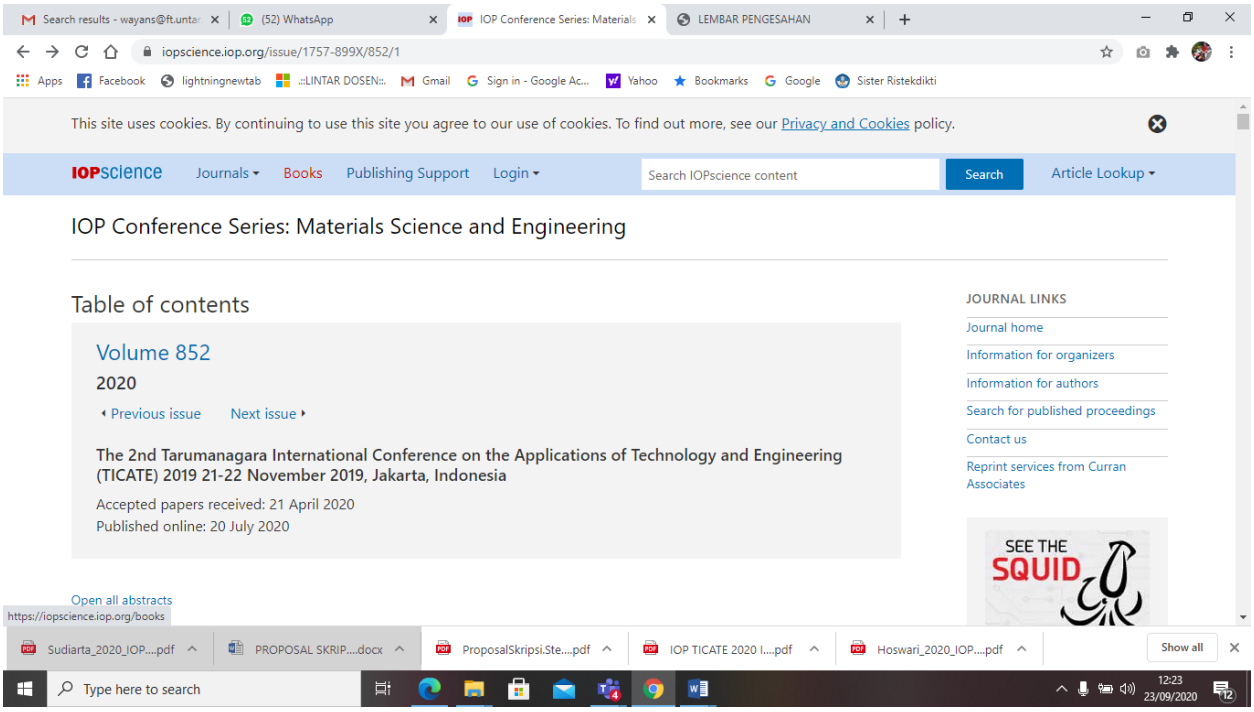
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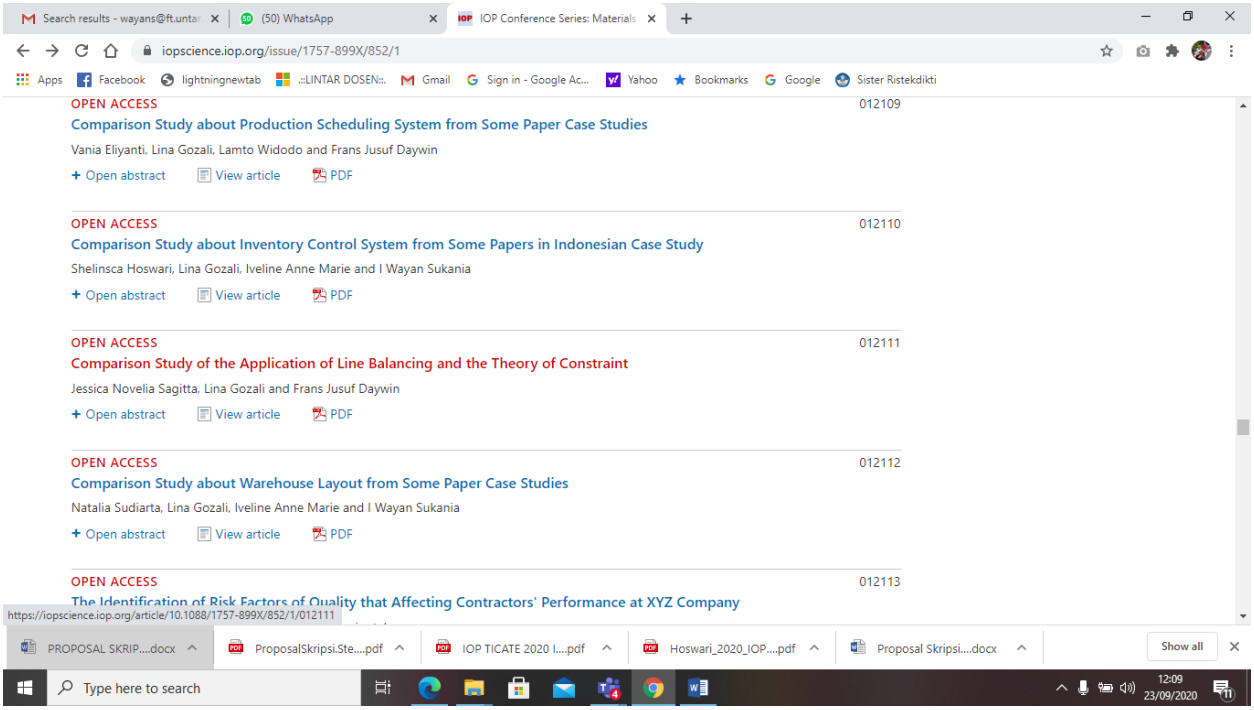
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Comparison Study about Warehouse Layout from Some Paper Case Studies

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Comparison Study about Warehouse Layout from Some Paper Case Studies

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Abstract. The warehouse activity has an important role in increasing production. A warehouse may be defined as a place used for the storage or accumulation of goods. The placement of raw materials in warehouse can be a serious problem. To solve the problem, warehouse layout planning is needed. The objective of this paper is to find out the gap between the methods that used in warehouse layout planning. The methods that can be used are Dedicated Storage, Class-Based Storage, Shared Storage, Randomized Storage and also Fishbone Layout. Each methods are used to reduce material handling distance so the flow of raw material will reach an optimum solution.

1. Introduction

Every company has a desire to increase the demands, the efficiency of production time, and also profits. Due to competitive companies, so the improvement of existing systems is needed, as well as the creation of a new system for the company's progress. To improve the systems, a company needs to fix warehouse activities. Warehouse involves all movements of goods and information within warehouses and distribution centers. It includes activities like receiving, storage, order-picking, accumulation, sorting and shipping. To optimize warehouse activities, an effective layout for the warehouse is needed. The main objective of layout planning is to reduce the distance of moving raw materials from warehouse to production department. To reach the nearer optimal solution, class-based storage can be applied.

2. Literature Study

Warehouse layout is an important consideration for a facility designer because the cost to rent, lease or buy real estate in the United States is increasing[1]. Before layout planning can begin, the specific objectives of a warehouse layout must be determined. In general, the objectives of a warehouse layout are to use space efficiently; to allow the most efficient material handling; to provide the most economical storage in relation to costs of equipment, use of space, damage to material, and handling labor; to provide maximum flexibility in order to meet changing storage and handling requirements; and to make the warehouse a model of good housekeeping.

There are two main storage strategies, i.e., the dedicated storage and the shared storage strategies. The concept of dedicated storage or fixed position storage is to locate a product in one specific location. The more popular products are assigned in more convenient locations. In contrast, shared storage is opposite to dedicated storage in which products in shared storage can be located in more than one location [3]. A Class-based storage is a dedicated storage which is related to ABC analysis and it is usually used to increase the overall throughputs. The products in a class-based storage can be categorized into three groups, Group A, Group B, and Group C.

Products categorized as Group A are the most frequently picked products, while Group C is the least frequently picked. The most frequently picked products, about 20 per cent of overall product: Group A, will be assigned to the most convenient locations of the warehouse. However, the percentage for each group is usually depends on the company policies [4].

Class-based storage is a compromise between randomized and dedicated storage. Inventory is assigned a class based on some criteria and each class is assigned a block of storage locations. Within each block of storage locations, material is stored randomly. The objective is to group material with similar characteristics and allocate floor space based on group priority. The classification procedure seeks to increase floor space utilization by limiting the effects of "honeycombing" and decrease material handling by ranking items based on throughput and storage space requirements [5].

The within-aisle travel time is the total travel time inside the aisles that an order picker has to traverse during a pick tour. It is intimately related to the routing method used. If use the return heuristic the within-aisle travel time (L^{WA}_{Return}) can be estimated as the summation (over the set of all aisles) of the product of the probability that aisle/is visited and the expected travel time inside the aisle [6].

Material handling is defined simply as moving material. Material handling is the movement, protection, storage and control of materials and products throughout manufacturing, warehousing, distribution, consumption and disposal. As a process, material handling incorporates a wide range of manual, semi-automated and automated equipment and systems that support logistics and make the supply chain work. Improvements in material handling have positively affected workers more than any other area of work design and ergonomics [7].

3. Comparison study and research gap

3.1 Research of warehouse layout design with class-based storage method

Naragain Phumchusri and Phuntira Kitpipit (2017) research title is Warehouse Layout Design for an Automotive Raw Material Supplier. The objective of this research is to design the layouts of the two permanent warehouses so that the spaces can be efficiently used and the total picking distance is low. The Adapted Class-Based Turnover Assignment is adopted in order to design the layouts for the two warehouses. Layouts of the warehouses are designed, analyzed, and evaluated. The best layouts give the best trade-off between quantitative results, i.e., the total picking distance and the remaining space, and qualitative results, i.e., the usability and the product suitability. The result of this research is the distance can be reduce by 34 km [8].

Santi N.K., Nasir W. S., Ceria F. M. T. (2013) research title is Redesign Layout of Goods Placement in Material Warehouse Based on Class Based Storage Policy. This time material placement in warehouse has not focus on total frequency movement for each material so the fast moving material will have a long distance. The way to solve that problem is through layout improvements [9].

Hidayat, N. P. A. (2012) research title is Warehouse Layout Design with Class Based Storage Method Case Study CV SG Bandung. This company has not had a good layout. It is shown from raw material inventory in storage that has not using storage layout theory. In this research, class based storage method and shelf, separate fabries are based on type of fabric in raw material storage that able to improving storage capacity. By proposes the

design raw material storage layout, it should be able to increasing storage capacity, thus, it will be able to give space [10].

3.2 Research of warehouse layouts design with fishbone/chevron layout

Goran D. and Tihomir O. (2014) research title is Warehouse Layout. The objective of this research is to reduce travel distance needed to store or retrieve a single pallet, thus improving the efficiency in the storage area. The result of this research is the reduction in the order- picking travel distance with the turnover-based storage could differ withrespect todifferent layouts and patterns used [11].

3.3 Research of warehouse layouts design with shared storage method

Firman A. E., dan Yaumal A.W. (2012) research title is Warehouse Layout Planning Using Shared Storage Method at Plastic Industry Semarang City. The objective of this research is to reduce material handling distance per month and provide convenience in checking raw materials. Shared storage method can be aplied in this research because the raw materials have the similar size. The result of this paper is give the best layout with the lowest distance [12].

Antoni Yohanes (2018) research title is Warehouse Layout Planning with Shared Storage Method at PT Pantjatunggal Knitting Mill. The problems faced by this company in raw material storage. The distance is too much movement of goods and the amount of material handling costs. Shared storage method is a method used to regulate the storage warehouse to be more effective. The results of the analysis and design of warehouse layout of raw materials is a new layout with shared storage methods [13]

3.4 Research of warehouse layout design with CRAFT method

Lina Y., Evi F., and Lely H. (2016) research title is Improvement Suggestion for Warehouse Layout Using CRAFT Method. In this case, the company has a problem in the layout of the warehouse that is not well arranged. The objective of this research is to suggest the improvement of warehouse layout by minimizing material handling distance. The result of this research is reduce the distance so the warehouse activity could be optimum [14].

3.5 Research of warehouse layout design with dedicated storage method

Andrea, F., Laura S., and Massimiliano M.S. (2013) research title is Minimizing Warehouse Space with a Dedicated Storage Policy. This paper presents a possible operations research- oriented solution to provide a tangible reduction of the overall required warehousing spcae, thereby translating the storage location assignment problem (SLAP) into a vertex colouring problem (VCP). The proposed methodology relies upon a dedicated storage policy, which is easyly implementable by companies of all sizes without the need for investing in expensive IT tools [15].

Tita T., Rindra Y., Tita T. (2017) research title is Improvement Suggestion for Finished Goods Warehouse Layout Using Dedicated Storage Method to Increase Efectiveness at PT Restomart Cipta Usaha. The problem in this company is the preparation of finished products in the market is not irregular or is weak orderly. Happened the preparation of units is done in any place in accordance with his project, setting it is also not fixed or fickle, so that cause to flow in and out goods this is not well coordinated. To deal with proposal is required rearrangement with the dedicated storage, from scratch travel

time obtained from goods in and freight out at the conditions [16].

3.6 Research about performance model for orderpicking systems with randomized storage
Charles, J.M., Khalid A.T. (2000) research title is An Integrated Performance Model for Orderpicking Systems with Randomized Storage. Storage area material flow models based on lot size reorder point policies are integrated with orderpicking travel time models to generate aggregate retrieval area space requirements for randomized storage systems. These results are used to develop cycle time models for single and dual command orderpicking transactions and to evaluate the impact of alternative interleaving disciplines on system performance [17].

Table 1 Research Gap

Description	Narag ain P.	Karo nsih S. N.	Nita P. A. H.	Gora n D.	Firma n A. E.	Anto ni Y.	Lina	Andr ea F.	Tita T.	Charles J. M.
Method	Class Based Stora ge	Class Based Stora ge	Class Based Stora ge	Fishb one Layo ut	Share d Stora ge	Share d Stora ge	CRA FT	Dedic ated Stora ge	Dedic ated Stora ge	Rando mized Storage
Makespan										
Improvement	X	X	X	X	X	X	X	X	X	X
Industry	Auto motiv e	Filter Produ ction	Conv ection	-	Plasti c	Knitti ng	Groce ries	-	Cons umer Good s	-
Production Capacity per year										
Instutution/Publisher	Chula longk orn Unive rsity	Unive rsitas Brawi jaya	Jurnal AL-AZH AR IND ONE SIA	Unive rsity of Zagre b	Dina mika Tekni k	Dina mika Tekni k	Jurnal Tekni k Indus tri	Unive rsity of Rome	Unive rsitas Dian Nusw antor o	Applie d Mathe matical Modelli ng

4. Research and Discussion

Based on study and research among all papers, we can conclude that to reduce material handling distance per month or to arrange raw materials in warehouse, we can use many methods of warehouse layout. The warehouse layout method such as Dedicated Storage, Class-Based Storage, Shared Storage, Randomized Storage, and also Fishbone Layout. We also can combine more than 2 methods to find the nearer optimal result.

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