher waiting time in the queue has occupied more space in the Gantt chart, which adds to non-value adding time (Fig. 4). This either must be eliminated or reduced to an extent that would save time in non-value adding activities. Non-value-added work has been regarded as waste in the conventional sense [10]. Waste has been defined as the needless, repetitious movement that must be eliminated immediately. For example, waiting for or stacking subassemblies [11]. Another set of activities called as "Necessary but non-value adding (NNVA)" is any operation doesn't create value but is necessary for streamlining the production process to increase the value of the final product [12]. The flow of writing notes, waiting in the long queues at restaurants and billing counters, and collecting the packaged goods are all necessary but non-value adding activities. The aim is to minimize unnecessary operations and reduce the process variability. Figure 5 represents the classification system to map such processes.

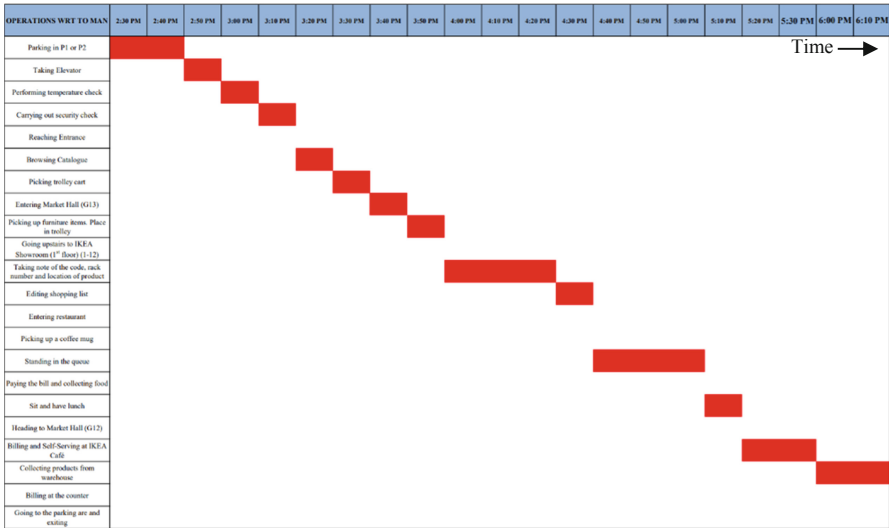


Fig. 4. Gantt chart describing man-type process flow chart given in Table 1

From Table 1, thirteen activities contribute to operations (represented by a yellow circle), five activities contribute to transportation (represented by a green arrow), two activities come under delay (represented by a purple ‘D’), one activity involves inspection (represented by a blue rectangle), and one activity comes under the combination of operation and inspection.

Table 1 also shows the detailed activities that are undergone by consumers on a typical visit to the IKEA store. Through the case study’s observation, there are twenty-two operations on average that are involved with respect to one consumer beginning from the time he/she enters to time they exit.

Layout modification involves rearranging the existing elements in such a manner so that productivity and efficiency increase. An essential element was considered here in Fig. 7 where all the heavier products are placed in proximity to the warehouse such that equipment handling becomes easier to manage. Similarly, products in demand (found out from user market research) are located in the initial regions of the entry zone so that customers can spend less time while picking the products of their choice. Figure 6 shows the existing layout, and the path shows one instance of a consumer’s travel, and Fig. 7 shows the modified layout that was devised to reduce the time and increase the efficiency of the consumer. The spaghetti diagram was used to convey the process flow redundancies that could be avoided in the modified layout and lead to optimum efficiency. The distances travelled in the modified layout as shown in Fig. 7 is depicted in Table 2, where the total distance travelled by the consumer is 356 feet and the total elapsed time is 128.06 min.

A Pareto chart, as shown in Fig. 8 illustrates process improvement in different activity categories of Operation, Transportation, Delay, Inspection and Operation and Inspection. This chart helps in identifying and focusing on areas that need immediate attention and improvement.

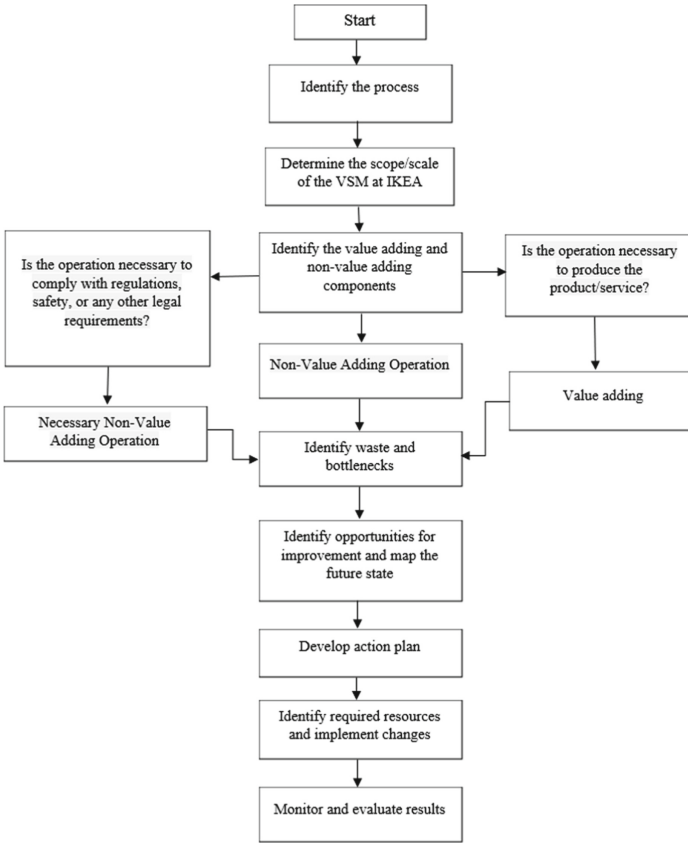


Fig. 5. Value Stream Mapping Classification System

Table 1. Flow Process Chart

#	Activity (by customer)	Distance Travelled (in feet)	Elapsed Time (in minutes)	○	➡	D	□	▽	◻
1	Parking in P1 or P2	30	15.74						
2	Taking Elevator	6	0.4						
3	Performing Temperature check	6	0.2						
4	Carrying out Security Check	6	1.54						
5	Reaching Entrance	4	1.1						
6	Browsing Catalogue	2	2.3						
7	Picking trolley cart	6	0.10						
8	Entering Market Hall (G13)	6	11.7						
9	Picking up furniture items. Place in trolley. Go to Home Décor	0	34.56						
10	Returning to G13 entry Going upstairs to IKEA Showroom (1 st floor) (1-12)	100	2.21						
11	Taking note of the code, rack number and location of the product	0	31.26						
12	Editing shopping list	0	5.19						
13	Entering restaurant	120	1.69						
14	Picking up a coffee mug	20	0.1						
15	Standing in the queue	0	11.47						
16	Paying the bill and collecting food	0	7.18						
17	Sit and have lunch	0	30.57						
18	Heading to Market Hall (G12)	150	1						
19	Billing and Self-Serving at IKEA Café	10	11.36						
20	Warehouse	200	40.62						
21	Billing at the counter	80	14.23						
22	Going to the parking are and exiting	10	17.25						
	Total	756	241.77						

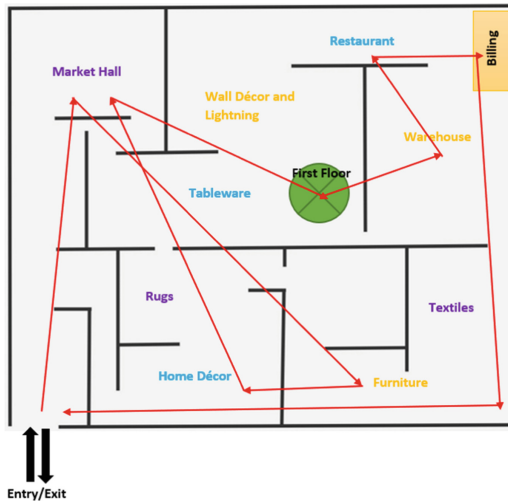


Fig. 6. Existing Layout

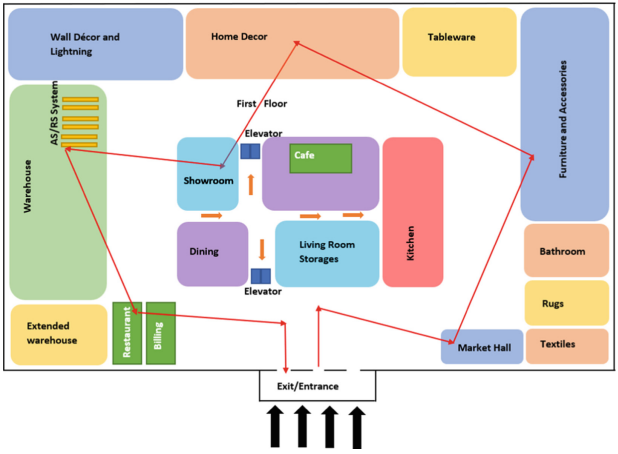


Fig. 7. Modified Layout

Table 2. Distance Travelled in Modified Layout

#	Activity (by customer)	Distance Travelled (in feet)	Elapsed Time (in minutes)
1	Parking in P1 or P2	30	15.74
2	Taking Elevator	6	0.4
3	Performing Temperature check	6	0.2
4	Carrying out Security Check	6	1.54
5	Reaching Entrance	4	1.1
6	Browsing Catalogue	2	2.3
7	Picking trolley cart	6	0.1
8	Entering Market Hall (G13)	50	3
9	Visit Furniture Section. Go to Home Décor	60	16.99
10	Showroom	80	1
11	Taking note of the code, rack number and location of the product	4	15.5
12	Editing shopping list	6	5.19
13	Warehouse	50	15
14	Restaurant	30	20
15	Billing	10	25
16	Exit	6	5
Total		356	128.06

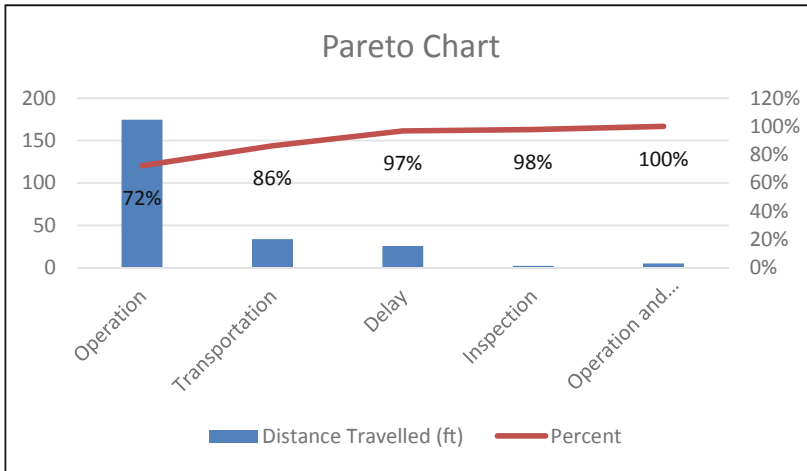


Fig. 8. Pareto Analysis, 80/20 Rule

6 Conclusion

In conclusion, the study's primary objective has been to introduce the background of the flow processes in operations management about IKEA's product process planning and map the operations efficiently to optimize the processes. Based on previous literature reviews and interviews conducted, an appropriate flow process chart has been devised. Through process flow chart and time-based process mapping, it is possible to work on the collection, analyzation, and interpolation of real data to test the efficiency of the flow of operations, and in other words, to strengthen the trustworthiness of this research. The continuous flow of an activity via a process enables researchers to identify the workflow and opportunities to optimize process flow efficiencies. The spaghetti diagram, as illustrated, has successfully reduced both the distance travelled and the elapsed time by an impressive 50%. Figure 8 clearly indicates that the initial three activities contribute to 80% of the total elapsed time of the consumer. Therefore, there is huge potential in developing efficient models aimed at reducing lead process times and enhancing overall productivity. The modified layout has demonstrated a strategic approach to grouping items based on demand and weight considerations. The model considers placing heavy duty products in proximity to the warehouse which is a thoughtful approach to streamlining operations. These findings collectively emphasize the importance of a well-structured process design and layout in optimizing efficiency within IKEA's product process planning.

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