

Bali
OSCM 2005

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PROCEEDINGS

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**OPERATIONS AND
SUPPLY CHAIN MANAGEMENT**

December 15-17, 2005

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Sepuluh Nopember Institute of Teknologi (ITS)
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**International Conference on
Operations and Supply Chain Management**

15 -17 December 2005
Bali, Indonesia

**Edited by Nyoman Pujawan
Iwan Vanany**

Organized and hosted by:
Department of Industrial Engineering
Sepuluh Nopember Institute of Technology
Surabaya – Indonesia



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It is an honor to us to welcome you to the First International Conference on Operations and Supply Chain Management. The theme of the conference is “The role of OM/SCM in promoting smarter use of global resources”. We have chosen this theme to reflect our concern with the long term sustainability of business and industry operations given the constantly depleting availability of resources in many sectors.

The response to our call for papers had been overwhelming. We received over 300 abstracts submission at the beginning, but due to various reasons, including the recent tragic bombings in Bali, only about 130 papers are scheduled to be presented. We are glad to see the international nature of the conference. We are glad to welcome participants from Australia, Canada, China, Cyprus, Finland, France, Germany, Hong Kong, India, Indonesia, Iran, Japan, Korea, Malaysia, Netherlands, New Zealand, Norway, Philippines, Singapore, Sweden, Switzerland, Taiwan, Thailand, Turkey, UK, USA. We are also glad to see many attendants from industries, which then makes this conference an excellent opportunity to create networking, not only between academics, but also between academics and practitioners.

This conference would not have been possible without contributions of many individuals and organizations. The supports from advisory and review committee have played fundamental roles in making sure the conference, in particular the accepted papers, are of high quality. We would also like to thanks the plenary speakers, Professor Kai Mertins from IPK Germany and Professor Luk Van Wassenhove from INSEAD for their willingness to address the audience in the plenary sessions. Thanks also to Professor M. Nuh, Rector of the Sepuluh Nopember Institute of Technology for his supports and encouragement. All members of the local committee have been instrumental in bringing this conference to a success. We are also indebted to a number of supporting organizations, including IPOMS, EUROMA, MSORMS, AIT and our sponsors for the endorsement, financial and other supports.

Finally, I wish you have an effective conference and enjoyable days here in Bali.

Conference co-chairs

Dr. Nyoman Pujawan
Sepuluh Nopember Institute of Technology (ITS), Surabaya – Indonesia

Dr. Saibal Ray
McGill University, Canada

CONFERENCE PROGRAM
INTERNATIONAL CONFERENCE ON
OPERATIONS AND SUPPLY CHAIN MANAGEMENT
BALI INTERNATIONAL CONVENTION CENTER, THE WESTIN RESORT,
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WEDNESDAY, 14 DECEMBER 2005

17.00 – 20.00 **Registration**

THURSDAY, 15 DECEMBER 2005

08.00 – 09.00 **Registration**

09.00 – 09.30 **Opening ceremony**
Welcome address from conference co-chairs
Welcome address by Rector of Sepuluh Nopember Institute
of Technology (ITS)

09.30 – 10.30 **Plenary Speech I**
Model Driven Management for Networked Enterprises
Prof. Dr.-Ing. Kai Mertins, FhG-IPK Berlin, Germany

10.30 – 11.00 **Break**

11.00 – 12.00 **Plenary Speech II**
Closed-loop supply chains: practice and potential
Prof. Luk Van Wassenhove, INSEAD

12.00 – 13.00 **Lunch Break**

13.00 – 14.45 **Parallel Sessions I**

14.45 – 15.15 **Break**

15.15 – 17.00 **Parallel Sessions II**

18.30 – 21.00 **Gala Dinner**

FRIDAY, 16 DECEMBER 2005

08.00 – 09.45 Parallel Sessions III

09.45 – 10.15 Break

10.15 – 11.15 Panel: ISO and Supply Chain Management

Panelist I: Prof. Charles Corbett, University of California, Los Angeles

Diffusion of ISO 9000 and ISO 14000 through global supply chains

Panelist II: Dr. Pavel Castka, University of Canterbury, NZ

ISO 26000 and Supply Chains - on the diffusion of the social responsibility standard

10.15 – 13.00 BREAK

13.00 - 14.45 Parallel Sessions IV

14.45 – 15.15 Break

15.15 – 17.00 Parallel Sessions V

17.00 – 17.15 Closing Remarks

SATURDAY, 17 DECEMBER 2005

CONFERENCE TOUR

(Time estimate: 06.30 – 17.00)

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CONTENTS

A. Procurement and Supply

1	<u>Supply management of hong kong manufacturers: some implications from case studies</u> Peter K. C. Lee and K. L. Mak.....	1
2	<u>Supplier selection and negotiation model with fuzzy profit target</u> Andi Cakravastia, Titah Yudhistira and Katsuhiko Takahashi.....	8
3	<u>Procurement performance measures framework</u> Bertha Maya Sopha and Patrik Jonsson	18
4	<u>An empirical taxonomy of purchasing functions: a study of united kingdom organizations</u> Paul D. Cousins, Benn Lawson and Brian Squire	26
5	<u>A model of corporate's board supervision over procurement processes: case of an Indonesian state owned enterprise</u> Arif Arryman and Yuki Indrayadi	34
6	<u>A review of the impact of terrorism disruptions on inbound supply chain strategies</u> Austen Okonweze	42

B. Inventory

1	<u>An effectiveness of an exponentially smoothed ordering policy</u> Takayoshi Tamura, Mitsutoshi Kojima, Seiichi Fujita and Chitoku Kumagai.....	1
2	<u>Solving for the dynamic inventory allocation problem under imperfect information and capacitated supply</u> Sylvana Saudale and Maher Lahmar	10
3	<u>A cost comparison of stochastic dynamic inventory control policies</u> Aysegul Tas and S. Armagan Tarim	19
4	<u>A single-vendor single-buyer production inventory model for perishable goods</u> Jonas C.P. Yu, H.M. Wee and J.M. Chen	27
5	<u>Safety stock allocation in a four-stage supply chain controlled by optimal production/distribution plan</u> Chumpol Monthatipkul and Pisal Yenradee	35
6	<u>An inventory pricing model when demand are price and inventory level dependent</u> Peng Sheng You	42

C. Service Operation And Performance

1	<u>Responsiveness index: a new performance measurement for the hotel industry</u> Mohd Rizal Razalli, Noornina Md Dahlan and T. Ramayah	1
2	<u>Improving productivity of service operations</u> Katri Ojasalo	10
3	<u>Maranatha christian university re-registring process service design in bandung – western java in indonesia</u> Yulianti, Vivi Arisandhy and Christina.....	17
4	<u>Small business performance in kedah state of malaysia</u> Nor Hasni Osman And Abdul Aziz Jemain.....	23
5	<u>Performance efficiency of the adventist book centers in the southern asia-pacific region</u> Benny Lule And Emilyn Cabanda.....	32

D. Maintenance

1	<u>The usage of EGT margin application as an engine performance deterioration measurement in aviation maintenance industries</u> Cornelis Radjawane and Lia Yuanawati.....	1
2	<u>A new algorithm for reliability bounds of coherent systems</u> Yi-Chih Hsieh.....	14
3	<u>A study of preventive maintenance planning for cellular manufacturing systems</u> Kanchan Das, Reza S. Lashkari and Sankar Sengupta.....	21

4	<u>Optimal replacement policy for repairable machine sold with warranty</u> Kusmaningrum S. Leksananto Bermawi P. Iskandar Harsono Taroepratjeka	:	29
5	<u>An immune algorithm for reliability design problems</u> T.-C. Chen.....	:	38
6	<u>Managing uncertainty and adding value in spares supply chain using option theory</u> Mohita G. Sharma and Kashi N. Singh	:	46
7	<u>Strategy development for industrial services and product support</u> Rajesh Kumar, Sukhvir Singh Panesar And Tore Markeset	:	55
8	<u>Closed loop supply chain management of repairable service parts: an empirical analysis</u> Vinayak Deshpande, Ananth Iyer, Asima Mishra (Non-Refereed)	:	61
9	<u>The role of industrial support services in operation and maintenance in the norwegian oil and gas industry</u> Sukhvir Singh Panesar And Tore Markeset	:	62
10	<u>Preventing product reliability problems through proactive testing</u> Gembong Baskoro.....	:	70
11	<u>Optimal maintenance policies for plants with several levels of risk</u> Toshio Nakagawa, Kodo Ito, and Kazunori Iwata	:	76
E. Agricultural and Other Sectors			
1	<u>The application of the AHP and TOC analyzing supply chain of a pig farming industry: a case study</u> Ririn Diar Astanti.....	:	1
2	<u>Agropolitan infrastructure development application of just-in-time logistic management in agriculture sector</u> Emil Elistianto Dardak	:	10
3	<u>A study of agribusiness supply chain for dryland farming products of Lombok island – Indonesia: an application of pluralistic approach</u> I Gusti L.P Tanaya, Murray Mc Grogor, Maria Fay Rola-Rubzen	:	18
4	<u>Application of solar energy for drying of sludge from pharmaceutical industrial waste water and probable reuse</u> Nasser Mehrdadi, Gholam-Reza N, Bidhendi	:	27
5	<u>Role of operational strategy in supply chains as a flexible system</u> Avneet Saxena, Subhash Wadhwa.....	:	35
6	<u>Performance of flexible supply chains under dynamic environment: a knowledge management perspective</u> Subhash Wadhwa, Avneet Saxena.....	:	45
F. SCM Development			
1	<u>Improving the implementation and application of complexity management in logistics- development of a framework</u> Prof. Dr. Wolfgang Kersten and Christian M. Meyer.....	:	1
2	<u>Supply chain development through project management</u> Yiannis E. Polychronakis, Aris A. Syntetos and Felix O. Labinjo.....	:	9
3	<u>Gap between theory and practice of supply chain management: a case study from the aerospace sector</u> Uche Okongwu.....	:	16
4	<u>The rise and fall of improvement methods : is anything new under the sun?</u> Dag Naslund.....	:	26
5	<u>The use of life cycle cost and profit assessment to improve operations and supply chain management performance of complex oil production facilities</u> Tore Markeset and Uday Kumar.....	:	36
G. Production System Design			
1	<u>Enhancing productivity of manufacturing process by improving material flow: a case study</u> Andreas B. Fransson, Andreas P. J. Rosell and Imad alsyouf.....	:	1
2	<u>Product family assembly line design based on common subassemblies</u> Dida Diah Damayanti, Anas Ma'ruf, Bermawi P Iskandar And Isa Setiasyah Toha ...	:	9
3	<u>A case study: resolve multirow facility layout problems using genetic algorithm</u>		

	Anastasia Lidya Maukar and Dian Retno Sari Dewi.....	:	20
4	<u>Application of just in time manufacturing in PT XYZ</u> Theosinov I. Siahay, Yahya Kurniawan and Ferdinand Latunij.....	:	28
5	<u>An optimal three-node closeness relationship diagramming</u> Wandee Udomwongyont and Chamnong Jungthirapanich.....	:	35
6	<u>Shop-floor project management for technology transfer</u> Victor Pantano, and Margaret Rossiter.....	:	42
7	<u>A design strategy for cell production system</u> - Kein'chi Mori (Non-Refereed).....	:	53
H. SCM Performance			
1	<u>Identifying the factors which determine the operational performance of SCM and analyzing their impacts on financial indexes</u> Sadami Suzuki, Takao Enkawa and Korrakot Yaibuahet.....	:	1
2	<u>Performance evaluation of supply chain processes according to determinants</u> Matthieu Lauras, Jacques Lamothe and Hervé Pingaud.....	:	9
3	<u>Managing value in fragmented networks – a case for integrative performance management</u> Nemile Achimugu, John M. Kay, Denyse M. Julien	:	17
4	<u>Innovative capabilities, customer focus, and company performances: an empirical study of business firms in malaysia</u> Fazli Idris.....	:	29
5	<u>On the thoughts to revive balanced scorecard for future adaptation : a survey of ndonesian companies</u> Eric And Rosita Meitha Surjani.....	:	36
6	<u>Interorganizational networks performance measurement system, a study of maritime port communities</u> Frank Guerin and Patrick Le Mestre.....	:	44
7	<u>Development of strategy formulation model for medium-sized shipyards</u> Buana Ma'ruf, Patdono Suwignjo and SjariefWidjaja.....	:	52
8	<u>Incorporating impreciseness in measuring supply chain competitiveness</u> Ade Febransyah.....	:	62
9	<u>The causal relationship between TQM practices, supply-chain, demand-chain, and company performance: evidence from the Indonesia's oil and gas industry</u> Wakhid Slamet Ciptono and Nurul Indarti.....	:	70
10	<u>Design of supply chain performance measurement system for lamp industry</u> Iwan Vanany, Patdono Suwignjo, Dito Yulianto.....	:	78
I. Transportation and Distribution			
1	<u>Application of linear single-commodity minimum-cost flow model tolong-haul freight transportation</u> M. Nurman Helmi.....	:	1
2	<u>Improve distribution performance at aalsmeer flower auction using teamwork</u> Mengfei Yu and René M. B. M. De Koster.....	:	10
3	<u>Direct plant delivery at fonterra brands indonesia</u> Andreas B. W, Josef H. Nudu, Jimmy Kurniawan and Endra M. Halim.....	:	18
4	<u>A two stages algorithm to solve transportation problem</u> Ali Basyah, Siregar Andi Cakravastia and Ima T. Mariani.....	:	26
5	<u>The development of AIS paradigm in dynamic routing</u> Eugene Y. C Wong and Hendry Y.K.Lau.....	:	34
J. Scheduling and OR Application			
1	<u>Parallel machine makespan minimization using ant colony optimization</u> Yun-Chia Liang and Jou-Chun Chen.....	:	1
2	<u>Single machine scheduling with job deliveries to multiple customer areas</u> Jen-Shiang Chen and Betty Chang.....	:	8
3	<u>Local search and generic algorithm techniques for solving vehicle routing problem with multiple trips and time windows</u> Suprayogi, Hiroyuki Yamato, Arief Hardianto.....	:	17
4	<u>OR practices on logistics management in taiwan: an academic view</u>		

	Yen-Chun Jim Wu and Ichin Huang.....	:	25
5	<u>A hybrid ant colony approach to multi-mode resource-constrained project scheduling problems with non-renewable types</u>		
	Chiu-Cheng Chyu, Angela H. L. Chen, and Xin-Huei Lin.....	:	33
6	<u>Graded categorisation for knowledge management systems</u>		
	James Sinclair, Margaret Rossiter, and Michael Cardew-Hall.....	:	41
7	<u>A strategic production contract to support sustainable manufacturing</u>		
	Nur Indrianti, and Masaaki Muraki.....	:	53
K. Planning and Forecasting			
1	<u>Supply chain management strategic planning : a review</u>		
	Noor Ajian Mohd Lair, Lee Luong, Romeo Marian And Sang-Heon Lee.....	:	1
2	<u>Exploitation of grey functions in forecasting series with limited history: an improved grey theory approach</u>		
	Li Zhou And Stephen M. Disney.....	:	10
3	<u>Production planning using hybrid analytical and simulation methods : a case study</u>		
	Ig. Joko Mulyono.....	:	18
4	<u>Economic kanban quantity and withdrawal lot size using opimal and meta-heuristic methods</u>		
	G.A. Widyadana, H. M. Wee, S. Chiamsiri, A. Pinnoi.....	:	25
5	<u>The effect of forecasting and information sharing in scm for multi-generation products</u>		
	So Young Sohn, Michael Lim.....	:	32
L. Sustainable Supply Chain			
1	<u>Design and analysis of a closed-loop supply chain network for lead-acid battery recycling</u>		
	Hailun (Helen) Zhang and R. S. Lashkari.....	:	1
2	<u>Comparative assessment to identify the characteristics of collectors in reverse logistics</u>		
	Jessica Hanafi, Sami Kara, H Kaebernick.....	:	9
3	<u>Reuse in action: a study of “trade-in” practices of electrical appliances in indonesia</u>		
	Maria Anityasari, Hartmut Kaebernick and Han Bao.....	:	18
4	<u>A proposal of design concept and supply chain for the energy saving era</u>		
	Satoshi Watanabe, Fukuya Ishino, Koudai Aman and Mikihiko Murao.....	:	28
5	<u>Strategy to encourage wastepaper recycling – a linear programming approach</u>		
	Rupesh Kumar Pati, Prem Vrat, and Pradeep Kumar.....	:	36
6	<u>Humanitarian disaster management: logistics in high gear</u>		
	Luk Van Wassenhove	:	45
M. Relationship and Collaboration			

1	<u>The benefits of trust and similarity in partnerships in the french food industry supply chain</u>	
	Dr Franck Brulhart.....	: 1
2	<u>Review of supply chain collaboration levels and types</u>	
	Jenny Bäckstrand and Kristina Säfsten.....	: 15
3	<u>Supply chain relationship profiles: a performance evaluation</u>	
	Muriati Mukhtar, Awaluddin Mohamed S, Mohamad Shariff Nabi Baksh.....	: 24
4	<u>Parent organisations impact on temporary organisations and their logistics requirements</u>	
	Nina Modig.....	: 32
5	<u>Supply chain management best practices of the indonesian small & medium enterprises</u>	
	Kristanto Santosa.....	: 43
6	<u>The effects of supplier management strategy on supply chain strategy towards firms performance</u>	
	Suhaiza Zailani, R. Premkumar, Mohamed Sulaiman, Nor Zalila J	: 53

N. Learning

1	<u>On the difference of skill development process by the type of job</u>	
	Ken'ichi Mori, Takashi Yamamoto and Kanjyu Haneishi.....	: 1
2	<u>Implementation of P3L (professionalism with 3-lane) by using IDEFO for process planning profession</u>	
	Ezra Peranginangin and Indra Djodikusumo.....	: 8
3	<u>Advancing lean production concept through experiential learning activity: a tamiya game</u>	
	Bertha Maya Sopha and Budi Hartono.....	: 15
4	<u>How well are the learning teams performing?–performance measurement of project action learning (pal) teams</u>	
	Kris, M. Y. Law and K. B. Chuah.....	: 23
5	<u>Managers' attitudes toward inter-organizational internet communication in china: the impact of organization, task and personal factors</u>	
	Vincent S.C. Fok.....	: 31

O. Inventory, Fullfillment Management, and Performance

1	<u>An empirical exmination of the relationship between inventory level and service level : the case of a thai retail supply chain</u>	
	Mohammad Asif Salam.....	: 1
2	<u>Customer categorisation: ABC-analysis</u>	
	Trond Trond Hammervoll.....	: 15
3	<u>Decision modeling for order fulfillment: a case study of semiconductor manufacturing</u>	
	James T. Lin And Chien-Ming Chen.....	: 26
4	<u>Supply chain enablers, competitive advantage, and firm performance: an</u>	

	<u>empirical investigaion of thai garment industry</u>	
	Mohammad Asif Salam.....	34
5	<u>The influence of activity and service logistic mix and integrated logistics decision support system upon customer satisfaction</u>	
	Sutarman.....	48
P. Supply Chain Configuration		
1	<u>Optimal supply chain formation using agent negotiation in set model based make-to-order</u>	
	Hyun Soo Kim, Jae Hyung Cho, Hyung Rim Choi and Soongoo Hong.....	1
2	<u>Applications of multi-agent systems in manufacturing and supply chain management</u>	
	T. N. Wong, C. W. Leung, Fang Fang, C. K. Fan and H. P. Tang.....	10
3	<u>A model to evaluate capacity sharing in a manufacturing network</u> Yosephine Suharyanti	18
4	<u>Development of subcontractors selection model in make-to-order environment</u>	
	Andi Cakravastia, Angga Surya Widjaja and Katsuhiko Takahashi.....	26
5	<u>Approach study on the combined optimization and coordination of parties in the supply chain</u>	
	Hui Hu and Jinsheng Shen.....	34
6	<u>A service level based approach to supply chain network design</u>	
	Soroush Saghafian and Mohammad Reza Akbari Jokar.....	44
Q. Product Development		
1	<u>Brand building in software product development : an empirical study</u>	
	Jukka Ojasalo and Rami Olkkonen.....	1
2	<u>Dynamically-generated virtual products for interactive 3d visualization of product customization</u>	
	Tien-Lung Sun and Yu-Wen Huang.....	8
3	<u>A framework for analyzing concurrent engineering implementation impediments</u>	
	Putu Dana Karningsih.....	14
4	<u>Risk management in concurrent engineering project in small contractor firm</u>	
	Dyah Santhi Dewi.....	22
R. Production and Inventory		
1	<u>A model to assess and improve the cost effectiveness of inventory management decisions: a case study</u>	
	Daniel Andersson, Mathias Hagsér and Imad Alsyouf.....	1
2	<u>Values of decision flexibilities in selling to a price setting newsvendor</u>	
	Saibal Ray - Non-Refereed.....	9
3	<u>Cost optimization strategy for high tech new product</u>	

	Hui Ming Wee And Ping Hui Hsu.....	: 10
4	<u>Critical production lead times decision problem</u>	
	Bibo Yang and Joseph Geunes.....	: 18
5	<u>Product-mix decision under toc heuristic using modified fuzzy-LP</u>	
	Pandian vasant, Arijit Bhattacharya.....	: 26
6	<u>Effects of resources allocation decisions on the performance of ATP system in a supply chain</u>	
	Tanti Octavia.....	: 36
S. Quality and SC Education		
1	<u>Teaching supply chain management in a business school: a pragmatic approach</u>	
	Uche Okongwu.....	: 1
2	<u>Teaching an undergraduate supply chain management course using the supply chain operations reference (scor)</u>	
	Ari Luis C. Halos.....	: 10
3	<u>Quality management in korea: an empirical study of quality management and performance</u>	
	Choong Y. Lee.....	: 18
4	<u>The status of the environmental management system (ISO 14001) programmes implemented by the manufacturing firms in malaysia</u>	
	Suhaiza Zailani, Roaimah Omar, Razuan Zainol, Elisha Nashruddin	: 26
5	<u>Adoption of supply chain quality management and its impact on manufacturing performance</u>	
	Roaimah Omar, Dr. Suhaiza Zailani & Prof Mohamad Sulaiman.....	: 33
6	<u>A performance measurement framework for evaluation of production ramp-up</u>	
	Magnus Berg And Kristina Säfsten.....	: 42
T. Quality		
1	<u>Achieving sustainable competitive advantage through the process-based quality management system</u>	
	Nugroho A. Suryo.....	: 1
2	<u>Service quality and customer preference towards islamic banking in malaysia : a study using carter</u>	
	Hendrik Lamsali, Razli Che Razak, Halim Mad Lazim, Darwina Ahmad Arshad.....	: 7
3	<u>Preliminary study on a six sigma framework for indonesian smes</u>	
	Kifayah Amar and Hasan Akpolat.....	: 16
4	<u>Proposal of six sigma implementation at PT Kemajuan II</u>	
	Christina Wirawan, Christina And Johan Setiawan.....	: 25
5	<u>Operational risk management systems – a comparative study</u>	
	Thitima Pitinanondha And Hasan Akpolat.....	: 33

6	<u>Mini-tqm framework for sme</u>	
	Mohd Nizam Ab Rahman And James D. T. Tannock.....	45
7	<u>ISO 26000 and supply chains – on the diffusion of the social responsibility standard</u>	
	Pavel Castka.....	54
	<u>Diffusion of ISO 9000 and ISO 14000 through global supply chains</u>	
8	Charles Corbett (Non-Reffered).....	62
U. Global SCM		
1	The impact of product design and supply chain structure on the profitability of international enterprises	
	George C. Hadjinicola and K. Ravi Kumar.....	1
2	The geographic component of production technology	
	Harm-Jan Steenhuis and Erik J. De Bruijn.....	9
3	Performance implications of low-cost country sourcing: an empirical investigation	
	Christopher Jahns, Evi Hartmann, Martin Lockström.....	18
4	Product variety in supply chains: insights from eight manufacturing companies in indonesia	
	Mahendrawathi Er, Nyoman Pujawan.....	32
5	The impact of the usage of supply chain system on ther worker’s productivity in manufacturing firms malaysia	
	Suhaiza Zailani, R Premkumar, Yen Swee Jiu.....	41
6	International performance: choice or determinism?	
	Janti Gunawan.....	51
V. Production and Delivery Synchronization		
1	An optimal control of a multi-stage production and distribution system by neuro-dynamic programming and it’s comparison with pull systems	
	Katsuhisa Ohno, Takahiro Ito, and Chitoku Kumagai.....	1
2	A study on the integrated model of retailer’s inventory order decision and distributor’s product transportation in a supply chain: single-period products	
	Shihyu Chou and Chia-Hsuan Hsu.....	9
3	Modeling of an integrated multi-objective production–distribution using fuzzy approach	
	I Nyoman Sutapa, Jani Rahardjo, Togar W. S. Panjaitan, Zepelin J. H. T.....	19
4	Synchronized production and transportation planning in the supply chain	
	Young Hae Lee And Jung Woo Jung.....	28
5	Production and distribution scheduling of ready-mix concrete	
	Pang Yoke Fong, Rajesh Piplani.....	36
6	Liquidation behavior of security holdings on considering market impact	
	Syouji Nakamura, Miwako Arafuka, and Toshio Nakagawa.....	37

W. Technology / Application for SCM

1	<u>Developing RFID applications for container tracking in shipping business</u> Okhyun Ryou, Jae Kwang Lee and Sung Ho Noh.....	: 1
2	<u>Application of operational trip planning software to a transportation problem for a norwegian dairy</u> Trond Hammervoll.....	: 10
3	<u>The adoption of new logistics technologies for logistics service providers</u> Chieh-Yu Lin.....	: 17
4	<u>A proposal for better performance of text mining</u> Koudai Aman, Satoshi Watanabe and Fukuya Ishino.....	: 25
5	<u>A uml-up approach for commerce software-system analysis and design</u> Erwin Widodo And Atsushi Ohnishi.....	: 34
6	<u>RFID technology and application for manufacturing and distribution</u> P. Tri Riska Ferawati Widiarsini and Cokorda Prapti.....	: 48
7	<u>An assessment methodology for technological capability on operate processes</u> Alina Shamsuddin And Umit Bititci.....	: 56

X Information Systems and Quality

1	<u>Information systems and quality management and the relationship to competitive operational performance</u> Cristobal Sanchez-R, Angel Martinez-L, David Hemsworth.....	: 1
2	<u>Quality based process model for reverse logistics</u> Jitendra Madaan, Subhash Wadhwa.....	: 9
3	<u>The role of information technology in reverse logistics management: Framework using intelligent agent technology</u> Subhash Wadhwa Jitendra Madaan.....	: 21
4	<u>Casestow: Recycling of past stowage plans</u> Setyo Nugroho.....	: 33
5	<u>Implementing extended Enterprise Resource Planning (ERP) system in thai small and medium enterprises (SME's): opportunities and limitations</u> Ungul Laptaned	: 41

A MODEL TO EVALUATE CAPACITY SHARING IN A MANUFACTURING NETWORK

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ABSTRACT

One of successful keys of a supply chain activity is about how to make harmony in supplying goods along the chain. Related to customer needs, the important factors are not only about the technical capabilities to attain right product specifications but also the capacity to satisfy due-date or market share. This paper tries to evaluate capacity sharing in a network of factories. Some of the factories may have same technical capabilities but different capacities. A factory is not seen as an individual object that has many competitors to fight but as a social object that has companions to share and collaborate. Each factory has its own contribution to the network's goals. Allowing only high capacity factories to do all orders without permitting low capacity factories to take part may mean allowing the network goes slower than it should do. The problem is how to assign each factory to make the network work properly. The analysis begins with a heuristic assignment model developed from several previous researches. The simulation study then is performed to evaluate the model workability in a dynamic probabilistic system. The result shows that the proposed model could give higher network throughput in most cases evaluated.

Keywords: manufacturing network, factory assignment, capacity sharing.

1. INTRODUCTION

1.1. Background

The objective of every supply chain is to maximize the overall value generated. Focusing on profitability at individual stages may lead to a reduction in overall supply chain profits (Chopra and Meindl, 2004). One of successful keys of manufacturing activities in a supply chain is about how to make harmony in supplying goods along the chain. This harmony is dedicated to satisfy customer needs that are related to appropriate product specifications and desirable delivery or available time. Appropriate product specifications are supported by the technical capabilities of manufacturing facilities, while desirable delivery or available time is supported by the capacity. This paper concerns with the second.

In the real industrial system, most manufacturing facilities are not independent. The performance of a factory for example, is influenced by its customers' and suppliers' performance. Several factories depending on each other will form a manufacturing network having one goal, living together by satisfying the customers.

Inspired by an Indonesian's original value of life namely '*gotong-royong*' that means 'collaborative actions among a group of people to achieve a goal' and stand on supposition that a factory could be seen as a social object like a human that has companions to share and collaborate, the research presented here tries to find the rule to utilize the manufacturing network capacity to maximize the network performance. The role does not only belong to the factories

having highest capacities. All the factories in the network have their own contribution to the network's goals.

1.2. Problem

When many orders consisting of many types of product have to produce in a kind of manufacturing network as mentioned above, these orders belong to the network, not to the factories individually. Then, the problem is how to assign each factory to make the network able to complete the orders properly. The initial hypotheses is 'allowing only high capacity factories to do all orders without permitting low capacity factories to take part means allowing the network goes slower than it should do'.

1.3. State of the Art

Chopra (2003) said that performing flexible network among several manufacturers, distributors, and retailers instead of performing a single line manufacturer-distributor-retailer will reduce the overall supply chain cost. Many other researches related to collaboration among supply chain elements are carried out yet, but most of them discussed about collaboration among different level of supply chain elements. The researches subsequently explained are related to collaboration among several same level supply chain elements as needed for this research. Suharyanti and Wigati (2003) proposed a model of capacity sharing in a manufacturing network when several network elements are under load comparing to the others. The model called KBDEJ (*Kapasitas Bersama antara Dua Elemen dalam Jaringan Manufaktur*; means capacity sharing between two elements in a manufacturing network) was used to evaluate how to assign two non-identical machines to process a number of single type parts coming dynamically and randomly. Meanwhile, Suharyanti et al (2005) developed a model called MLAWP-AR (Modified Least Average Weighted Process time with Alternative Routing) to allocate a number of jobs to a number of identical machines, improving the previous model called LAP (Least Average Process time) proposed by Subramaniam et al (2000). MLAWP-AR is built based on minimum cumulative load sharing in order to achieve low average flow time and low work in process. Together with the supposition mentioned in Sub-section 1.1, the logic of KBDEJ and MLAWP-AR are adopted here to develop a new assignment model for a manufacturing network.

1.4. Objectives

The purpose of this research is to develop an assignment model for a manufacturing network as explained in Section 2. The principles of splitting an order to several manufacturing facilities proposed by KBDEJ model and the principles of distributing a number of orders to several manufacturing facilities from MLAWP-AR model will be adopted. Average flow time of order in the network is used as parameter to represent delivery time to customer.

2. SCOPE

2.1. System Configuration

Manufacturing system evaluated here is a manufacturing network which consists of several factories as shown in Figure 1. The factories are classified to several groups representing stages of a process chain. All factories in a group have same technical capabilities but different capacities and will be called as parallel factories. A coming order will proceed through all the stages to make it complete. Number of order types may be less or more than number of parallel factories in each group. At each stage, an order will allocate to one or more factories according to

the assignment model proposed in this research. The order arrives in unit of transportation lot. The order arrivals are probabilistic as well as transportation time between two factories and production lead time of each factory. Transportation time is presented in hours per unit of transportation lot and production lead time is presented in days per unit of transportation lot. Lead time is all the time needed to process a lot of order in a factory, from preparation to time before delivery.

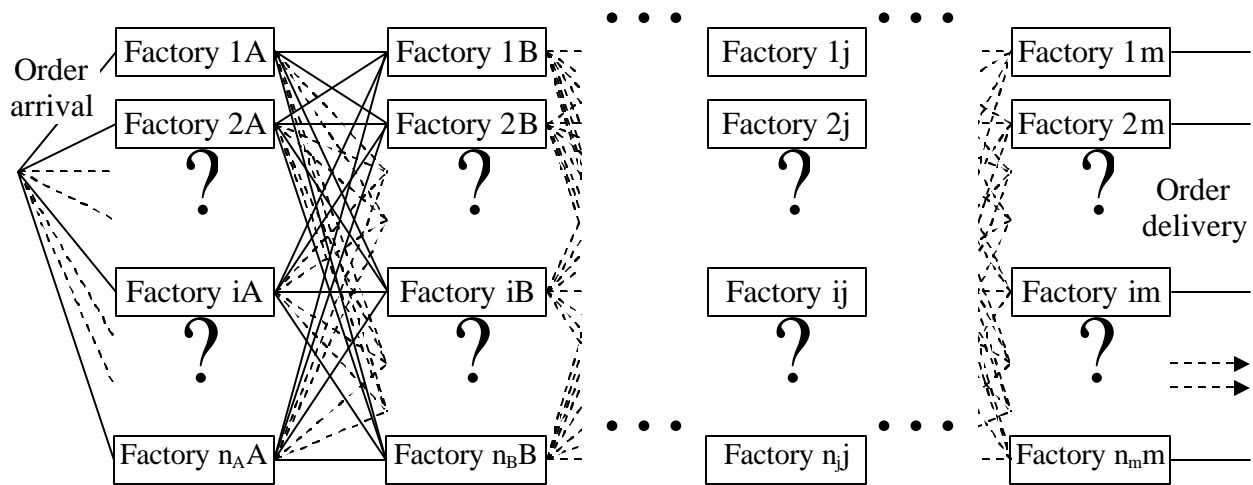


Figure 1. System configuration of m stages with n_j factories in group j .

2.2. Assumptions

These are some assumptions used here to simplify the problem:

- (1) No due-date restriction is considered.
- (2) All the factories are always in normal condition.
- (3) Number of transportation devices between any two factories are not limited.
- (4) Information management in the network is suitable.
- (5) Inter-arrival time distribution of orders are exponentially distributed.
- (6) Transportation time and production lead time is uniformly distributed.
- (7) Order lot splitting is not permitted.
- (8) No cost aspect is discussed.

3. METHOD

The proposed assignment model is a heuristic model. It is developed based on KBDEJ and MLAWP-AR models. A number of hypothetical cases are generated and are classified to 3 categories: cases with number of jobs less than number of parallel factories, cases with number of jobs equal to parallel factories, and cases with number of jobs larger than number of parallel factories. The proposed model then applied to all these cases. To evaluate model workability in a dynamic probabilistic system, a simulation study is performed using Arena Software version 7.01.

4. THEORETICAL REVIEW

4.1. KBDEJ Model

KBDEJ model proposed by Suharyanti and Wigati (2003) is a mathematical model representing a load queue length of a constraint resource that is used as limit point to switch load allocation to a non-constraint resource. By using a simulation study of a number of hypothetical cases, the KBDEJ model as written in Equation (1) provided network capacity enhancing for capacity sharing between two serial directly connected resources or between two parallel resources. The KBDEJ model did not work for capacity sharing between two serial non-directly connected resources.

$$N_{cmax}' = N_{cmax} - \frac{\overline{N_c} \overline{L_c}}{\overline{L_{cn}} \left(\frac{1 - \overline{U_c}}{1 - \overline{U_n}} \right) + \overline{L_c}} \quad (1)$$

where N_{cmax}' = maximum limit of load queue length at constraint resource

N_{cmax} = maximum value of load queue length at constraint resource in initial system

$\overline{N_c}$ = mean load queue length at constraint resource

$\overline{L_{cn}}$ = mean lead time of constraint resource load at non-constraint resource

$\overline{L_c}$ = mean lead time at constraint resource

$\overline{U_n}$ = mean utilization of non-constraint resource in initial system

$\overline{U_c}$ = mean utilization of constraint resource in initial system

The KBDEJ model application showed that moving a part of load from a constraint manufacturing facilities to another non-constraint manufacturing facilities in a manufacturing network will enhance the network capacity.

4.2. MLAWP-AR Model

Starting from LAP model proposed by Subramaniam et al (2000), Suharyanti et al (2005) developed an assignment model called MLAWP-AR to allocate a number of operations of a number of jobs to a number of identical machines. The assignment rule was based on the parameter shown in Equation (2).

$$t_{pm} = \sum_{i=1}^N \alpha_i t_{ipm} \quad , \quad p = 1, 2, 3, \dots, P; m = 1, 2, 3, \dots, M \quad (2)$$

The MLAWP-AR model is a heuristic model represented by this algorithm (for N jobs with maximum P operations each, allocated to M identical machines):

- (1) Calculate t_{pm} using Equation (2).
- (2) Start from non-allocated p with $\min(t_{pm})$.
- (3) Calculate $t_{pm(cum)}$ for all p and m (defined as cumulative t_{pm} of operations have allocated to machine m plus operation p).
- (4) Determine m_p^* that is defined as m for operation p related to $\min(t_{pm(cum)})$.
- (5) If all p have allocated, go to step (6), otherwise back to step (2).
- (6) Find operation p^* that is defined as an operation allocated in m_{max} (machine with maximum load) that will alternatively move to m_{min} (machine with minimum load) when number in queue at m_{max} are larger than number in queue at m_{min} .
- (7) End.

where t_{ipm} = processing time of operation p of job i at machine m
 t_{pm} = weighted average processing time of operation p of all job at machine m
 $t_{pm(kum)}$ = cumulative t_{pm} of all allocated operation at machine m plus operation p
 m = index for machine
 m_p^* = assigned machine for operation p
 i = index for job
 p = index for operation
 α_i = proportion of job i

The principle of MLAWP-AR model is allocating an operation to a machine one by one so that the weighted average of allocated operation time at every machine is minimum. Using a simulation study, the application of MLAWP-AR model resulted shorter flow time than LAP in 68% of all the hypothetical cases evaluated.

5. THE PROPOSED MODEL: LEAST BALANCE LOAD ASSIGNMENT

5.1. Model Development

Based on:

- (1) supposition that the factories in the manufacturing network discussed here are social objects so that all the factories have to be involved in processing the orders,
- (2) capacity sharing among all the factories in a group to process a number of order when the number of order less than the number of factories as what the KBDEJ model did,
- (3) balance order distribution among the factories when the number of orders larger than or equal with the number of factories as what the MLAWP-AR model proposed,

a model of capacity sharing among the factories in a manufacturing network will develop in order to achieve minimum average flow time of orders in the network. That is why this proposed model focuses in these principles:

- (1) All the factories in the network should be involved in processing orders.
- (2) Each order should be completed as soon as possible.
- (3) The load should be allocated as evenly as possible to the factories.

These are the steps of the assignment algorithm of the proposed assignment model called LBLA (Least Balance Load Assignment):

- (0) Initialize $S = \{A, B, \dots, m\}$, $S' = \{\emptyset\}$, $O_j = \{1, 2, \dots, K\}$, $O_j' = \{\emptyset\}$, $F_j = \{1, 2, \dots, n_j\}$, $F_j' = \{\emptyset\}$ for all $j \in S$.
- (1) Start from $j = A$.
- (2) Find $t_{ijk}^* = \min\{t_{ijk}\}$ for all $i \in O_j$ and $k \in F_j$, break tie arbitrary
- (3) Allocate order $k \arg(\min\{t_{ijk}^*\})$ to f_{ij} , revise O_j , O_j' , F_j , and F_j' .
- (4) If $K = n_j$ go to Step (5), if $K < n_j$ go to Step (7), otherwise go to Step (13)
- (5) If $O_j = \{\emptyset\}$ go to Step (6), otherwise back to Step (2)
- (6) If $S = \{\emptyset\}$ go to Step (19), otherwise move to next j and back to Step (2)
- (7) For all $k \in O_j'$ define $t_k^* = t_{ijk}^*$
- (8) Find order $k^* = \text{order } k \arg(\max\{t_k^*\})$, $k \in O_j'$
- (9) For all $i \in F_j$, calculate t_k^* using Equation (3)
- (10) Assign $f_{ij} \arg(\min\{t_k^*\})$ to process k^* , revise F_j and F_j'
- (11) If $F_j = \{\emptyset\}$ go to Step (12), otherwise back to Step (8)
- (12) If $S = \{\emptyset\}$ go to Step (19), otherwise move to next j and back to Step (2)
- (13) If $F_j = \{\emptyset\}$ go to Step (14), otherwise back to Step (2)
- (14) For all $i \in F_j'$ define $t_i^* = t_{ijk}^*$

- (15) For all $k \in O_j$ calculate t_i^* using Equation (4)
- (16) Allocate order k to f_{ij} $\arg(\min\{t_i^*\})$, revise O_j and O_j'
- (17) If $O_j = \{\emptyset\}$ go to Step (18), otherwise back to Step (15)
- (18) If $S = \{\emptyset\}$ go to Step (10), otherwise move to next j and back to Step (2)
- (19) End.

where i = index for parallel factories, $i = 1, 2, \dots, n_j$
 j = index for stages, $j = A, B, \dots, m$
 f_{ij} = factory i in stage j
 k = index for order, $k = 1, 2, \dots, K$
 t_{ijk} = production lead time of order k in factory i of stage j
 O_j = {non-allocated orders at stage j }
 O_j' = {allocated orders at stage j }
 F_j = {non-assigned factories at stage j }
 F_j' = {assigned factories at stage j }
 S = {non-evaluated stages}
 S' = {evaluated stages}
 s_{jk} = number of factories assigned to process order k at stage j
 The equations required to run the algorithm are as follow.

$$t_k^* = \frac{t_k^* \cdot s_{jk}^2 + t_{ijk}^*}{(s_{jk} + 1)^2} \tag{3}$$

$$t_i^* = t_i^* + t_{ijk}^* \tag{4}$$

5.2. Application Examples

The following 3 examples represent the 3 case categories: cases with number of jobs less than number of parallel factories, cases with number of jobs equal to number of parallel factories, and cases with number of jobs larger than number of parallel factories. Table 1, Table 2, and Table 3 show the production lead time data. Shaded cells show the assignment decisions. The transportation time data are not shown here because they do not significantly affect the flow time (on average only 1/24 of production lead time).

As shown in Table 1, Order 1 and Order 2 are allocated to more than one factory in both stages because number of orders is less than number of parallel factories. In stage A Order 2 is allocated to only one factory with short production lead time, while Order 1 is allocated to 4 factories because the production lead time are relatively long.

In Case 2, since number of orders is equal to number of parallel factories, each order is allocated to one factory and each factory only assigned to process one order. Table 2 shows that in order to involve all the factories, an order is not always allocated to a factory that have shortest production lead time. The allocation of Order 2 to Factory 3B is an example.

Table 1. Production lead time (days) data and assignment decisions for Case 1: 2 orders, 2 stages, 5 factories in each stage

Order	Stage A					Stage B				
	f_{1A}	f_{2A}	f_{3A}	f_{4A}	f_{5A}	f_{1B}	f_{2B}	f_{3B}	f_{4B}	f_{5B}
1	9	10	9	4	9	7	5	9	2	2
2	8	4	2	3	9	1	3	6	4	3

Table 2. Production lead time (days) data and assignment decisions for Case 2: 5 orders, 2 stages, 5 factories in each stage

Order	Stage A					Stage B				
	f_{1A}	f_{2A}	f_{3A}	f_{4A}	f_{5A}	f_{1B}	f_{2B}	f_{3B}	f_{4B}	f_{5B}
1	3	3	5	4	10	1	7	5	3	4
2	3	7	2	9	10	5	10	7	9	4
3	6	3	5	6	6	10	8	9	4	3
4	2	9	8	7	1	10	9	7	1	8
5	6	10	10	4	4	7	2	3	1	10

Table 3 shows an example of Case 3. Here number of orders is larger than number of parallel factories, so that each factory is assigned to process more than one orders. In order to evenly distribute the orders to the factories, an order is allocated to a factory that have minimum cumulative production lead time, rather than to a factory that have shortest production lead time. The allocation of Order 1 to Factory 1A, not to Factory 1B, is an example.

Table 3. Production lead time (days) data and assignment decisions for Case 3: 5 orders, 2 stages, 2 factories in each stage

Order	Stage A		Stage B	
	f_{1A}	f_{2A}	f_{1B}	f_{2B}
1	4	3	2	3
2	9	7	4	9
3	2	4	4	10
4	9	2	3	1
5	5	3	10	9

6. SIMULATION STUDY

To evaluate workability of the proposed LBLA model in the dynamic probabilistic system, a simulation study using Arena Software version 7.01 was performed. Sixty cases were hypothetically generated. Fifteen of these are cases with number of jobs less than number of parallel factories, 20 are cases with number of jobs equal to parallel factories, and the other 25 are cases with number of jobs larger than number of parallel factories.

In this simulation study, the proposed LBLA model application is compared to shortest processing time assignment. In the shortest processing time assignment, orders are allocated to factories that have shortest processing time. Consequently, not all the factories in the network are assigned, violating the ‘gotong-royong’ philosophy of the proposed LBLA model.

Technical evaluation of the simulation result is based on the theories and methods presented by Law and Kelton (1991).

7. CONCLUSION

The simulation result shows that the application of LBLA model gives better average flow time than shortest processing time assignment in 58.33% of the cases, 10% of the cases shows no differences, while the other 31.67% of the cases fails to show the advantage of LBLA model. Evaluation on the 31.67% failed cases shows that the significant difference between the

lowest assigned production lead time and the highest one is the reason for unsuccessful application of LBLA model. In the real system, it means that capacity sharing between a very high capacity factory and a very low capacity factory will lead to network capacity reduction.

Although 31.67% of cases shows the unsuccessful application of LBLA model, it does not mean that the model is unsuitable for any cases. For short time running, involving the very low capacity factories in the network activities may lead to profit reduction, but for long time improvement planning, it might be useful to push improvement action acceleration of the very low capacity factories. If the very low capacity factories are never involved in the network activities, they will be never encouraged to improve themselves and may go down.

8. REFERENCES

- Chopra, S., 2003, Designing the distribution network in a supply chain, *Transportation Research Part E: Logistics and Transportation Review*, 39, 2, 123 – 140.
- Chopra, S., Meindl, P., 2004. *Supply Chain Management: Strategy, Planning, and Operations*, 2nd Edition, Pearson Education, New Jersey.
- Law, A.M., Kelton, W.D., 1991, *Simulation Modeling and Analysis*, 2nd Edition, McGraw-Hill, New York.
- Subramaniam, V., Lee, G.K., Ramesh, T., Hong, G.S., Wong, Y.S., 2000, Machine selection rule in a dynamic job shop, *International Journal of Advanced Manufacturing Technology*, 16, 902 – 908.
- Suharyanti, Y., Laniewati, Kusumaningrum, A., Tjahjono, M.E., 2005. Penugasan mesin-mesin multipurpose non-identik pada sistem non-fleksibel. *Prosiding Seminar Nasional Teknologi Simulasi dan Aplikasinya untuk Optimasi Industri*, Yogyakarta, 124 – 129.
- Suharyanti, Y., Wigati, S.S., 2003. Model penggunaan kapasitas bersama untuk meningkatkan kapasitas jaringan manufaktur. *Proceedings Seminar Sistem Produksi VI 2003 Pemberdayaan Industri Pendukung untuk Optimasi Rantai Pasok Manufaktur*, Yogyakarta, 746 – 754.



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