Redesign of office layout using activity relationship chart (ARC) at the “X” department administration office of a “Y” university

by Wahyukaton -

Submission date: 18-Dec-2021 09:56AM (UTC+0700)
Submission ID: 1733173674
File name: 5._20181129_Redesign_of_office_ISIEM_2018.pdf (1.19M)
Word count: 3848
Character count: 21715

ISSN : 1978-774X

VOL. 11, 2018

1978-774X

11TH INTERNATIONAL SEMINAR ON INDUSTRIAL ENGINEERING & MANAGEMENT

PROCEEDING 11th ISIEM 2018

"Technology & Innovation Challenges Towards Industry 4.0 Era"

ISIEM

NOV 27-29

MAKASSAR

SWISS-BELHOTEL

PANTAI LOSARI

Industrial Engineering Department

Supported by:

Sponsored by :

telkomsigma

trusted · IT · company

by Telkom Indonesia

ISSN : 1978-774X

PROCEEDING

11th ISIEM

The 11th International Seminar on
Industrial Engineering and Management

Swiss-Belhotel Makassar, Sulawesi Selatan-Indonesia
November 27 – 29, 2018

Organized by :

Industrial Engineering Department of

• Universitas Pasundan • Universitas Tarumanagara •
• Universitas Trisakti • Al Azhar Indonesia University•
• Universitas Esa Unggul • University of Pancasila •
•Atma Jaya Catholic University of Indonesia •

Supported by :

Sponsored by :

PREFACE

Bismillahirrahmanirrahim,
Assalamu'alaikum Warrahmatullah Wabarrakatuh,

This issue is published in line with the Eleventh International Seminar on Industrial Engineering and Management (11th ISIEM). The articles cover a broad spectrum of topics in Industrial Engineering and Management, which are Quality Engineering Management, Decision Support System and Artificial Intelligent, Ergonomics, Supply Chain Management, Production System, Operation Research, and Industrial Management. These articles provide an overview of critical research issues reflecting on past achievements and future challenges. Those papers were selected from 120 abstracts, and we send these papers to IOP to be published there as an Open Access Proceeding. This statistic shows the high competition to get published on this proceeding. This issue and seminar become special as more delegates come and join from various country as well as universities. We host 90 delegates both from abroad and local.

The 11th ISIEM is hosted by seven universities, which are Universitas Pasundan, Universitas Esa Unggul, Universitas Trisakti, Universitas Tarumanagara, Universitas Al-Azhar Indonesia, Atma Jaya Catholic University of Indonesia, and Universitas Pancasila.

This is the thirteenth years of the collaboration of those universities, and the second time we had MOU with IOP in United Kingdom to publishing the papers that is indexed by Scopus.

In this occasion, let us give special thanks to Prof. Dr. Md. Mamun Habib, from BRAC Business School (BBS), BRAC University, Bangladesh, Editor-in-Chief, International Journal of Supply Chain Management (IJSCM) UK, Prof. Dr. Dzuraidah Abd. Wahab from Center for Integrated Design of Advanced Mechanical Systems Faculty of Engineering and Built Environment, University Kebangsaan Malaysia, for their contribution as keynote speakers. We are also grateful to all reviewers, for their commitment, effort and dedication in undertaking the task of reviewing all of the abstracts and full papers. Reviewing a large number of submissions in a relatively short time frame is always challenging. Without their help and dedication, it would not be possible to produce this proceeding in such a short time frame. I highly appreciate all members of committees (advisory, steering, and organizing committees) for mutual efforts and invaluable contribution for the success of seminar.

Wassalamu'alaikum Warrahmatullah Wabarrakatuh.

Ir. Wahyukaton, MT.
Chairman

COMMITTEE

STEERING COMMITTEE

1. Dr. Rina Fitriana, S.T., M.M., IPM
   (Universitas Trisakti)
2. Dr. Iphov Kumala Sriwana, S.T., M.Si., IPM
   (Universitas Esa Unggul)
3. Trifenaus Prabu Hidayat, S.T., M.T.
   (Atma Jaya Catholic University of Indonesia)
4. Ir. Toto Ramadhan, M.T.
   (Universitas Pasundan)
5. Ir. Ahmad Chirzun, M.T.
   (Al Azhar Indonesia University)
6. Wilson Kosasih S.T., M.T., IPM
   (Universitas Tarumanagara)
7. Ir. Rini Prasetyani, M.T., IPM
   (University of Pancasila)

OPERATING COMMITTEE

Chairman: Ir. Wahyukaton, M.T.
(Universitas Pasundan)

Co-Chairman: Ir. Ahmad Chirzun, M.T.
(Al Azhar Indonesia University)

Exchequer: Dr. Iphov Kumala Sriwana, S.T., M.Si., IPM
(Universitas Esa Unggul)
Dr. Winnie Septiani, ST, M.Si., IPM
(Universitas Trisakti)

Secretariat:
Endro Wahyono (Universitas Tarumanagara)

Paper and Review Coordinator:
Nunung Nurhasanah, S.T., M.Si. (Al Azhar Indonesia University)

Accommodation:
Vivi Triyanti, S.T., M.Sc. (Atma Jaya Catholic University of Indonesia)

Event Coordinator:
1. Stefani Prima Dias Kristiana, S.T., M.Sc. (Atma Jaya Catholic University of Indonesia)
2. Chendrasari Wahyu Oktavia, S.Si., M.T. (Atma Jaya Catholic University of Indonesia)

Publication Coordinator:
Rahmi Maulidya, S.T., M.T. (Universitas Trisakti)

Fundraiser:
1. Dr. Rina Fitriana, S.T., M.M., IPM (Universitas Trisakti)
2. Ir. Rini Prasetyani, M.T., IPM (University of Pancasila)

Indexing:
Dr. Wisnu Sakti Dewobroto, M.Sc. (Podomoro University)

Website Administrator:

1. Dr. Ir. Yogi Yogaswara, M.T. (Universitas Pasundan)
2. Wawan Tripiawan, S.T., M.T. (Telkom University)

City Tour Coordinator:

1. Dr. Ir. Nofi Erni, M.M., IPM (Universitas Esa Unggul)
2. Kirana Rukmayuninda Ririh, S.T., M.T. (University of Pancasila)
3. Dino Rimantho, S.T., M.T. (University of Pancasila)

Seminar Coordinator:

Dr. Lamto Widodo, S.T., M.T., IPM (Universitas Tarumanagara)

Documentation:

Wawan Tripiawan, S.T., M.T. (Telkom University)

EDITOR

Chief Editor:

Rahmi Maulidya, S.T., M.T. (Universitas Trisakti)

Member:

1. Dr. Wisnu Sakti Dewobroto, M.Sc. (Podomoro University)
2. Arnolt K. Pakpahan, S.T., M.M., IPM (Universitas Trisakti)
3. Asrul Harun Ismail, S.T., M.T., PMP (University of Pancasila)
4. Bambang Cahyadi, S.T., M.T., IPM (University of Pancasila)
5. Endro Wahyono (Universitas Tarumanagara)
6. Sidik Nurjaman, S.T., M.T. (Universitas Pasundan)
7. Riana Magdalena, S.Si., M.M. (Atma Jaya Catholic University of Indonesia)

REVIEWER

1. Prof. Dr. Md Mamun Habib	(BRAC Business School, BRAC University, Bangladesh)
2. Prof. Matteo M. Savino	(Sanio University, Italy)
3. Prof. Ir. Dr. Sha'ri bin Mohd Yusof	(Universiti Teknologi Malaysia, Malaysia)
4. Dr. Muhammad Shafiq	(University of Engineering and Technology Taxila, Pakistan)
5. Fajar Kurniawan, S.T., M.Si.	(Saint Mary's University of Hong Kong)
6. Ir. Dr. Syuhaida Ismail	(Universiti Teknologi Malaysia, Malaysia)
7. Dr. Ir. Hj. Arumsari, M.Sc., IPU	(Universitas Pasundan, Indonesia)
8. Dr. Ir. Hj. Tjutju Tarliah Dimyati, MSIE., IPM	(Universitas Pasundan, Indonesia)
9. Ir. Wahyukaton, M.T.	(Universitas Pasundan, Indonesia)
10. Dr. Ir. Yogi Yogaswara, M.T.	(Universitas Pasundan, Indonesia)
11. Dr. Ir. Syarif Hidayat, M.Eng.Sc, M.M.	(Al Azhar Indonesia University, Indonesia)
12. Nunung Nurhasanah, S.T., M.Si.	(Al Azhar Indonesia University, Indonesia)
13. Dr. Iphov Kumala Sriwana, S.T., M.Si., IPM	(Universitas Esa Unggul, Indonesia)
14. Prof. Parwadi Moengin, Ph.D.	(Universitas Trisakti, Indonesia)
15. Dr. Winnie Septiani, S.T., M.Si., IPM.	(Universitas Trisakti, Indonesia)
16. Ronald Sukwadi, S.T., M.M., Ph.D., IPM.	(Atma Jaya Catholic University of Indonesia, Indonesia)
17. Vivi Triyanti, S.T., M.Sc.	(Atma Jaya Catholic University of Indonesia, Indonesia)
18. Dr. Lamto Widodo, S.T., M.T., IPM.	(Universitas Tarumanagara, Indonesia)
19. Arif Bimantoro S, BSEE., MEE., Ph.D.	(University of Pancasila, Indonesia)

AGENDA

November 27, 2018

18:00	-	18:30	Registration
18:30	-	19:30	Dinner
19:30	-	20:00	Opening Ceremony: Representation of Universitas Pasundan, Al Azhar Indonesia University, Universitas Trisakti, Atma Jaya Catholic University of Indonesia, Universitas Tarumanagara, Universitas Esa Unggul, and University of Pancasila's greeting
20:00	-	21:15	Keynote Speech # 1 **Prof. Dr. Md. Mamun Habib** **BRAC Business School, BRAC University, Bangladesh** Moderator: Dr. Ir. Syarif Hidayat, M.Eng.Sc, M.M.
21:15	-	21:30	Photo Session

November 28, 2018

06:30	-	08:00	Breakfast and Registration
08:00	-	09:15	Keynote Speech # 2 **Prof. Dr. Dzuraidah Abd. Wahab** **Center for Integrated Design of Advanced Mechanical System - Faculty of Engineering and Built Environment, University Kebangsaan Malaysia** Moderator: Dr. Iphov Kumala Sriwana, S.T., M.Si., IPM
09:15	-	09:30	Coffee and Tea Break
09:30	-	12:10	Parallel session #1
12:10	-	13:00	Lunch break
13:00	-	15:40	Parallel session #2
15:40	-	16:00	Coffee and Tea Break
16:00	-	18:40	Parallel session #3
18:40	-	21:00	Dinner

November 29, 2018

06:00	-	08:00	Breakfast
08:00	-	21:00	City Tour

November 30, 2018

06:30	-	10:00	Breakfast
	-	12:00	Check Out

KEYNOTE SPEECH

#1

Prof. Dr. Md. Mamun Habib
BRAC Business School, BRAC University, Bangladesh
Visiting Scientist, University of Texas - Arlington (UTA), USA
Editor-in-Chief, International Journal of Supply Chain Management (IJSCM), UK

#2

Prof. Dr. Dzuraidah Abd. Wahab
Center for Integrated Design of Advanced Mechanical System
Faculty of Engineering and Built Environment
University Kebangsaan Malaysia

PARALLEL SESSION

SESSION 1 ROOM 1
Moderator: Rina Fitriana, S.T., M.M., IPM

TIME	PAPER	PAPER NO	FIELD
9:30 - 9:40	**Schedule risk analysis by different phases of construction project using CPM-PERT and Monte-Carlo simulation** *Andrie Pasca Hendradewa.* Universitas Islam Indonesia	38	OR
9:40 - 9:50	**Planting system modeling of chrysanthemum seedling plants stock for profit optimization** *Anita Ilmaniati and Dani Hamdan Taufik.* Padjadjaran University	50	OR
9:50 - 10:00	**Analysis daily newspaper distribution in Solo by agent-based simulation** *Izatul Fitria Febriandini, Yuniaristanto, Wahyudi Sutopo and Muhammad Hisjam.* Sebelas Maret University	7	OR
10:00 - 10:10	**Improvement route for distribution solutions MDVRP (Multi Depot Vehicle Routing Problem) using Genetic algorithm (case study: PT. KM)** *Rina Fitriana, Parwadi Moengin and Utami Kusumaningrum.* Universitas Trisakti	116	OR
10:10 - 10:20	**Multi responses optimization for the sugar content and microbial impurities of carrot syrup** *O Isabella and Yurida Ekawati.* Universitas Ma Chung	14	OR
10:20 - 10:30	**Domino algorithm: a novel consstructive heuristics for travelling salesman problem** *Asrul Harun Ismail* University of Birmingham	119	OR
10:30 - 10:40	**Integer Linear Programming Model and Algorithm to Integrate Heuristics Scheduling EDD, Inventory Control and Distribution Problems in a Modular Production System** *Parwadi Moengin, Elfira Febriani Harahap, Sucipto Adisuwiryo, and Weny Ango Fransiska* Universitas Trisakti	79	OR
10:40 - 10:50	**Waste assessment using lean manufacturing in rubber production** *Elita Amrina, Nilda Tri Putri and Dwara Mitha Anjani.* Universitas Andalas	56	PS
10:50 - 11:00	**Integration of lean manufacturing and group technology layout to increase production speed in the manufacture of furniture** *Ukurta Tarigan, Uni Pratama P. Tarigan and Vincent Sukirman.* Univeristas Sumatera Utara	84	PS
11:00 - 11:10	**Flow shop scheduling with drum-buffer-rope and CDS algorithm to minimize lateness and work in process at PT. AKS** *Akma Septia Viady, Pratya Poeri Suryadhini and Meldi Rendra.* Telkom University	92	PS

PS – Production & Maintenance System

Redesign of office layout using activity relationship chart (ARC) at the "X" department administration office of a "Y" university

Wahyukaton[1], **Ghina Affifah**[2]

[1]Industrial Engineering Department, Engineering Faculty, Universitas Pasundan
Jl. Setiabudi 193 Bandung, West Java, Indonesia, wahyukaton@unpas.ac.id
[2]Industrial Engineering Department, Engineering Faculty, Universitas Pasundan
Jl. Setiabudi 193 Bandung, West Java, Indonesia, ghnaff04@gmail.com
wahyukaton@unpas.ac.id, ghnaff04@gmail.com

Abstract. Administration office at "X" Department is a room for managing papers and letters administration, documentation, archiving, and also a room for communication to lecturers and students and office administrators. This room needs to have good layout in order to support the activity for all elements within the department. Redesign the office layout will reduce the time to wait for completing the letters which are needed by the students and the lecturers. This paper's objectives are to improve the information flow and data flow, to reduce the documents stack, and to create a comfortable office to meet the facility layout principles. Activity Relation Chart (ARC) is been used to redesign the office layout by distributing questionnaires to the students and officers and lecturers to obtain the preference of closeness to construct the chart. The result is to redesign the desk into "L" shape to reduce the movements. Also, this result was explained later by a simulation using ARENA.
Keywords: ARC, layout, office, facility, simulation

1. Introduction

Facility layout is an activity to analyze, to concept, to design, and to realize the system for goods producing or services. Generally, facility layout is described as floor plan, a physical facility to optimize the relationship of officers, workers, materials flow, information flow, and a needed procedure to obtain effective and efficient effort [1]. The scoop of facility layout is not only for manufacture problems, also it is been applied to office, transportation, warehousing, packaging, and so on, and those fields corresponding to input, process, and output. In manufacturing fields, the input, process, and output could be tangible, raw materials and components, but in office layout, the input, process, and output would be intangible like information flow and data flow.

The administration office is dealing with documents, papers, letters to run the administration for the department. This paper's objectives are to improve the information flow and data flow, to reduce the documents stack, and to create a comfortable office to meet the facility layout principles, in this paper, Activity Relationship Chart (ARC) is been used.

2. Method

Facility layout is an activity to analyze, to concept, to design, and to realize the system for goods producing or services. Generally, facility layout is described as floor plan, a physical facility to optimize the relationship of officers, workers, materials flow, information flow, and a needed procedure to obtain effective and efficient effort [1]. The scoop of facility layout is not only for manufacture problems, also it is been applied to office, transportation, warehousing, packaging, and so on, and those fields corresponding to input, process, and output. In manufacturing fields, the input, process, and output could be tangible, raw materials and components, but in office layout, the input, process, and output would be intangible like information flow and data flow.

The administration office is dealing with documents, papers, letters to run the administration for the department. This paper's goals are to improve the information flow and data flow, to reduce the documents stack, and to create a comfortable office to meet the facility layout principles.

Facilities in an office must be well planned and arranged in a layout such a manner that the objective of increase in productivity and efficiency of an office operations achieved. There are different techniques and approaches for facility layout design; among this systematic layout planning approach is adopted for design office facility layout in this paper is chosen Activity Relationship Chart (ARC) to meet the objectives. A simplified framework for the application of systematic layout planning for the design of office facility layout is proposed by making enough modifications in the basic approach.

This technique can be successfully applied for both production and service facilities. The systematic layout planning starts with data collection regarding the activities, closeness, rooms, equipment. Based on these input data an activity relationship diagram is drawn. Then a space relationship diagram is prepared by considering the availability and requirement of space constraints. A number of alternative layouts are generated by incorporating the results from relationship diagrams. These layouts are evaluated and select the best one that meets the objectives [2]. Simplified Systematic Layout Planning is especially useful in job shops or process layouts, where there are many different products that are produced in limited quantities. Where there is no consistent process flow, the development of a relationship chart may be the best data you have to determine relative placement of separate work areas. The value of a relationship chart should not be ignored in product-oriented layouts or production lines. The six-step process will aid you in locating all the necessary support functions. [5][6]

2.1 Variables for Questionnaire

The questionnaires were distributed to three groups of respondents, which were lecturers, officers, and students. For those three groups, the questionnaire's variables are as follows,

Table 1. Closeness

	AD	LR1	LR2	MDB	IB	SIB	DC	PM	OR	T
Administration Desk (AD)										
Lecturer Room 1 (LR1)										
Lecturer Room 2 (LR2)										
Mark Display Board (MDB)										
Information Board (IB)										
Seminar Information Board (SIB)										
Documents Cabinet (DC)										
Photocopy/Printer Machine (PM)										
Officer Room (OR)										
Toilet (T)										

Table 2. Layout Variables, Ordinal Scale 1 – 5 for agreement

Sub Variable	Indicators
Desk layout	U shape L Shape
Cabinet layout	U shape L Shape
Orientation	In the middle of the room At the corner of the room

Table 3. Waiting room Variables, Ordinal Scale 1 – 5 for agreement

Sub Variable	Indicators
Bench	Long bench Chair
Orientation	Outside the room Inside the room

2.2 Activity Relationship Chart (ARC)

The objective of ARC is to obtain a closeness relationship from every activity within office or factory organization. To explain the degree of closeness among activities in ARC, symbols are used, which are A, E, I, O, U, and X.

A : *Absolutely necessary*
E : *Especially important*
I : *Important*
O : *Ordinary closeness*
U : *Unimportant*
X : *Undesirable*

2.3 Layout

Layout is a decision to determine a long term for an operation efficiency. There are many effects based on layout decision, such as capacity, process, flexibility, cost, work environment quality, customer contact, and enterprise image. The effective layout will help the enterprises to support they business's strategy for differentiation strategy, low cost, and quick respond.

In order to planning a layout, it needs to,

1. High benefit of rooms, facilities, and labors.
2. Improvement of information flow, material flow, labor flow
3. Increase work morale and a better safety
4. Increase enterprise and customer interaction
5. Increase flexibility

To describe layout, a block layout is used regarding relationship among activities.

2.4 Simulation

Plant layout design requires diverse field of knowledge. Among others the application and use of computers become an advantage. Computer can perform tedious computations and generate several alternative solutions much more rapidly and effectively than manual procedures. [3]

Simulation is a method to duplicate or to describe a real system characteristic. The early idea of simulation is to imitate the real system as mathematically, then to learn the characteristics and operational characters, and decision is made based on a simulation eventually. With this method, the real system will remain untouched until a benefit or loss is found based on a simulation. A simulation software ARENA is used to modelling a redesign layout.

3. Result and Discussion

After questionnaires been distributed, collected, and summarized, all questions are valid and the questionnaire is reliable.

The ARC can be formed as follows,

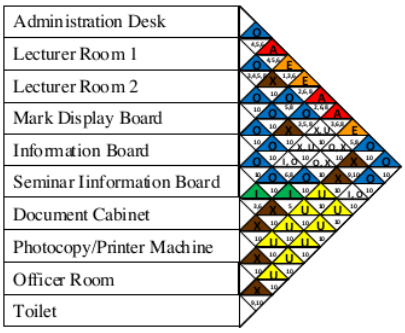

Figure 1. Activity Relationship Chart

Table 4. Closeness of ARC

Code	Closeness
1	Using the same record
2	Using the same personal
3	Using the same room
4	Personal relationship level
5	Paperwork relationship level
6	Paper flow sequence
7	Using the same work flow
8	Using the same equipment and facility
9	Noisy, dirty, dusty, etc.
10	Anything might need

Based on the processed questionnaires, the chosen administration desk layout is “L” shape, cabinet layout is “U” shape, and long bench for the waiting room, with regards to ARC, then the layout redesign of the administration office will be as follows,

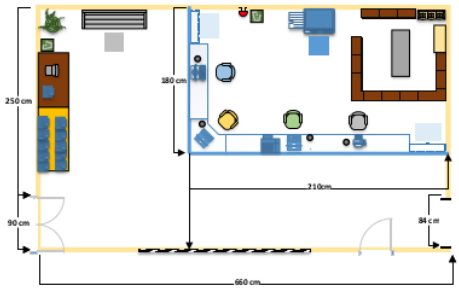

Figure 2. Layout Redesign

The simulation using ARENA software, the result as follows,

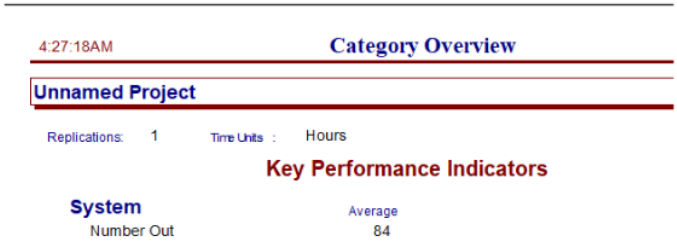

Figure 3. Key Performance Indicators (KPI)

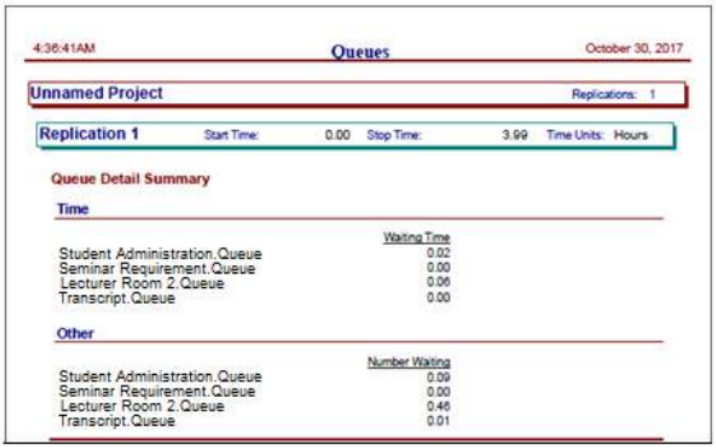

Figure 4. Queue Detail Summary

The result of the simulation shows that the queue on managing documents are minimum, indicated in the Table 4 that the waiting time is 0.06, and number of waiting is under 1 person, it means that the work flow runs well.

4. Conclusion

Based on an ARC and layout redesign, the conclusion can be drawn that to improve activity flow, work flow, and information flow, the layout is using "L" shape desk, cabinet layout is "U" shape will minimize the movement and increase the efficiency in regard of managing paper work and administration work in administration office, and it has been proved by the simulation.

5. References

[1] James M. Apple., 1990, Plant Layout and Material Handling, John Willey & Son, New Jersey

[2] Anish I, Arish Ibrahim, Facility Layout Design of Library Using Systematic Layout Planning, *International Journal of Library and Information Studies*, Vol.4 (3) Jul-Sep, 2014, pp. 23-27.

[3] Ameha Mulugeta, Birhanu Beshah and Daniel Kitaw, Computerized Facilities Layout Design, *Journal of EEA,* Vol. 30, 2013, pp. 27-32.

[4] Marni Astuti, Eko Poerwanto, Agus Trianingsih, Analisis Tata Letak Fasilitas Dengan Menggunakan Metode Activity Relationship Chart Pada Industri Mebel Bambu Karya

Manunggal Yogyakarta, *Seminar Nasional Teknologi Informasi dan Kedirgantaraan (SENATIK)*, Vol. III, 21 Desember 2017, pp. 112-116.

[5] Jeff Mohr, and Mike Willett, Simplified Systematic Plant Layout, *Center for Industrial Research and Service*, Vol. 34, No. 1, Fall 1999, pp. 5-8.

[6] Shah, C. R., A. M. Joshi, Increased Productivity in Factory Layout by Using Systematic Layout Planning (SLP), *International Journal of Advanced Engineering Technology*, Oct-Dec, 2013, pp. 61-63.

Redesign of office layout using activity relationship chart (ARC) at the “X” department administration office of a “Y” university

ORIGINALITY REPORT

24%	19%	20%	11%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	china.iopscience.iop.org Internet Source	5%
2	Submitted to Pasundan University Student Paper	4%
3	teknik.univpancasila.ac.id Internet Source	3%
4	A S Viady, P P Suryadhini, M Rendra. "Flowshop Scheduling with Drum-Buffer-Rope and CDS Algorithm to Minimize Lateness and Work in Process at PT. AKS", IOP Conference Series: Materials Science and Engineering, 2019 Publication	2%
5	www.ajol.info Internet Source	1%
6	etj.uotechnology.edu.iq Internet Source	1%
7	S. Alif[1], B. Aribowo[2]. "Line Balancing Application Analysis of Generator	1%

	Manufacturing Process in DPG Inc.", IOP Conference Series: Materials Science and Engineering, 2019 Publication	
8	es.scribd.com Internet Source	1 %
9	ti.unpar.ac.id Internet Source	1 %
10	"Preface", IOP Conference Series: Materials Science and Engineering, 2020 Publication	1 %
11	P Moengin, E F Harahap, S Adisuwiryo, W A Fransiska. "Integer Linear Programming Model and Algorithm to Integrate Heuristics Scheduling EDD, Inventory Control and Distribution Problems in a Modular Production System", IOP Conference Series: Materials Science and Engineering, 2019 Publication	1 %
12	Wahyukaton, Siti Qodriyah. "Determining a combination of factors on rubber end manufacturing using taguchi method at PT. Agronesia Bandung", IOP Conference Series: Materials Science and Engineering, 2017 Publication	1 %
13	www.inderscienceonline.com Internet Source	1 %

14	Submitted to London School of Business and Finance Student Paper	1 %
15	A Hasta, Harwati. "Line Balancing with Reduced Number of Operator: A Productivity Improvement", IOP Conference Series: Materials Science and Engineering, 2019 Publication	1 %
16	karya.uii.ac.id Internet Source	1 %
17	Izatul Fitria Febriandini, Yuniaristanto, Wahyudi Sutopo, Muhammad Hisjam. "Analysis daily newspaper distribution in Solo by Agent Based Simulation", IOP Conference Series: Materials Science and Engineering, 2019 Publication	1 %
18	M L Singgih, Y Prasetyawan, Sutikno, D Hartanto, F R Kurniawan, W T Wicaksana. "Maintenance management improvement based on reliability centered maintenance II in energy generating industries", IOP Conference Series: Materials Science and Engineering, 2019 Publication	1 %
19	O Isabella, Yurida Ekawati. "Multi Responses Optimization for the Sugar Content and	1 %

Microbial Impurities of Carrot Syrup", IOP Conference Series: Materials Science and Engineering, 2019
Publication

20	www.portalgaruda.org Internet Source	1 %

Exclude quotes	On	Exclude matches	< 1%
Exclude bibliography	On		