Proceeding
5th International Seminar on Industrial Engineering & Management (5th ISIEM)

“Innovation in technology, information, and management concerning worldwide economic challenge”

February 14–16, 2012
Aston Hotel, Manado, Indonesia

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Proceeding
The 5th International Seminar on Industrial Engineering and Management (5th ISIEM)

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FOREWORD

This issue is published in line with the Fifth International Seminar on Industrial Engineering and Management (5th ISIEM). The theme to this seminar is “Innovation in Technology, Information, and Management Concerning Worldwide Economic Challenge”. The articles cover a broad spectrum of topics including Quality Engineering and Management, Supply Chain Management, Operation Research, Decision Support System and Artificial Intelligence, Production System, Industrial management, and Ergonomics. The articles provide an overview of critical research issues reflecting past achievements and future challenges.

Full papers were reviewed by peer reviewers and finally we published 80 titles. This issue and seminar become special as more delegates come and join from various countries as well as universities. We host 77 delegates both from abroad and local.

First and second ISIEM are hosted only by three universities, namely Trisakti, Esa Unggul and Gunadarma Universities. This year event, it’s hosted by seven universities, i.e. Atma Jaya Catholic University of Indonesia, Trisakti University, Esa Unggul University, Pasundan University, Al-Azhar Indonesia University, Tarumanagara University, and last but not least, De La Salle Manado University.

In this occasion, let us give special thank to Mr. Marcus Pitt, President Director PT SOHO Industri Pharmasi and Assoc. Prof. Dr. Chuvej Chansa-ngavej, Director, SIU Research Center Program Director - PhD in Management Science, School of Management Shinawatra University (SIU International), Thailand. Your contribution to this seminar as reviewers and as keynote speakers makes this event more valuable. 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 paper. Without their help and dedication, It would not be possible to produce this proceeding in such a short time frame.

We want to thank all those who submitted papers for review and those whose papers were chosen for presentation at the seminar and those who submitted manuscripts to be published in this proceeding. We highly appreciate all members of committee director, steering committee and organizing committee for mutual efforts and invaluable contributions for the success of the seminar.

Finally, have intensive discussion in this seminar and enjoyable stay in Manado

Vivi Triyanti ST. M.Sc
(Atma Jaya Catholic University of Indonesia)

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# TABLE OF CONTENT

**Foreword**  
**Committee**  
**Reviewer**  
**Table Of Content**

## Book One

### IM – Industrial Management

<table>
<thead>
<tr>
<th>No</th>
<th>Code</th>
<th>Title and Author</th>
<th>Page</th>
</tr>
</thead>
</table>
| 1  | R01  | Encouraging Business Model Innovation To Improve Firm’s Competitiveness Through Deutero-Learning And Adhocracy Culture  
**Jahja Hamdani Widjaja** | IM – 1 |
| 2  | R05  | e-Government: Awareness and Participation Among Malaysian Citizens  
**Sabariyah Binti Din, Lim Ai Ling, Anand Agrawal** | IM – 9 |
| 3  | R06  | Financing Innovation In Indonesia: A Promising Future  
**Jean-Baptiste Morin** | IM – 17 |
| 4  | R11  | Corporate Environment, Operations Strategy And Company Performance At Garment Industries In West Java Province  
**Atty Tri Juniarti** | IM – 21 |
| 5  | R15  | The Influence of Internal Control Implementation-Based Sarbanes Oxley Act (SOA) Section 404 on The Auditor’s Opinion of The Public Company Management Assertions  
**Liza Laila Nurwulan, Ika Rachmawati** | IM – 29 |
| 6  | R21  | Formulation Of Strategies To Increase Brand Equity Poke Sushi Restaurant Using Ie Matrix  
**Rudy Vernando Silalahi, Donny Indrawan, Andy Mitra Gunadi** | IM – 40 |
| 7  | R25  | Developing The Maintenance Scorecard For The Quality Improvement Of Mass Transportation Service (Study at PT Kereta Api Indonesia)  
**Emelia Sari, Didien Suhardini, Winnie Septiani** | IM – 50 |
| 8  | R26  | Developing Business Process Model To Provide Workers In An Outsourcing Company: A Case Study  
**Triarti Saraswati, Amelia Paramita, Invanos Tertiana** | IM – 56 |
| 9  | R27  | Do we ready to face Globalization of Accounting? Exploratory Study of Accounting Faculties in Indonesia  
**Wirawan ED Radianto** | IM – 63 |
| 10 | R29  | Calibrating Competitive Factors To Define Corporate Strategies: A Case Study  
**Liliani, Michael Siek** | IM – 70 |
| 11 | R30  | The Effect Of Product Value And Store Image Intention To Buy Car (A Case Study Of Visitors In Surabaya OTO Seller)  
**J.E. Sutanto** | IM – 77 |
| 12 | R36  | Entrepreneurship Education: Enhance Indonesian economic growth and national development  
**Widjaja Hartono** | IM – 83 |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>R40</td>
<td>The Relationship Between Corporate Social Responsibility And Social ROI With Resource-Based View As Moderating Factors: A Conceptual Model</td>
<td>Fan Liu, Ronald S.</td>
<td>IM – 96</td>
</tr>
<tr>
<td>15</td>
<td>R41</td>
<td>Integration David’s Strategic Management Model With Balanced Scorecard Performance Management System</td>
<td>Triwulandari S. Dewayana, Adi Irianto</td>
<td>IM – 103</td>
</tr>
<tr>
<td>16</td>
<td>R43</td>
<td>Cultural Changing In Global Competition</td>
<td>Meidiahna Kusuma</td>
<td>IM – 111</td>
</tr>
<tr>
<td>17</td>
<td>R44</td>
<td>Study Of Airasia; World’s Best Low-Cost Airline</td>
<td>Charly Hongdiyanto</td>
<td>IM – 117</td>
</tr>
<tr>
<td>19</td>
<td>R56</td>
<td>Relations Model Of Employee Commitment To The Organization Towards Employee Loyalty And Working Quality</td>
<td>Fauzia Dianawati, Dwinta Utari, Hanifah Handayani</td>
<td>IM – 131</td>
</tr>
<tr>
<td>20</td>
<td>R58</td>
<td>Analysis Of Asset Ownership And Debt For Jakarta MRT Project In South-North Corridor (Lebak Bulus-Kampung Bandan)</td>
<td>Romadhani Ardi, Erinda Muslim, Dimas Setyo Utomo</td>
<td>IM – 139</td>
</tr>
<tr>
<td>21</td>
<td>R65</td>
<td>Computer Integrated Manufacturing Maturity Model Design In Mineral Water Industry</td>
<td>Yudha Prasetyawan, Ria Novitasari</td>
<td>IM – 147</td>
</tr>
<tr>
<td>22</td>
<td>R70</td>
<td>Enhancement Fleisch And Osterle Model At PT Garuda Indonesia Base On Virtual Organization Concept</td>
<td>Danan Umar Daihani, Rivan Syamsurijal Biya</td>
<td>IM – 155</td>
</tr>
<tr>
<td>23</td>
<td>R71</td>
<td>Developing UKM Goes Online to be a Virtual Broker in Indonesia by Adopting Vega and Virtect Matric Model</td>
<td>Danan Umar Daihani, I Dewa Made Ari Dananjaya, Arief Dwi Hartanto</td>
<td>IM – 163</td>
</tr>
<tr>
<td>24</td>
<td>R73</td>
<td>UST Method As The Effective Strategy In Credit Management</td>
<td>Angreine Kewo, Mario Vitores</td>
<td>IM – 170</td>
</tr>
<tr>
<td>25</td>
<td>R76</td>
<td>A Dynamic Balanced Scorecard Of An Upstream Oil And Gas Portfolio Company</td>
<td>Fransiscus Rian Pratikto, Karlina Eka Wahyuni</td>
<td>IM – 178</td>
</tr>
<tr>
<td>26</td>
<td>R77</td>
<td>Indicators For Knowledge Management Performance Measurement From Human Capital Perspective Using Knowledge Management Balanced Scorecard</td>
<td>Amelia Kurniawati, Luciana Andrawina</td>
<td>IM – 187</td>
</tr>
<tr>
<td>27</td>
<td>R87</td>
<td>Analysis Of Relationship Between Internal Locus Of Control On Career Maturity Among IE Students In University Z</td>
<td>Hans Christian Andrew Salim, Marsellinus Bachtiar Wahyu</td>
<td>IM – 193</td>
</tr>
<tr>
<td>28</td>
<td>R91</td>
<td>Election Analysis Of Cooperation Using The Analisys Hierarchy Process In The Development Spam Pdam Bandar Lampung City</td>
<td>Wiwik Sudarwati</td>
<td>IM – 201</td>
</tr>
</tbody>
</table>
### SCM – Supply Chain Management

<table>
<thead>
<tr>
<th>No</th>
<th>Code</th>
<th>Title and Author</th>
<th>Page</th>
</tr>
</thead>
</table>
| 1  | R33  | Scorecard Design For Measuring Company Performance Based On Customer And Suppliers Perspectives Case Study at KF Indonesia  
*Eka Kurnia Asih Pakpahan, Reviandari Rizkiani* | SCM – 1 |
| 2  | R68  | Supplier Performance Evaluation Using Data Envelopment Analysis BCC Model and Super Efficiency Model in Pumping Unit Producer  
*Yadriifil, Maya Arlini P., Irmawati Ulfah* | SCM – 7 |
| 3  | R83  | A Synchronization Approach for Supply Chain Performance Hedging in Cane Based Agroindustry  
*Iphov K. Sriwana, Taufik Dja†na* | SCM – 14 |
| 4  | R86  | The Effect Of Buyers’ Characteristics On The Selection Of Categories Of Indonesian Domestic Airline Service  
*Mimi Halimin, Feliks Prasepta S. Surbakti* | SCM – 21 |
| 5  | R90  | A Forecasting Model Of Raw Material Supply Using Artificial Neural Network  
*Nofi Erni* | SCM – 26 |

### ER – Ergonomics

<table>
<thead>
<tr>
<th>No</th>
<th>Code</th>
<th>Title and Author</th>
<th>Page</th>
</tr>
</thead>
</table>
| 1  | R22  | Ergonomics Intervention Using Cognitive Approach In Reducing Work Error  
*Nataya Charoonsri Rizani, Mithia Ulfia, Winnie Septiani* | ER – 1 |
| 2  | R45  | The Influence Of Ergonomic Concept To The Work Posture And The Physical Work Environment And Its Impact On The Worker Performance (A Case Study On The Manufacturing Process Division at PT. Sinar Terang Logamjaya Bandung)  
*M. Yani Syafei, Erwin Maulana Pribadi* | ER – 7 |
| 3  | R46  | Breastfeeding Jacket Design Using Ergonomic Approach  
*Mira Rahayu, Fajar Dhitya, Grita Adrinovian* | ER – 16 |
| 4  | R57  | The Ergonomic Analysis Of Walking Posture Using Student Backpack  
*Maya Arlini Puspasari, Arian Dhini, Komara Jaya* | ER – 21 |
| 5  | R62  | Ergonomics Intervention To Reduce Work Load On Wood Department In Furniture Manufacturing  
*Dian Mardi Safitri, Ni Made Putri Wulandari, Nora Azmi* | ER – 27 |
| 6  | R78  | Standard Of Cloth Sizes For Toddler (Girl) Based On Athropometry Dimension  
*Vivi Triyanti, Maria Santiana* | ER – 34 |
| 7  | R88  | Workload Evaluation between Beginner and Skillful Worker (Case Study: Manual Harvesting and Transporting of Sugar Cane)  
*Lamto Widodo, Bambang Pramudya, Sam Herodian, M. Faiz Syu’aib* | ER – 40 |
<table>
<thead>
<tr>
<th>No</th>
<th>Code</th>
<th>Title and Author</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R02</td>
<td>Configuration of an Industrial Ethernet Network to Control a Flexible Manufacturing System Joe Kwan Hoei</td>
<td>PS – 1</td>
</tr>
<tr>
<td>2</td>
<td>R35</td>
<td>Batch Scheduling In Two-Stage Flowshop With Common And Dedicated Machine To Minimize Total Actual Flow Time Pratya Poeri Suryadhini</td>
<td>PS – 8</td>
</tr>
<tr>
<td>3</td>
<td>R38</td>
<td>Improvement Of Assembly Line Design In PT. SMI By Lean Manufacturing Approach Sadzwina Faiza Prasasya, Dida Diah Damayanti</td>
<td>PS – 14</td>
</tr>
<tr>
<td>4</td>
<td>R48</td>
<td>Proposal Of Machine Maintenance Planning And Maintenance Information System (Case Study at PT. BBI) Amal Witonohadi, Dannis S. Pramudya</td>
<td>PS – 21</td>
</tr>
<tr>
<td>5</td>
<td>R49</td>
<td>Evaluation To Production Performance Considering Departments Distance and Route Time Using Simulation With ARENA Yogi Yogaswara</td>
<td>PS – 27</td>
</tr>
<tr>
<td>6</td>
<td>R52</td>
<td>The Usage Of Lean Manufacturing Concept For Reducing Waste Of Corrugated Box Cardboard Production (Case Study : at Converting Division, PT. Purinusa Eka Persada Bandung) Resha Akbar, Rd. Rohmat Saedudin, Haris Rachmat</td>
<td>PS – 32</td>
</tr>
<tr>
<td>7</td>
<td>R59</td>
<td>Inventory Control Of The Products For Special Sale Model Y M Kinley Aritonang, Feronika</td>
<td>PS – 44</td>
</tr>
<tr>
<td>8</td>
<td>R64</td>
<td>Application Synchronous Manufacturing By Using Drum-Buffer-Rope And Promodel Simulation Tiena Gustina Amran, Annisa Pranowo</td>
<td>PS – 49</td>
</tr>
<tr>
<td>9</td>
<td>R74</td>
<td>Considering The Time Value Of Money Into The Lot Size Decision In Material Requirement Planning Arum Sari, Ade Agus Junaedi</td>
<td>PS – 57</td>
</tr>
<tr>
<td>10</td>
<td>R75</td>
<td>A Preliminary Study On Safety Stock Placement Problems With Stochastic Lead Times Carles Sitompul, Dedy Suryadi, Johanna Hariandja</td>
<td>PS – 63</td>
</tr>
<tr>
<td>11</td>
<td>R82</td>
<td>Applying Theory Of Constraint And Particle Swarm Optimization Method To Determine The Quantity Of Product Mix Sumiharni Batubara, Rahmi Maulidya, I Komang Mahendradata</td>
<td>PS – 67</td>
</tr>
<tr>
<td>12</td>
<td>R85</td>
<td>Comparison Performance Analysis Between Heuristic Pour, Nawaz Enscore And Ham (NEH) Algorithm In Completing The Flowshop Scheduling At PT. XYZ Lina Gozali, Lamto Widodo, Teddy Kurniawan</td>
<td>PS – 73</td>
</tr>
<tr>
<td>13</td>
<td>R89</td>
<td>Applying Multi Population Genetic Algorithm to Multi Objective Scheduling System Rahmi Maulidya, Sumiharni Batubara and Mochammad Iman Fachry</td>
<td>PS – 81</td>
</tr>
</tbody>
</table>
# Table of Content

## QM – Quality Engineering & Management

<table>
<thead>
<tr>
<th>No</th>
<th>Code</th>
<th>Title and Author</th>
<th>Page</th>
</tr>
</thead>
</table>
| 1  | R04  | Utilization Of Chromium Waste From Tanning Industry as Ceramic Glaze  
*Lusia Permata Sari Hartanti* | QM – 1 |
| 2  | R07  | Quality Improvement Of Packaging Label Printouts: An Analysis And Implementation Of Six Sigma And Work Method Redesign  
*Djoko Sihono Gabriel, Aris Triono* | QM – 6 |
| 3  | R08  | Process Monitoring With Multivariate Control Chart For Auto Correlated Data: A Case Study At Pharmaceutical Industry  
*Ig. Joko Mulyono, Ivan Gunawan, Suhartono* | QM – 11 |
| 4  | R16  | Quality Control Development Based On Lean Six Sigma Method  
*Wahyukaton* | QM – 16 |
| 5  | R18  | Quality Improvement and Jar Cleo Product Development based on Quality Function Deployment at PT Berkah Plastic Industri  
*Johnson Saragih, Dedy Sugianto, Wira Nurdjana* | QM – 21 |
| 6  | R50  | Longterm Upgrading Airport Runway’s: An Approach Of Support Vector Regression  
*Amar Rachman, Sumarsono Sudarto, Sarah Noviani* | QM – 26 |
| 7  | R53  | Design Of TQM Scorecards For Construction Service Industry Using AHP And Fuzzy-AHP Method Based On Malcolm Baldrige National Quality Award 2009-2010 Criteria  
*Erlianda Muslim, T. Yuri M. Zagloel, Intan Purbosani* | QM – 33 |
| 8  | R60  | Quality Improvement Of Food Jar Products Using Six Sigma Method  
*Leli Deswindi, Christin* | QM – 40 |
| 9  | R61  | Analysis Of Operational Wastes In A Logistics Service Company Using Lean Six Sigma Method  
*Syarif Hidayat, Lisa Heryani* | QM – 48 |
| 10 | R63  | FMEA (Failure Mode And Effect Analysis), And Expert System In Lubricant Machine Oil Production Process  
*Rina Fitriana, Andhika Mandala Utama, Johnson Saragih* | QM – 56 |
| 11 | R66  | Automated Visual Grading And Inspection For Egg  
*Yudha Prasetyawan, Achmad Mustakim* | QM – 62 |
| 12 | R79  | Implementation Study Of Malcolm Baldrige Criteria For Performance Excellence (MBCFPE) In Higher Education (Case Study Of University X)  
*Ahmad Chirzun, Adi Pranoto* | QM – 70 |
| 13 | R84  | Customers And Employees Satisfaction Analysis With Human Sigma Approach: A Case Study In A Hotel Service  
*Dendi Prajadhiana Ishak, Triyono* | QM – 77 |

## DSS – Decision Support System and Artificial Intelligence

<table>
<thead>
<tr>
<th>No</th>
<th>Code</th>
<th>Title and Author</th>
<th>Page</th>
</tr>
</thead>
</table>
| 1  | R14  | The Evolution of Computing: from Local Computing to Cloud Computing  
*Maria Angela Kartawidjaja* | DSS – 1 |
| 2  | R19  | Design Knowledge Management Model of Standarization Accounting Code System: Study Case Audit Board of Republic of Indonesia  
*Riya Widayanti* | DSS – 10 |
### Table of Content

<table>
<thead>
<tr>
<th>No</th>
<th>Code</th>
<th>Title and Author</th>
<th>Page</th>
</tr>
</thead>
</table>
| 3  | R24  | Proposal For The Design Of Decision Support System For Machine Maintenance Priority In PT. Biuteknika Bina Prima  
*Winnie Septiani, Sucipto Adi Suwiryo, Amalia Nurinsana* | DSS – 18 |
| 4  | R32  | Comparison Of Nutritional Status Data Calculation Between K-Nearest Neighbour And Bayesian Algorithms  
*Erni Seniwiati, Ferry Wahyu Wibowo* | DSS – 24 |
| 5  | R37  | An Architecture for Legal Knowledge-based System in Indonesia  
*Wahyu C. Wibowo, Adriana Sari Aryani* | DSS – 31 |
| 6  | R67  | Designing Business Process Model And Data Architecture For Information System At Fitness Center (Case Study Helios Fitness)  
*Sonna Kristina, Rivans Liviyandi* | DSS – 35 |
| 7  | R81  | Quality Improvement of Personal Computers Configuration Management Using IT Infrastructure Library: Study on IT Directorate of XYZ University  
*Ahmad Juang Pratama, Paula Ruth Prawinoto* | DSS – 41 |

### OR – Operation Research

<table>
<thead>
<tr>
<th>No</th>
<th>Code</th>
<th>Title and Author</th>
<th>Page</th>
</tr>
</thead>
</table>
| 1  | R23  | A Design of Risk Transfer System for Raw Materials Commodity of Agroindustry  
*IGA Anom Yudistira, and Lisa Ratnasari* | OR – 1 |
| 2  | R28  | Fuzzy Multi Objective Linear Programming For Optimization Of Agroindustrial Logistic Design  
*Pudji Astuti* | OR – 13 |
| 3  | R34  | Heuristic For Asymmetric Capacitated Vehicle Routing Problem  
*Tjutju Tarliah Dimyati* | OR – 20 |
| 4  | R51  | Demand Forecasting Comparasion Between Artificial Neural Network And Support Vector Regression With Traditional Methods  
*Sumarsono Sudarto, Amar Rachman, Rendra Satya Wirawan* | OR – 27 |
| 5  | R54  | Determination Of Balance Ratio Load Factor And Calculation Of Waiting Time For Urban Transportation In Depok  
*Nunung Nurhasanah, Dewi Wulandari* | OR – 33 |
| 6  | R69  | Exponential Barrier Method in Solving Linear Programming Problems  
*Parwadi Moengin* | OR – 39 |
| 7  | R72  | Study and Evaluation of Methods for Solving Traveling Salesman Problem (TSP) Interaction Gani Method and Nearest Neighbor Method  
*Mohammad Syarwani* | OR – 44 |
Evaluation to Production Performance Using Simulation
(Yogi Yogaswara)

1. INTRODUCTION

Simulation technique is a tool for analyzing and testing solutions before implementing in the real system. As computer, because more powerful, so the use of simulation techniques as a tool for research and solving problems became more popular [1].

Concept of simulation technique is to imitate the real system as a model and after that use the model to work in many conditions and study the effects to evaluate the solution strategies for the real system. Since the simulated model will show the results and the side effect of different conditions as assumption in testing stage of the simulation model. These outcomes help the analyzer better understand the transient stage of the system and predict the effects that showed occur during changing the system (see [2], [3] and [4]).

This study is about the application of a simulation model to assist performance evaluation of production considering departments distance and route time by using empirical data on a shoe-making industry. The existing condition is composed of 3 main parts which are processed into 9 departments of production. Departments 1st – 5th are a fabrication process, Departments 6th – 7th are the assembling process 1st and 2nd, Department 8th is the process of packing, and the department 9th is the inspection/Quality Control process.

The problem that occurs is how to improve production performance as measured by the total output of goods or product, the total time of the production process, the total of WIP, and the average waiting time in queue of each process on the Shop floor by considering the distance of the department and route time component. Simulation is used to evaluate the best alternatives generated by analyzing the behavior of the system from any scenario that has been made.

2. SYSTEM EXPLANATION

The existing condition on a shoe-making industry is composed of 3 main parts which are processed into 9 departments of production. Departments 1st – 5th are a fabrication process, Departments 6th – 7th are the assembling process 1st and 2nd,...
Department 8th is the process of packing, and the department 9th is the inspection/Quality Control process. Production Process of Shoe is shown at Figure 1 Operation Process Chart. Distance between Departments/stations is shown at Table 1. Probability distribution generated for the processing time at each station can be shown in Table 2.

3. MODEL AND SIMULATION

3.1. Model Assumptions
The assumptions used in the model as follows:
- Simulation Setting (Run Setup) : 1 time number of replication and replication length : 6 days with 8 work-hour per day.
- Processing time for each station/department are exponentially distributed (see Table 2).
- Fixed capacity operator 1 person for each machine.
- Rute time needed at the time of leaving each station is constant 0.25 minute delay for each unit and the transporter that is used as a transfer material has a velocity of 10 seconds for each unit of movement.
- Rejected/failed product are assumed at 10% of the products manufactured.

3.2. Performance Measures
The problem that occurs is how to improve production performance as measured by the total output of goods or product, the total time of the production process, The total of WIP, and the average waiting time in queue of each process on the Shop floor by considering the distance of the department and route time component.
- Total output : the number of product output in a range of simulation time
- Total time for completed processing of product.
- Number of WIP : number of product work in process or waiting in queue for processed.
- Average waiting time in queue for each production process.

3.3. Simulation Model
The model places the logic model flow in ARENA block modelling according to the process flows of each components as follows the operation process chart in Figure 1. The logic model with ARENA block modelling shown in Figure 2, 3, 4, 5, 6 and Figure 7 respectively:
Model is built using the ARENA model of basic process modules, advanced process and transfer advanced to represent the real system. Use of the transfer module is intended to generate a route time behavior. As for the distance between the department used distance and transporter module.

The parameters that has been given to the simulation model in accordance with the system previously mentioned assumptions.

4. SIMULATION EXPERIMENTS

Simulation experiment is carried out by using 3 simulated scenarios. The scenario is constructed aiming to observe the behavior of the system from changes in total WIP, total output, the average waiting time in queue, and processing time at each station / department to consider the route time and distance between departments.

The first scenario is original empirical data and existing condition. The second scenario make changes to the original route time constant of 0.25 minute per unit of motion, transformed into exponentially distribution with mean 0.25 minute. While the third scenario is to make changes in the distances between departments.

The distance between stations for 3rd scenario shown in Table 3.
Table 3. Distance Between Stations for 3rd Scenario

<table>
<thead>
<tr>
<th>DISTANCE BETWEEN STATIONS</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
<th>L</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Acceptance of components</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td>10</td>
<td>12</td>
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<td>6</td>
<td>13</td>
<td>10</td>
<td>5</td>
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<td></td>
</tr>
<tr>
<td>B. Measuring table.Station</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td>12</td>
<td>4</td>
<td>7</td>
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<td>13</td>
<td>10</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. Cutting machine.Station</td>
<td>6</td>
<td>6</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td>12</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td>12</td>
<td>3</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>D. Pattern &amp; Measuring Process</td>
<td>9</td>
<td>9</td>
<td>6</td>
<td>9</td>
<td>6</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>E. Heating Station</td>
<td>10</td>
<td>10</td>
<td>6</td>
<td>9</td>
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<tr>
<td>F. Sewing machine.Station</td>
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<td>12</td>
<td>9</td>
<td>10</td>
<td>12</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td>7</td>
<td>6</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G. Component 1 assemble 1 Station</td>
<td>4</td>
<td>4</td>
<td>23</td>
<td>6</td>
<td>8</td>
<td>32</td>
<td>6</td>
<td>4</td>
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<td>16</td>
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<td>H. Component 2 assemble 1 Station</td>
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<td>5</td>
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<td>6</td>
<td>8</td>
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<td>16</td>
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<td>J. Component 3 assemble 2 Station</td>
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<td>2</td>
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<td>K. Component 1 assemble 1 Station</td>
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<td>6</td>
<td>9</td>
<td>5</td>
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<td>2</td>
<td>3</td>
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<td>L. Inspection Station</td>
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<tr>
<td>M. Warehouse Station</td>
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<td>5</td>
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<td>7</td>
<td>3</td>
<td>1</td>
<td>2</td>
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</tbody>
</table>

4.2. Validation and Verification
Validation and verification evidence was gathered from the simulation results for the run simulating 6 days of activities. Since this was a closed queueing network there were no new entities entered or leave the system except the entities indicated to ship-out from the plant as finished goods. The simulation output was verified by using a constant number to check with the summation of processing time of one flow line equal to simulation running result in order to make sure that model represented the real production system.

5. CONCLUSION
From the simulation results, shows that the outcomes of the 3rd scenario that showed better results, which obtained the reduction of processing time, average time waiting in queue, total output is larger and less total WIP. In the 3rd scenario is a reduction of the distance between departments to close departments that have the longest time in the process of movement between departments.

The best result to scenario comparison can be shown in Table 7, and 8.

Table 4. The Result of 1st Scenario

<table>
<thead>
<tr>
<th>Process</th>
<th>Processing Time (minute)</th>
<th>Waiting Time (minute)</th>
<th>Total Output (units)</th>
<th>Total Average WIP Comp/Parts (units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assembling Process 1</td>
<td>10.68</td>
<td>4.32</td>
<td>17</td>
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</tr>
<tr>
<td>Assembling Process 2</td>
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<td>35.44</td>
<td>17</td>
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</tr>
<tr>
<td>Packing Process</td>
<td>20.17</td>
<td>4.67</td>
<td>17</td>
<td>Component 1</td>
</tr>
<tr>
<td>Heating Process</td>
<td>12.88</td>
<td>8.08</td>
<td>17</td>
<td>Component 2</td>
</tr>
<tr>
<td>Inspection Process</td>
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</tr>
<tr>
<td>Cutting Process</td>
<td>23.58</td>
<td>29.98</td>
<td>34</td>
<td>Component 3</td>
</tr>
<tr>
<td>Pattern &amp; Measuring Process</td>
<td>37.32</td>
<td>206.56</td>
<td>34</td>
<td>Component 3</td>
</tr>
<tr>
<td>Sewing Process</td>
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<td>22.51</td>
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</tr>
<tr>
<td>Pressing Process</td>
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<td>34</td>
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</tr>
</tbody>
</table>

Table 5. The Result of 2nd Scenario

<table>
<thead>
<tr>
<th>Process</th>
<th>Processing Time (minute)</th>
<th>Waiting Time (minute)</th>
<th>Total Output (units)</th>
<th>Total Average WIP Comp/Parts (units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assembling Process 1</td>
<td>31.31</td>
<td>16.42</td>
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</tr>
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<td>Assembling Process 2</td>
<td>24.83</td>
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<td>Packing Process</td>
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<td>Heating Process</td>
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<tr>
<td>Cutting Process</td>
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<td>596.47</td>
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</tr>
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<tr>
<td>Pressing Process</td>
<td>35.12</td>
<td>83.33</td>
<td>56</td>
<td>Component 3</td>
</tr>
</tbody>
</table>

Table 6. The Result of 3rd Scenario

<table>
<thead>
<tr>
<th>Process</th>
<th>Processing Time (minute)</th>
<th>Waiting Time (minute)</th>
<th>Total Output (units)</th>
<th>Total Average WIP Comp/Parts (units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assembling Process 1</td>
<td>15.24</td>
<td>17.46</td>
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<td>Component 1</td>
</tr>
<tr>
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<td>17.44</td>
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<td>23</td>
<td>Component 1</td>
</tr>
<tr>
<td>Packing Process</td>
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<tr>
<td>Heating Process</td>
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<td>22</td>
<td>Component 2</td>
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<td>0.19</td>
<td>22</td>
<td>Component 2</td>
</tr>
<tr>
<td>Cutting Process</td>
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<td>22.71</td>
<td>22</td>
<td>Component 2</td>
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<tr>
<td>Pattern &amp; Measuring Process</td>
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<td>57.63</td>
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<td>Component 3</td>
</tr>
<tr>
<td>Sewing Process</td>
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<td>5.03</td>
<td>44</td>
<td>Component 3</td>
</tr>
<tr>
<td>Pressing Process</td>
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<td>32.47</td>
<td>44</td>
<td>Component 3</td>
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</tbody>
</table>

Table 8. The Comparison of WIP

<table>
<thead>
<tr>
<th>Total Output</th>
<th>Total Work In Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Component 1</td>
<td>17</td>
</tr>
<tr>
<td>Component 2</td>
<td>17</td>
</tr>
<tr>
<td>Component 3</td>
<td>34</td>
</tr>
</tbody>
</table>
Graphic Processing Time, Total Output and Total Work in Process for three scenarios can be shown in Figure 8, 9 and 10.

6. REFERENCES


