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Theme:

Quality, Competitiveness, and Value-Added Services in Solving Predetermined Global Crisis

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FOREWORD

This issue is published in line with the third International Seminar on Industrial Engineering and Management (3rd ISIEM). The articles cover a broad spectrum of topics including Quality Function Deployment, Decision Support System and Artificial Intelligent, Ergonomics, Supply Chain Management, Production System, Operation Research, and Industrial Management. The articles provide an overview of critical research issues reflecting on past achievements and future challenges. Those papers were selected from 165 abstracts. This statistics 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 86 delegates both from abroad and local. We are very happy as we gather more than thrice delegates this year compare to previous year. This could be happened since more universities join as committee. First and second ISIEM are hosted only with three universities, namely Trisakti, Gunadarma, and Indonusa Esa Unggul Universities. This year event, It's hosted by six universities, i.e. Gunadarma, Trisakti, Indonusa Esa Unggul, Bina Nusantara, Atma Jaya Catholic, and Petra Christian Universities. This becomes evident to us that with cooperation we will succeed.

It is then our expectation so that to the future more universities join us as organizing committee. In this occasion, let us give special thank to Prof. Dr. E.h. Dr.-Ing. habil. Josef Schlattmann from Hamburg University of Technology, Germany. Your contribution to this seminar as reviewer, and as keynote speaker makes this event more valuable. Allow us also to thank Prof. Emeritus Adnyana Manuaba and Ir. I. Made Dana M. Tangkas from *Direktur Teknik dan PIC. Toyata Motor Manufacturing Indonesia*, 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.

As closing remarks, Let's say thanks to the Lord Almighty God for all His blessing on us.

Dr. Ir. Hotniar Siringoringo, M.Sc.
Chair

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A SIMULATION MODEL FOR INTEGRATED PRODUCTION - DISTRIBUTION PROBLEM

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ABSTRACT

The approach of production-distribution integration problem using analytical model lacks of ability to accommodate supply chain uncertainty such as delay, queuing, machine breakdown, vehicle breakdown, operator work consistency, and environmental factor. The purpose of this research is to develop a simulation model that accommodates multiple uncertainty factors in order to generate production and distribution plan which not only minimize production and distribution cost but also feasible to be implemented in real life. The simulation model is designed using ARENA software to picture the production and distribution process for three periods in a supply chain consist of two factories and five distribution center by direct shipment. The stochastic simulation result shows the total time required to produce and deliver according to production-distribution planning for period one and two are higher than 48 available hours and concluded that previous analytical model solution is not feasible to be implemented and thus has to adjust the capacity.

Keywords: supply chain, production-distribution integration, analytical model, simulation model, stochastic.

1. INTRODUCTION

Supply Chain Management (SCM) is the management of material and information flow that happened between facilities like supplier, manufacturer, assembly, and distribution centre (DC) (Thomas and Griffin, 1996). According to Lee and Sook (2002) the main process in a supply chain (SC) is the production planning and distribution. The more competitive and global market has pushed companies to reduce operational and inventory along SC that brings closer relation between production and distribution functions (Chen, 2004).

Annisa (2008) has developed a mathematical model in the form of Mixed Integer Programming (MIP) for production-distribution integration problem in a supply chain having characteristics of multiple products supplied by multiple factories, multiple planning horizon period, direct delivery to DC, and vehicle constraints. The model has a weak point by assuming the data to be deterministic so that it can not accommodate uncertainty in SC; i.e. production and delivery time from factory to DC are assumed to be known in exact while reality shows many uncertainty factors that affect those variables: delay, queue, machine failure, vehicle breakdown, and environmental factors such as weather and traffic jam.

Simulation has been proven to be an effective performance evaluation and modelling tool for stochastic system in a complex real world situation (Fahimnia *et.al*, 2008). Based on MIP model shortage and the benefit of simulation model, this research is conducted to develop a simulation model for production-distribution integration problem depicted in Annisa (2008) so that the production and distribution planning solution obtained does not only minimize production and distribution cost but also feasible to be implemented in real world.

2. THEORETICAL BACKGROUND

Supply Chain (SC) literatures show that optimization and simulation of production-distribution planning is an area which received many attentions in recent decades (Fahimnia *et.al*, 2008). Linear Programming (LP) and Mixed Integer Programming (MIP) is frequently used to develop mathematical model in production-distribution integration problem from simple

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scale problem of two stages SC, one planning period, and does not involve vehicle decision to more complex problem (Annisa, 2008). To obtain optimal solution in an LP model, the solution chosen is to use simplex or revised simplex algorithm and branch and bound or cutting plane for MIP model. Those algorithms have drawback of complex calculation so that computation time to obtain an optimal solution increases exponentially with model complexity.

Judging from the drawbacks of those algorithms to resolve complex problem, many researchers develop other optimization models to resolve LP and MIP problems with shorter computation time and sub optimal solution Based on the literatures on this topic, several optimization methods that have been developed are:

- Lagrangian relaxation. Several researchers that develop this method to resolve mathematical problem of production-distribution integration problem with different characteristic setting are Fumero and Vercellis (1999), Barbarasoglu and Ozgur (1999), Jayaraman and Pirkul (2001), and Nishi *et.al.* (2007)
- Genetic Algorithm (GA). It is the most widely used optimization method, one amongst others are by Jang et.al. (2002), Syarif and Gen (2003), Gen and Syarif (2005), Aliev et.al. (2007), and Altiparmak et.al. (2009).
- Simulation. Several researchers who have developed simulation model for production-distribution integration problem are Alfieri and Brandimarte (1997), Wang and Soemon (2006), and Lim et.al. (2006).
- Combination of two or more optimization method. Yeh (2005) developed heuristic algorithm using greedy method which is improved by hybrid local search method. Yeh (2006) further developed mimetic algorithm (MA) which is a combination of GA, greedy heuristic, and local search method. While Lee and Sook (2002) proposed hybrid approach by combining analytical and simulation model to resolve production-distribution integration problem.

Simulation has been proved to be the most effective performance evaluation and modeling tool for stochastic system in the complex real world situation. According to Fahimnia et.al. (2008), simulation can be used for two purposes in terms of modeling production-distribution planning:

1. Validate the outcome of optimization model proposed.
2. To develop flexible simulation model and visualize production-distribution planning which is adaptable to many different scenarios in a manufacturing environment.
   - Alfieri and Brandimarte (1997) used MODSIM, a simulation language based on object, to develop simulation model of inventory management system.
   - Lim et.al. (2006) developed mathematical model to determine facility capacity in production-distribution network and further developed simulation model to analyze resulted production-distribution planning by considering loading policy.
   - Wang and Soemon (2006) developed a module based template to model and analyze production-distribution system using discrete event simulation in ARENA software.

3. RESEARCH METHOD

Production-distribution integration problem discussed in this research took place in two echelon supply chain consists of two factories and five DCs. Each factory capable of producing two products and directly deliver to DC using factory's vehicles. Planning horizon considered was three periods each having 48 hours time range.

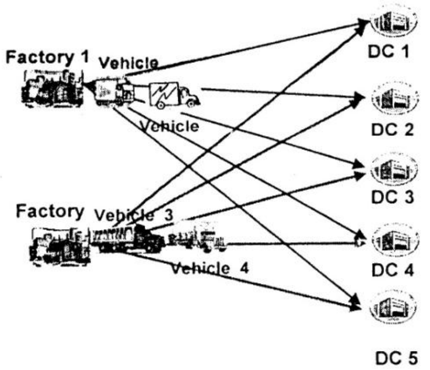

Figure 1. Production – Distribution System Under Study

3.1 Formulation and Finding Solution for Production-Distribution Integration Problem using Analytical Model

Based on the above supply chain structure, data generation was initiated to obtain data for 1) each product demand from each DC in one period, 2) production capacity of each factory, 3) production time for each product, 4) minimum and maximum inventory level for each product in each factory, 5) minimum and maximum inventory level for each product in each DC, 6) production and inventory cost in each factory, DC's inventory cost and factory set up cost, 7) vehicle capacity, 8) Each vehicle delivery cost per hour in regular and overtime, and 9) delivery time from each factory to each DC using specified vehicle. Next, analytical model was formulated by referring to model developed by Annisa (2008) to obtain decision variable solution for each period: 1) product is produced or not in factory, 2) product quantity, 3) product inventory in each factory and DC at the end of period, 4) product quantity delivered by specified vehicle from each factory to each DC, and 5) number of direct delivery for each vehicle from factory to DC. Solution was computed using LINGO software run on Intel (R) Core (TM) 2 Duo CPU " 2.00 GHZ 3062 MB RAM.

3.2 Deterministic Simulation Model Development

In this simulation model, uncertainty factor in SC was ignored and all data input had predefined value. The development of deterministic simulation model was based on several data: 1) analytical model solution obtained from LINGO software, 2) production time for each product in each factory, 3) delivery time from factory to DC, and 4) product's demand in each DC. Simulation model was developed using ARENA software.

3.3 Verification test

Verification is a process to check correctness of the conceptual simulation translation model into programming language (Kelton, 2000). Verification test was done on ARENA software using Run-Check Model function. The test resulted in "No Error in Model" message to indicate that the model was verified.

3.4 Running deterministic simulation model

Having verified the simulation model, next step is to run the model on ARENA software. Running the model gave information of total time required to produce and distribute in one specified period.

3.5 Validation test

Validation's purpose is to determine whether simulation model developed has accurately represented real world situation (Kelton, 2000). Since the problem in this research was not based on real world case, the total time in real world system was approached by creating spreadsheet simulation based on real world logical process. The model is said to be valid when total time deviation from deterministic model simulation is less than or equal to 5% of spreadsheet simulation total time.

3.6 Stochastic simulation model development and running

After deterministic simulation model verified and valid, the next step is to design stochastic simulation model by considering uncertainty in SC.

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3.7 Analytical model solution validation

Based on stochastic simulation running result, it is known whether an analytical model solution is worth to be implemented or not. When production and distribution total time of stochastic simulation model is smaller than available time in one period (48 hours) then we can say that the analytical model is worth to be implemented.

4. RESULT AND DISCUSSION

Analytical model solution obtained from LINGO software is shown in Table 1 and 2. Table 1 informs the factory decision to produce a product or not in specified period, how many products to be made, and inventory level of each product in each factory. Table 2 informs the travel start an end for each vehicles, delivery amount, and product quantity to be delivered by each vehicle.

Table 1. Production and Inventory Amount in Each Factory (in Unit)

Factory	Product	Period	Production Decision	Production Amount	Inventory
P1	1	1	√	2187	333
		2	√	2193	333
		3	√	3029	333
	2	1	√	4355	325
		2	√	4344	1008
		3	√	977	325
P2	1	1	√	2835	533
		2	-	-	-
		3	-	-	-
	2	1	√	2000	1122
		2	-	-	-
		3	-	-	-

Table 2. Frequency and Delivery Amount from Each Factory to Each DC

Vehicle		Period	Factory - DC	Delivery Frequency	Delivery Characteristic		
Type	Capacity (m^3)				Product Type	Product Volume (m^3)	Quantity (unit)
V1	985	1	F1 – D2	2	P1	1	303
					P2	1	1448
V1	985	1	F1 – D3	2	P1	1	937
					P2	1	95
V2	1155	1	F1 – D3	1 (over time)	P2	1	1155
V2	1155	1	F1 – D4	2 (over time)	P1	1	580
					P2	1	634
V1	985	1	F1 – D5	1	P1	1	34
					P2	1	698
V4	1330	1	F2 – D1	2	P1	1	1278
					P2	1	663
V4	1330	1	F2 - D5	1	P1	1	1024
					P2	1	215
V1	985	2	F1 – D2	2	P1	1	781
					P2	1	1189
V1	985	2	F1 – D3	1	P1	1	473
					P2	1	512
V1	985	2	F1 – D4	1	P1	1	624
					P2	1	861
V1	985	2	F1 – D5	1	P1	1	315
					P2	1	1099
V3	1655	2	F2 – D1	1 (over time)	P1	1	533
					P2	1	1122
V1	985	3	F1 - D1	1	P1	1	985
V1	985	3	F1 - D3	2	P1	1	468
					P2	1	517
V1	985	3	F1 - D4	2	P1	1	835
					P2	1	899
V1	985	3	F1 - D5	1	P1	1	741
					P2	1	244

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The result shows that vehicle V2 on first period will travel one time from Factory 1 to DC 1 delivering 75 unit of Product 1 and 866 unit of Product 2. Compared to vehicle V2 capacity of 1155 m^3, the two products can be loaded in one time delivery. Travelling solution for all other vehicles for each period can also be seen in table 2.

Based on the above analytical model solution, the deterministic simulation to model production-distribution activity in a SC was using modules available in ARENA software such as: Create, Assign, Decide, Process, Station, Hold, Batch, Transport, Allocate, and Move. Figure 2 shows the deterministic simulation model for production-distribution problem on a two factories and direct delivery to five DCs on first period. The model was then verified using Run-Check Model facility.

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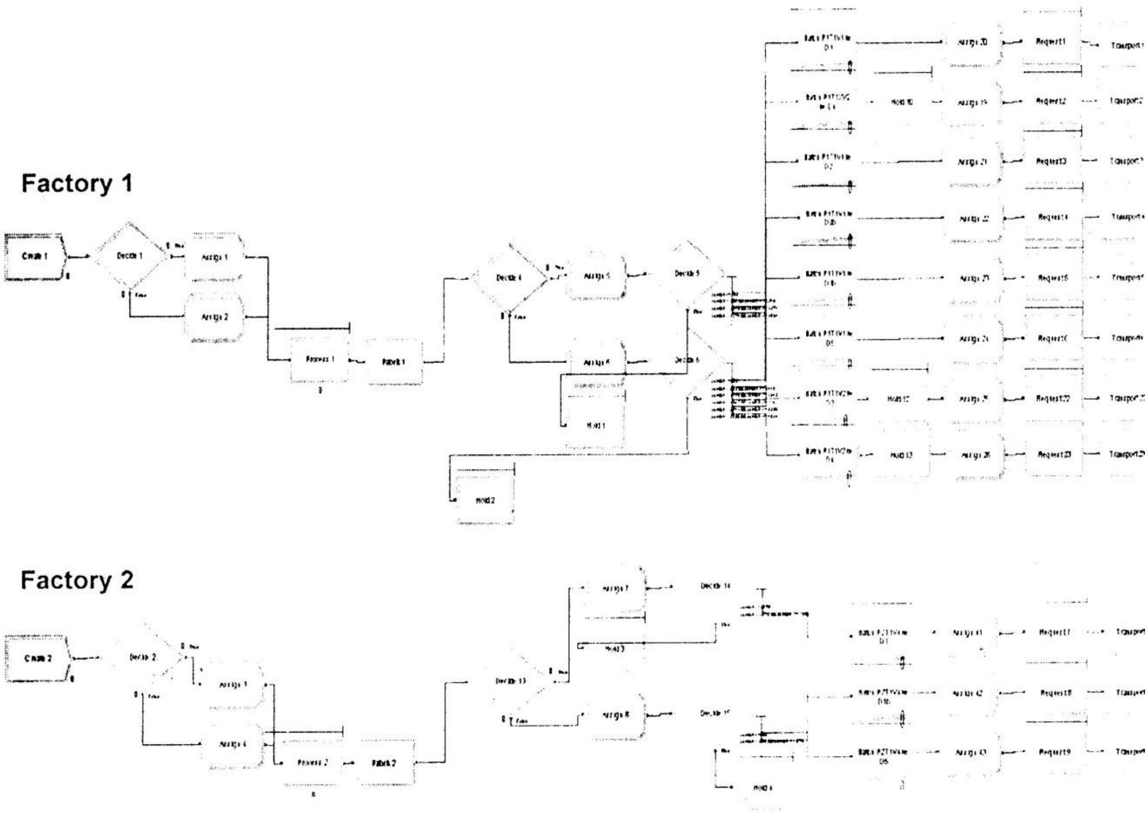

Figure 2. Deterministic Simulation Model for Production-Distribution System on Period 1

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The verified deterministic simulation model was then run on each period and obtained total time required to produce and distribute on period 1 was 48 hours (with additional overtime delivery from factory 1 to DC 4 addition becomes 54.977 hours); 47.994 hours on period 2 (with additional overtime delivery to DC 1 addition becomes 50.722 hours); and 37.194 hours on period 3. While the predicted real world total time with simulation spreadsheet shown on table 3 is 48 hours on period 1 (with additional overtime delivery to DC 4 becomes 54.956 hours); 47.994 hours on period 2 (with additional overtime delivery from factory 2 to DC 1 becomes 50.714 hours); and 37.193 hours on period 3. Comparation shows that deterministic simulation total time is almost the same with real world system estimate, and was concluded that the deterministic simulation model was valid and able to represent real world behaviour.

By using simulation model to accomodate uncertainty, the deterministic simulation model developed was modified to include uncertainty factor such as machine and vehicle failures and repair times, vehicle varied speed, and random production times. Table 4 shows different input values for those two simulation model.

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Table 3. Simulation Spreadsheet Result

Period	Factory	Product	Production amount	Delivery Quantity	Production Time	Production Finish	DC	Vehicle	Delivery Time	Delivery Start	Delivery Finish	Delivery Frequency	Product Quantity Delivery
1	1	1	2187	303	3.03	3.03	D2	V1	-	(wait for production of product 2)			
				937	9.37	12.4	D3	V1	0.913	12.4	14.236	1 Batch	P1 937
				34	0.34	12.74	D5	V1	-	(wait for production of product 2)			
				580	5.8	18.54	D4	V2	1.178	50.244 (over time)	52.600	1 Batch	P1 580
			(Inventory)	333	3.33	21.87							
		2	3673	682	4.092	25.962	D2	V1	1:327	25.962	28.617	1 Batch	P1 303+P2 682
				766	4.596	30.558	D2	V1	1.327	30.558	33.213	1 Batch	P2 766
				95	0.57	31.128	D3	V1	0.918	33.212545	35.049	1 Batch	P2 95
				698	4.188	35.316	D5	V1	1.264	35.316	37.843	1 Batch	P1 34 + P2 698
				1155	6.93	42.246	D3	V2	1.122	48.000 (over time)	50.244	1 Batch	P2 1155
				634	3.804	46.05	D4	V2	1.178	52.600 (over time)	**54.956**	1 Batch	P2 634
			(Inventory)	325	1.95	**48**							
	2	1	2835	1278	14.058	14.058	D1	V4	1.188	14.058	16.433	1 Batch	P1 1278
				1024	11.264	25.322	D5	V4	-	(wait for production of product 2)			
			(Inventory)	533	5.863	31.185							
		2	2000	663	4.9725	36.1575	D1	V4	1.188	36.1575	38.533	1 Batch	P2 663
				215	1.6125	37.77	D5	V4	1.850	38.5325	42.233	1 Batch	P1 1024 +P2 215
			(Inventory)	1122	8.415	46.185							
2	1	1	2193	448	4.48	4.48	D2	V1	1.327	4.48	7.135	1 Batch	P1 781
				473	4.73	9.21	D3	V1	-	(wait for production of product 2)			
				624	6.24	15.45	D4	V1	0.964	15.45	17.377	1 Batch	P1 624

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				315	3.15	18.6	D5	V1	-	(wait for production of product 2)			
			(Inventory)	333	3.33	21.93							
		2	4344	864	5.184	27.114	D2	V1	1.3275	27.114	29.769	1 Batch	P2 1189
				512	3.072	30.186	D3	V1	0.918	30.186	32.022	1 Batch	P1 473 + P2 512
				861	5.166	35.352	D4	V1	0.9635	35.352	37.279	1 Batch	P2 861
				670	4.02	39.372	D5	V1	1.264	39.372	41.899	1 Batch	P1 315 + P2 670
				429	2.574	41.946	D5	V1	1.2635	41.946	44.473	1 Batch	P2 429
			(Inventory)	1008	6.048	**47.994**							
	2	1	0	533	Production from period 1		D1	V3					
		2	0	1122	Production from period 1		D1	V3	1.357	48 (over time)	**50.714**	1 Batch	P1 533 + P2 1122
3	1	1	3029	652	6.52	6.52	D1	V1	1.236	6.52	8.993	1 Batch	P1 985
				468	4.68	11.2	D3	V1	0.918	11.2	13.036	1 Batch	P1 468 + P2 517
				835	8.35	19.55	D4	V1	0.964	19.55	21.477	1 Batch	P1 835
				741	7.41	26.96	D5	V1					
			(Inventory)	333	3.33	30.29							
		2	0	517	Production from period 2		D3	V1	-	Product 1 and 2 was delivered at the same batch			
				491	Production from period 2		D4	V1	0.964	32.738	34.665	1 Batch	P2 899
			977	408	2.448	32.738							
				244	1.464	34.202	D5	V1	1.264	34.665273	**37.193**	1 Batch	P1 741 + P2 244
			(Inventory)	325	1.95	36.152							

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Table 4. Input Differences in Deterministic and Stochastic Simulation Model

Data Type	Data Input	
	Deterministic	Stochastic
Production time for product 1 in factory 1 (hour)	0.01	Normal (0.01002, 0.00246)
Production time for product 2 in factory 1 (hour)	0.006	Lognormal (0.00925, 0.008915)
Production time for product 1 in factory 2 (hour)	0.011	Normal (0.01095, 0.002628)
Production time for product 2 in factory 2 (hour)	0.0075	Normal (0.007533, 0.002095)
Vehicle V1 speed (km/hour)	55	Normal (55, 5)
Vehicle V2 speed (km/ hour)	45	Normal (45, 5)
Vehicle V3 speed (km/ hour)	35	Normal (35, 5
Vehicle V4 speed (km/ hour)	40	Normal (40, 5)
Time between failure for each machine in factory 1 (hour)	-	Weibull (34, 40)
Time between failure for each machine in factory 2 (hour)	-	Weibull (25, 30)
Time between failure for vehicle V1 (hour)	-	Weibull (32, 37)
Time between failure for vehicle V2 (hour)	-	Weibull (20, 25)
Time between failure for vehicle V3 (hour)	-	Weibull (18, 22)
Time between failure for vehicle V4 (hour)	-	Weibull (20, 24)
Time to repair for each machine in factory 1 & 2 (hour)	-	normal (2, 0.5)
Time to repair for vehicle V1 - V4 (hour)	-	normal (1, 0.15)

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Base on input shown on Table 4, the stochastic simulation model was developed using ARENA software. The model was then run 10 replicates. The total production and distribution time for each iteration can be seen on Table 5.

Table 5. Running Solution for Stochastic Simulation Model

Replication	Period (hour)		
	1	2	3
1	63.832	68.688	41.234
2	64.292	66.998	41.304
3	63.25	66.94	41.054
4	64.584	66.716	41.194
5	63.477	68.233	39.784
6	63.369	67.501	40.084
7	64.775	65.735	43.114
8	65.277	65.333	42.344
9	63.325	66.365	40.634
10	64.888	65.992	40.464
Avrge time	64.1069	66.8501	41.121

Table 5 shows at average the total time of stochastic simulation model is far different compared to deterministic model. Each by 16.1069 hours on period 1, 18.8561 hours on period 2, and 5.635 hours on period 3. Next by incorporating uncertainty factor and production time variation, the analytical model solution was become unfeasible on period 1 and 2 due to it exceed 48 hours available time.

5. CONCLUSION

Simulation model was proven able to accommodate uncertainty in production-distribution planning process in a SC and validate the production-distribution planning resulted from analytical model. By incorporating probabilistic uncertainty factor such as machine and vehicle breakdown, vehicle varied speed, and random production time, it is concluded that the analytical model solution becomes unfeasible due to total time in period 1 and 2 exceed the available time in those periods. Production capacity adjustment is necessary so that the analytical model solution will be feasible to be implemented in real world situation.

6. REFERENCES

Alfieri, A. and P. Brandimarte (1997). "Object oriented modelling and simulation of Integrated production distribution system", *Computer Integrated Manufacturing Systems*, 10(4), 261-266

Aliev, R.A., Fazlollahi B., Guirimov B.G., Aliev R.R. (2007). "Fuzzy genetic approach to aggregate production-distribution planning in supply chain management", *Information Sciences*, 177(20,): 4241-4255.

Altiparmak, F., Mitsuo G., Lin L., Ismail K. (2009). "A steady-state Genetic Algorithm for Multi-Product Supply Chain Network Design". *Computers & Industrial Engineering*, 56, 521-537.

Annisa, K.G. (2008). "Simultaneous and Decoupled Model to Resolve Production-Inventory-Distribution-Inventory Integration Problem", *Jurnal Teknik Industri*, 10(1),

Barbarosoglu, G. and D. Ozgur (1999). "Hierarchical design of an integrated production and 2-echelon distribution system", *European Journal of Operational Research*, 118, 464 – 484.

Chen, Z.L., 2004. "Integrated production and distribution operations : taxonomy, models, review", in *Handbook of Quantitative Supply chain Analysis : Modelling in the E-Business Era*, Kluwer Academic Publishers.

Fahimnia, B., Lee L., Romeo M. (2008). " Optimization/Simulation Modeling of The Integrated Production-Distribution Plan : An Innovative Survey ", *WSEAS Transactions on Business and Economics*, issue 3, vol. 5, 44-57.

Fumero, F. and C. Vercellis (1999). "Synchronized Development of Production, *Inventory*, and Distribution Schedules", *Transportation Science*, 33, 330 – 340.

Gen, M. and A. Syarif (2005). "Hybrid genetic algorithm for multi-time period production/distribution planning", *Computers & Industrial Engineering*, 48(4), 799-809.

Jang, Y.J., Jang, S.Y., Chang, B.M., Park, J. (2002). "A combined model of network design and production/distributi on planning for a supply network", *Computers & Industrial Engineering*, 43(1-2), 263-281.

Jayaraman, V. and H. Pirkul (2001). "Planning and coordination of production and distribution facilities for multiple commodities", *European Journal of Operational Research*, 133(2), 394-408.

Kelton, W. D. (2000). *Simulation with ARENA,* McGraw Hill Companies.

Lee, Y.H. dan Sook H.K. (2002). "Production-distribution planning in supply chain considering capacity constraint ", *Computer and Industrial Engineering*, 43, 169-190.

Lim, S.J., Suk J.J., Kyung S.K., Myon W.P. (2006). "A simulation approach for production-distribution planning with consideration given to replenishment policies ", *The International Journal of Advanced Manufaturing Technology*, 27(5), 593-603.

Nishi, T., M. Konishi, and M. Ago, A distributed decision making system for integrated optimization of production scheduling and distribution for aluminum production line. Computers & Chemical Engineering, 2007. 31(10): p. 1205-1221.

Syarif, A., and M. Gen (2003), "Hybrid genetic algorithm for production / distribution system in supply chain", *International Journal of Smart Engineering System Design*, 289-298.

Thomas, D.J. and Paul M.G. (1996). "Coordinated Supply Chain Management", *European Journal of Operational Research*, 94, 1- 15.

Wang X. and Soemon T. "Moduled-Based modelling of production-distribution systems considering shipment consolidation", 2006, in Proceedings of the 2006 Winter Simulation Conference, 1477-1484.

Yeh, W.C. (2005). "A hybrid heuristic algorithm for the multistage supply chain network problem", *The International Journal of Advanced Manufacturing Technology*, 26, 675-685.

Yeh, W.C. (2006). "An efficient memetic algorithm for the multi-stage supply chain network problem", *The International Journal of Advanced Manufacturing Technology*, 29(7), 803-813.