UPH UNIVERSITAS PELITA HARAPAN InCoGITE & HospiTour
UMN SGU SWISS GERMAN UNIVERSITY
4th INCOGITE and 2nd HOSPITOUR 2022
"Regenerative Economy, Business & Tourism: Through innovation & Sustainability"
Thursday, November 17th, 2022 - Universitas Pelita Harapan Tangerang

Warehouse Management System to Improve Work Efficiency at an Apparel Company

Yunanto Herlaksono[1], Julbintor Kembaren[2], Friska Natalia[3]

[1] yunanto.herlaksono@student.umn.ac.id
[2] julbintor.kembaren001@binus.ac.id
[3] friska.natalia@umn.ac.id

[1] Program Studi Magister Manajemen Teknologi, Universitas Multimedia Nusantara, Tangerang, Indonesia
[2] Business Management Program, Binus Business School Master Program, Bina Nusantara University, Jakarta, Indonesia
[3] Universitas Multimedia Nusantara, Tangerang, Indonesia

Abstract. Efficiency and Productivity Improvement have been compulsory to all companies in garment industry, to be more competitive and become sustainable in the business. The focus of this study is in warehouse area where people are struggling with inaccurate data therefore creating inefficiency in working practices. Authors created questionnaires and interviews with users to understand on current working practices with required time to complete. The result of this study will be used to develop a software which is combined with RFID to help companies in managing all activities in warehouse. This study can also be used to give clear picture of problems/challenges that are being faced by factories, solution that can be implemented and potential benefits that can be gained from this solution. The companies will then need to prepare themselves for digital transformation, change the work methods from manual to digital, firmer SOP and be open-minded to new technologies.

Keywords: efficiency; productivity; warehouse management system

1. Introduction

Digital Transformation has become key success factor to many companies in winning the competition, as it can improve efficiency and being closer to customers (Tabrizi et al., 2019) and at the same time require companies to adopt to the changes on strategic, organization, information technology, supply chain until marketing (Verhoef et al., 2021) which require commitment from all stakeholders.

Warehouse is one of areas where inefficiency and inaccuracy of data occur and the problem is mainly because data is still managed manually so it becomes very time consuming to look for information as well as generating reports. The systematic approach in managing warehouse area will help to give significant improvement from materials receipt, storage, finding and transfer to production (Atieh et al., 2016). This will help to eliminate waste (Lal Sharma et al., 2018) and help factories to be sustainable in the business.

By using Lean Manufacturing methodology we can identify where the wastes occur, why the wastes happen and how to solve them. Below is the description on situation:

- Transportation, it is difficult to locate and find the required materials as there is no clarity where are the materials stored.
- Inventory, it is difficult to know the inventory level in detail and their allocation to production orders.
- Defects, improper storage will cause to materials broken or even loss.
- Motion, no clear information on where the storage of the materials has caused users to keep looking for the required materials, repetition works.
- Over processing, no visual data and systematic method in materials storage have caused to unnecessary movement/transfer of materials from one location to the others.
- Waiting, most of the time production need to wait in a long time to get the required materials.

The above situation is caused by the manual works of the users in recording the information, manual way of locating and storage the materials.

This study is to identify the problems in warehouse, find the root cause, propose the solution and try to measure the potential benefits after implementation of the solution.

2. Research Methodology

The method used is by considering key factors (i) Management; (ii) Material flow; (iii) Information flow which are then becoming the base in defining Maturity Level which are (i) Ignoring; (ii) Defining; (iii) Adopting; (iv) Managing; (v) Integrated (Facchini et al., 2020) (Batz et al., 2020).

The research is using questionnaire and interviews to key users to identify current problems and expectations for improvement. This is then tested using Cronbach Alpha to provide unique estimation on the testing reliability (Gliem & Gliem, 2003), and using scale 1 – 5 where 1 (Integrated), 2 (Managing), 3 (Adopting), 4 (Defining) and 5 (Ignoring) to understand the Digital Maturity.

Table 1 explains on the stage of where a company can accept digital technology and to identify where to start as well as the approach during implementation. The awareness of a company in digital technology solutions can be measured by using this model.

Table 1
Digital Maturity Model

Ignoring	Defining	Adopting	Managing	Integrated
Not aware of the needs for integration	See the needs for integration but do not know how to manage	Already start integration	Integration in most level	Full integration and create synergy
Not aware on solution to correct information flow and materials	Aware on solution to correct information flow and materials but not use yet	Some solutions to correct information flow and materials have already been implemented	Many solutions to correct information flow and materials which have been implemented	All available solutions to correct information flow and materials have been implemented already

Table 2 describes on the characteristic of respondents who will be actively involved during the digital transformation period and continue as the key users. It is very important to understand who are the key users of the system, what are the challenges they are facing on the current working practices and what are their expectations should the digital technology is implemented in the company.

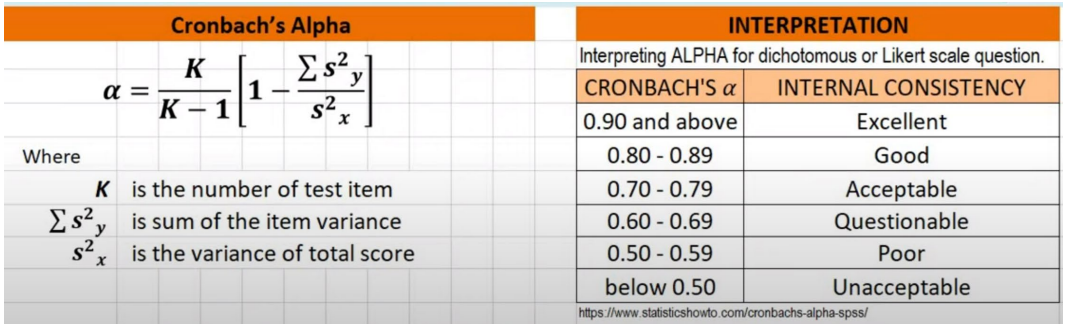
Table 2
Characteristic on respondents and objectives of Digital Transformation

Respondent	Defining Future state of Digital Maturity Model
Marketing – Manager, Spv & Staff	Marketing Department need to understand material status to ensure sales orders can be produced and delivered as per request from buyers
Procurement – Manager, Spv & Staff	Procurement Department need to ensure that the materials from suppliers are delivered as per issued PO (quantity, quality and receipt date)
Warehouse – Manager, Spv & Staff	Warehouse Department need to manage and monitor all activities, and coordinate with all related departments
Production – Manager, Spv & Staff	Production Department need to ensure the requested goods to be available on time and not causing to stoppages in production

Shipping – Manager, Spv & Staff	Shipping Department need to have enough time to book shipment to fulfil delivery date
Finance – Manager, Spv & Staff	Finance Department need to ensure there is no claim/penalty from buyers due to late delivery. They also need to ensure the procurement costs and material consumption is still within the budget as this will affect to the COGS

Figure 1 describes on how the calculation is made based on the collected data by using formula and certain parameters to decide whether the result is valid. The Cronbach Alpha is the method to measure internal consistency and how closely related a set of items as a group. In this study we try to correlate the stage of where a company adopting digital technology in warehouse area.

Figure 1
Cronbach Alpha



3. Theoretical Framework

Improper ways in handling activities in warehouse will cause to high cost that lead to eroding profitability of the company (Faber et al., 2013). By using the approach of Lean Manufacturing to identify waste we can see problems that are related to activities in warehouse, from conceptual, implementation design, implementation and evaluation until the completion of Lean transformation process (Mostafa et al., 2013).

Based on this we have created questionnaires related to tasks of day to day operations of all related departments and tried to get information on how much time required to complete those tasks. We then compared with time required to complete if using WMS and see the variance. This is explained on table 3.

Table 3
Calculation on potential savings on WMS implementation

No	Department in charge	Activities	Unit time (in minutes)				
			Manual	WMS	Variance	Transaction per day (unit)	Total Saving
1	Marketing	Checking materials availability from running orders, to ensure materials can satisfy demand	10	1	9	10	90
2		Checking materials availability before receiving new orders	30	1	29	5	145
3	Warehouse	Data input on materials receipt	5	3	2	20	40
4		Matching data between PO with GRN (Goods Received Notes)	15	5	10	50	500
5		Define storage location on new incoming materials, as per required space (material dimension vs space availability)	30	1	29	10	290
6		Record data transaction on materials movement (location transfer or materials issued)	5	1	4	5	20
7		Searching materials storage location	30	5	25	10	250

8		Stock checking, compare data and physical materials	30	1	29	10	290
9	Production	Request and pick up materials (fabrics/accessories) to warehouse	60	1	59	15	885
10		Process materials transfer to different work order	20	10	10	3	30
11		Return on reject and replacement with new materials (notes: rejects can be due to quality issue or defects during production)	60	10	50	8	400
12	All Departments	Data reporting for analysis	40	10	30	18	540
		TOTAL (in minutes)	335	49	286	164	3480
		TOTAL SAVING per day (in hours)			**4,77**		**58**
		TOTAL SAVING per month (in hours) - 22 work days					**1.276**

4. Results and Discussions

The questionnaires and interviews were conducted with 32 respondents with 13 questions, and these have fulfilled minimum sampling (Bujang et al., 2018) (Cicchetti, 1999).

Table 4

Stage on Digital Maturity

No	Departement	Activities	Data recording Method	Stage in Digital Maturity				
				Ignoring	Defining	Adopting	Managing	Integrated
1	Marketing	Check on material availability from running orders, to ensure materials can satisfy demand	Excel			√		
2	Procurement		Excel			√		
3	Production		Excel		√			
4	Warehouse		Excel		√			
5	Marketing	To ensure materials availability before accepting any new orders, related to confirmation/promise on delivery date	Email			√		
6	Procurement		Email			√		
7	Warehouse		Excel		√			
8	Warehouse	Data recording on materials receipt	Excel		√			
9	Procurement	Data matching between procurement (PO) with GRN (Goods Received Notes)	Excel		√			
10	Warehouse		Excel		√			
11	Procurement	Claim process if quantity and quality of materials do not meet the requirement as per procurement	Email		√			
12	Warehouse		Excel		√			
13	Production		Excel		√			

14	Finance		Excel			√		
15	Warehouse	Locate the storage location of incoming materials, as per required space (material dimension and space availability)	Excel		√			
16		Record on data transaction of materials movement (change location or transfer/issued to production)	Excel		√			
17		Finding materials location	Manual		√			
18		Stock check, compare between data and physical of materials	Manual & Excel		√			
19	Finance					√		
20	Production	Request on materials to warehouse	Email, Paper		√			
21		Process on materials transfer from different work order	Email, Paper		√			
22		Return on *reject* and replace with new materials (note: rejects can be due to quality problem or defects in production)	Email, Paper		√			
23	Warehouse		Paper		√			
24	Marketing		Paper		√			
25	Procurement		Paper		√			
26	Finance		Paper			√		
27	Marketing	Data reporting for analysis	Excel, Paper			√		
28	Procurement		Excel, Paper			√		
29	Warehouse		Excel, Paper		√			
30	Production		Excel, Paper		√			
31	Shipping		Excel, Paper		√			
32	Finance		Excel, Paper			√		

The result was then converted to get data with Cronbach Alpha method and get the result as follow:

Table 5
Result with Cronbach Alpha method

Variables	Description	Value	Internal Consistency
K	Number of respondents	32	**Acceptable**
$\sum s^2y$	Total variant	3.753906	
s^2x	Variance from total	12.74609	
α	**Cronbach Alpha**	**0.728243**	

The result shows consistency in the Digital Maturity Model and questionnaires that have been built. We then did further analysis on potential benefits in warehouse area by investigating on how much time required on current method of manual and compare with the time spent by users once the WMS has been implemented. The result is in minutes as the potential savings, and this can be used as justification for a company to do digital transformation.

5. Conclusions

Digital Transformation must give positive impact to the business from both operational and financial benefits, and they are all measurable. From the study we have proven that digital transformation can bring benefits to the company by enabling them to gain time savings in their works. The accuracy in data will also help users to analyse and make correct decisions so the company can perform better and become more competitive.

Implementation on WMS (Warehouse Management System) will definitely bring benefits to users as to help them in speed (time savings) and data accuracy. Speed means efficiency and data accuracy means effectiveness in completing the works.

6. Declarations

6.1 Limitations and Future Research

The study is limited to one company with limited number of respondents, and the main focus is on potential time savings to complete routine tasks. Future studies may look at larger sample from more companies in different industries. Future studies can also look at the knock on effects after time savings can be gained, ie. users have more time to do more analytical jobs for better decision making, more tasks can be assigned to users to enable them to be multi-tasking employees etc.

6.2 Acknowledgement

We would like to thank to Universitas Multimedia Nusantara (UMN) for the full support during the research and study.

References

Atieh, A. M., Kaylani, H., Al-Abdallat, Y., Qaderi, A., Ghoul, L., Jaradat, L., & Hdairis, I. (2016). Performance Improvement of Inventory Management System Processes by an Automated Warehouse Management System. *Procedia CIRP*, *41*, 568–572. https://doi.org/10.1016/j.procir.2015.12.122

Batz, A., Ole´sków-Szłapka, J., Stachowiak, A., Pawłowski, G., & Maruszewska, K. (2020). Identification of Logistics 4.0 Maturity Levels in Polish Companies—Framework of the Model and Preliminary Research. In *Sustainable Logistics and Production in Industry 4.0* (pp. 161–175). http://www.springer.com/series/10152

Bujang, M. A., Omar, E. D., & Baharum, N. A. (2018). A review on sample size determination for cronbach's alpha test: A simple guide for researchers. *Malaysian Journal of Medical Sciences*, *25*(6), 85–99. https://doi.org/10.21315/mjms2018.25.6.9

Cicchetti, D. v. (1999). Sample size requirements for increasing the precision of reliability estimates: Problems and proposed solutions. *Journal of Clinical and Experimental Neuropsychology*, *21*(4), 567–570. https://doi.org/10.1076/jcen.21.4.567.886

Faber, N., de Koster, M. B. M., & Smidts, A. (2013). Organizing warehouse management. *International Journal of Operations and Production Management*, *33*(9), 1230–1256. https://doi.org/10.1108/IJOPM-12-2011-0471

Facchini, F., Olésków-Szłapka, J., Ranieri, L., & Urbinati, A. (2020). A maturity model for logistics 4.0: An empirical analysis and a roadmap for future research. *Sustainability (Switzerland)*, *12*(1), 1–18. https://doi.org/10.3390/SU12010086

Gliem, J. A., & Gliem, R. R. (2003). *Calculating, Interpreting, and Reporting Cronbach's Alpha Reliability Coefficient for Likert-Type Scales*.

Lal Sharma, S., Lal Sharma Assistant Professor, S., Mudgal Amit Kumar Jha, P., & Kumar Govind Kumar Singh, A. (2018). Study of Lean Manufacturing for Manufacturing of Auto Components. *Global Research and Development Journal for Engineering*, *3*(5). https://www.researchgate.net/publication/324770887

Mostafa, S., Dumrak, J., & Soltan, H. (2013). A framework for lean manufacturing implementation. *Production and Manufacturing Research*, *1*(1), 44–64. https://doi.org/10.1080/21693277.2013.862159

Tabrizi, B., Lam, E., Girard, K., & Irvin, V. (2019). *Digital Transformation Is Not About Technology*. https://hbr.org/2019/03/digital-transformation-is-not-about-technology

Verhoef, P. C., Broekhuizen, T., Bart, Y., Bhattacharya, A., Qi Dong, J., Fabian, N., & Haenlein, M. (2021). Digital transformation: A multidisciplinary reflection and research agenda. *Journal of Business Research*, *122*, 889–901. https://doi.org/10.1016/j.jbusres.2019.09.022