POULTRY REVERSE SUPPLY CHAIN PROCESS CONVEYS ENVIRONMENTAL SUSTAINABILITY

Mohammad SHAMSUDDOHA
University of Chittagong, Bangladesh
mdsdoha@gmail.com

Tasnuba NASIR
Curtin University, Perth, Australia

Abstract
Environmental sustainability is eminent concept for the corporate industry to manage internal and external resources for contemporary and future generation. This valued concept make beneficiary to its follower in terms of environment friendly reputation and gaining extra profit. Reverse supply chain (RSC) is one of the divisions of supply chain management that deals product return, waste reduction, recycle and reuse. The researchers have preferred this potential area based on particular case industry to observe how reverse supply chain can be used to protect and improve environmental hazards. The objectives of this paper are twofold. First, it offers a literature review on sustainability along with environment and supply chain in conjunction with reverse supply chain issue. Second, it develops a sustainable environment friendly model based on reverse supply chain theory. Later, model has been fitted in simulation environment through Simul8 package. The paper ultimately focused on sustainability (only dealt with environmental domain) along with reverse supply chain process in the hub of poultry industry of Bangladesh.

Key words: *Sustainability, Reverse Supply Chain, Poultry Industry, Bangladesh*

JEL Classification: *O10, Q01, Q56, Q57*

I. INTRODUCTION

Production procedures are often complicated as it deals with environment, social and economic issues during different stages of production (Corbett and Kleindorfer 2003; Seuring and Muller 2008). To maintain intact environment for the subsequent generation, it is always key to preserve their optimal productions based on changing supply and demands. It is harder for the corporate level to incorporate environmental sustainability and supply chain management involved with their production process (Shamsuddoha 2010). Reverse supply chain is comparatively newer concept among supply chain concepts as it deals with product return, recycle, reuse, keep intact of surrounding environment and internal waste management (Shamsuddoha 2011). Bangladesh is considered one of the most appropriate countries in the world for poultry rearing (Shamsuddoha and Sohel 2008). In Bangladesh, poultry farms have grown up through private ownership. Private entrepreneurs are brave enough to establish scientific poultry farming having minimal supports from Government and concern authorities. Truly, these poultry entrepreneurs do not have sufficient knowledge on reverse supply chain and environment sustainability. Now days, bunch of young generation are motivated to involve with poultry farming as a profession due to high competition in the corporate job market (Shamsuddoha, Klass, and Quaddus 2011). These young educated people are trying their best to accept scientific knowledge on reverse supply chain and environment sustainability for their sustainable farming. Applications of such dynamic concepts easily guide them toward scientific farming with better profitability and sustainability. The positive thing is that entrepreneurs are learning so fast by the help of other poultry developed country like USA, Canada, France, China, Malaysia, Thailand etc. There is plethora research works on it. This kind of research can help to understand to the poultry stakeholders what they should do for achieving environmental sustainability and applying reverse supply chain process within their operations.

II.LITERATURE

Sustainability focused on natural environment with implicit recognition of social and economic responsibilities (Jennings and Zandbergen 1995). Environment needs to be protected from unfettered expansion if we are to preserve human welfare before diminishing returns set in (Mill 1848). Interestingly, Ricardo believed that human ingenuity and scientific progress would postpone the time when population would overtake resources (Ricardo 1973; Daly 1999). "The Limits to Growth" (Meadows et al. 1972) and "Beyond the Limits" (Meadows, Meadows, and Randers 1992) trembled the convictions of the technological optimists.

Most common perception on defining sustainability, 'meeting the needs of the present without compromising the ability of future generations to meet their own needs'(WCED 1987). In reality, animal science and technology must be linked and deals with the society's benefits, optimum use of resources, sensitive environments with complex ecological balances and economically efficient production systems (Boyazoglu 2002). However, sustainability also must integrate issues and flows that extend beyond the core of supply chain management: product design, manufacturing by-products, by-products produced during product use, product life extension, product end-of-life, and recovery processes at end-of-life

In this process, reverse supply chain refers to the series of activities necessary to retrieve a product from a customer and either dispose of it or recover value (Prahinski and Kocabasoglu 2006; Linton, Klassen, and Jayaraman 2007). Again, the reverse chain process potentially can reduce negative environmental impacts of extracting virgin raw materials and waste disposal (Kocabasoglu, Prahinski, and Klassen 2007). For instance, Wal-Mart has dedicated redistribution or processing centers for reverse logistic aspects of repairs, replacement part return to customers, inspection, salvage, disposal and reworks such as upgrades (Krumwiedea and Sheub 2002). Over the last decade, reverse logistics has had a significant social, economic and environmental impact on industry as well as society. Companies that receive items back from the customer and try to hide from the significance of reverse logistics miss profit-making opportunities (Cottrill 2000). Reverse logistics with end-of-life (EOL) products embraces many different characteristics of environmentally conscious manufacturing, including disassembly, reuse (Edwards and Daniel 1992), recycling and remanufacturing (Gungor and Gupta 1999).

There are four different poultry wastes: litter (Burak Aksoy 2008), manure (Rivera-Cruz et al. 2008), feathers (Shih 1993), broken eggs and intestines (Burns and Stickney 1980). Poultry litter can be the source of fertilizer (Gupta and Charles 1999), bio gas (Bala 1991), charcoal and fish feed (Burns and Stickney 1980); feathers can be raw materials for the Bed industry (Shamsuddoha 2011), broken eggs for the bakery and intestines for the fish farms (Shamsuddoha 2011). All these areas have great potential to meet social, economic and environmental aspects that will make the industry and society more sustainable. Thus, literature review shown that a few number of research have been conducted on environmental sustainability and reverse supply chain process. Research gaps remain in the theory and practice of the poultry industry. No evidence was found of reverse supply chain issues being considered in the light of the poultry industry. This is the reason why, the researchers have taken the Bangladeshi poultry industry as a research case.

III. METHODOLOGY

The study covered literature review on Bangladesh Poultry, sustainability with environmental issues and importantly reverse supply chains. This paper used observation tool to generate poultry model for Bangladesh poultry in light of environmental benefits and impacts. Both primary and secondary data and information have been used in this study. Primary information was collected on September 2011, mainly through in-depth interviews with the sample respondents. The total respondents were three executives from a reputed poultry industry in Bangladesh. These respondents were nominated based on their widespread knowledge and experiences in this particular industry. The positions of those three executives are Executive Director, Production Manager and Hatchery Manager from the case industry. Secondary information like literature were collected from different published documents such as referral journal and conference paper, survey reports, statistical yearbooks and various reports.

This study followed research paradigm of positivist ontology, empirical epistemology and quantitative methodology based on real supply chain cases of poultry process. Design science methodology has been chosen for this study. Design science is concerned with "devising artifacts to attain goals (Simon 1969). March and Smith focused on the two main activities of design science research (DSR): firstly, building an artifact and evaluating it; secondly, design science products are of four types, constructs, models, methods, and implementation (March and Smith 1995). In this research, different artifacts have used in simulation modeling. Here, an artifact means design and develop soft or hard objects that can meet specific purpose and goal (Venable 2006b, 2006a). A simulation package of SIMUL8 is used as a tool to analyze existing poultry processes in order to investigate the research objectives. Simulation is an appropriate tool to analyze and predict future outcome. In

this way, entrepreneurs can control the variables where they need to interfere for the sake of better results and optimality.

IV. BANGLADESH POULTRY, ENVIRONMENT SUSTAINABILITY AND REVERSE SUPPLY CHAIN (RSC)

Over 73% people lives in the rural areas and are highly dependent on agriculture and livestock system in Bangladesh. The contribution of the livestock sub-sector to GDP and the agriculture sector as a whole is currently 3.2% and 10.11% respectively (*Discovery Bangladesh* 2009). Poultry industry is one of the major among livestock sub-sector. Approximately 20% of the protein consumed in Bangladesh originates from poultry. Among poultry species, the chicken population is dominant over others, at almost 90%, followed by ducks (8%) and a small number of quail, pigeons and geese. Free range 'backyard' and scavenging poultry, that are traditionally reared by rural women and children, still play an important role in generating family income, in addition to improving the family's diet with eggs and meat (*Cambridge Journal* 2009). The poultry industry is committed to supply cheap source of good quality nutritious animal protein to the nation (Shamsuddoha 2010). At the same time alternative protein supplies are bit costly in compare to chicken meat and eggs. In this circumstances, landless, under privileged, malnourished, ignorant and poor people can involve with poultry farming to benefit of achieving economic, social and environmental benefit from it.

To implement reverse supply chain concepts in Bangladesh poultry industry, there are small chances of product retrieval, return or reconditioning in the reality sense, as most chicken products are perishable. However, there are immense opportunities to reuse or recycle poultry wastage. By reusing poultry wastage, industries can make valuable products like fertilizers, bio-gas, pillows, charcoal, and bakery items. This kind of wastage conversion will help to maintain our environment and will add value at the customer end of the product cycle (Shamsuddoha 2011). Sustainability, Environment and RSC in the poultry industry have not received proper consideration by the poultry stakeholders.

V. BUILDING SIMULATION MODEL FOR ENVIRONMENTAL SUSTAINABILITY

Table 1 shows the different potential by-products that come from poultry wastes through reversing poultry wastage. Thus, RSC can contribute to other types of industry by providing existing raw materials to generate various by-products via small-medium companies. Above table demonstrates that how poultry wastes can be managed through different small and medium type of industry. It is now understandable that poultry wastes can be well-managed through applying reverse supply chain process. The model (Figure One) has been developed based on poultry process in Bangladesh. This model has been conceptually developed through in depth interview with poultry entrepreneurs. RSC part of this model has been developed based on real practice and future potentials to use poultry wastes.

Bangladesh is densely populated country with inadequate land facilities and resources. In this circumstance, this poultry wastes can be vital resources for Bangladesh people. These resources can make various kind of by-product including biogas (power/electricity) which is very essential for home and industrial users. By conducting in-depth interviews with large poultry farm executives, the researchers came to know that there is a lack of use of poultry wastes. This lack of use in turn pollutes the environment. The participants in the interviews are trying some environmental practices which may help them to remain free from poultry disease and make some extra economic benefits by creating bi-products from wastes (Shamsuddoha 2011). Appropriate poultry waste management can help to alleviate environmental hazards. The economic and social aspects of RSC with respect to the poultry industry are incredibly vivid in that the reverse supply chain process applied to each individual waste could help to build a new business. These businesses can easily commercialize their products for both home and industrial users in Bangladesh.

Table 1: Possible Bi-Product from Poultry Wastes (Shamsuddoha 2011)

Waste Types	**Name of Waste**	**Possible By-Products**	**Usage**
Poultry wastes	Poultry litter	Fertilizers	Crop industry
		Bio-gas	Industry/home user
		Charcoal	
Feed wastes	Discarded poultry intestines and feed	Fish feed	Fish industry

Eggs	Rejected eggs (unbroken)	Biscuits and cakes	Bakery industry
	Rejected eggs (broken)	Fish feed	Fish industry
Poultry feathers	Processed feathers	Beds and pillows	Bed and pillow industry
Dead chicks and chickens	Chicken paste	Fish and duck feed	Fish and poultry industry

Figure one demonstrates that the poultry model has been fitted in simulation model by using Simul8 package. This model is containing three different parts of mainstream forward, forward and reverses supply chain in the poultry industry. First, mainstream supply chain started from parent (mother of broiler and layer chicks) and ends up with finished product of meat and eggs. Meat and eggs are selling in the open, processed and ready market. Still, second, further forward supply chain consists of distributor, farmers, middlemen of ready or mature bird and eggs. Third, reverse supply chain process showed in the bottom of the simulation model which consists of managing poultry wastes of broken and un-hatched eggs, poultry litter, poultry feather etc. This particular section is highlighted areas in this research. This research tried to show how poultry wastes can be input of other by-product industries or additional economic potential for the existing industry.

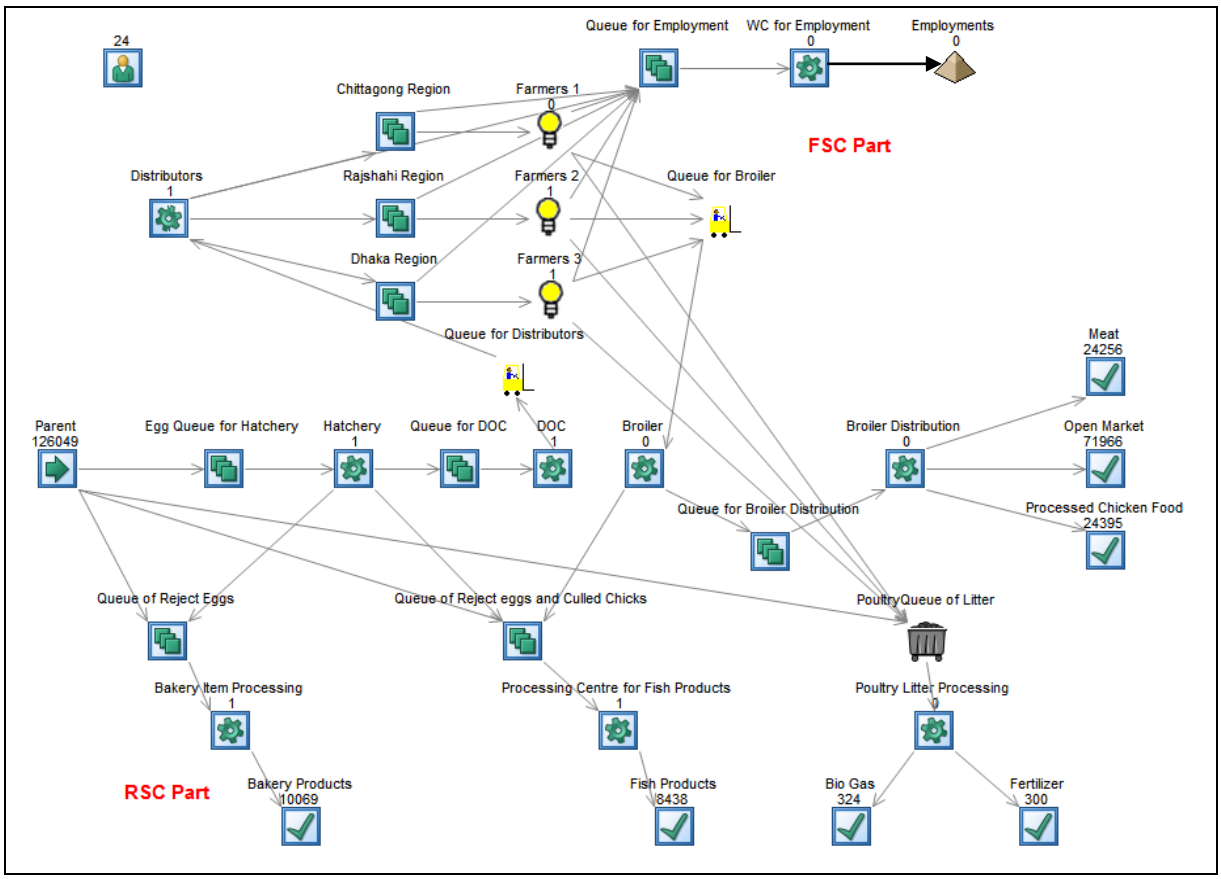

Figure 1 Poultry Simulation Model along with Reverse Supply Chain (RSC) Application

Poultry process industries generates different kind of wastes for example, culled birds; rejected hatching eggs; litter; manure; rejected, damaged, broken and un-hatched eggs; waste feed, poultry intestines and feathers. All of those can be used as further raw materials for different types of industries (Shamsuddoha 2011). Poultry industries may use of RSC concepts as they apply to poultry waste management; these include industries like a small-scale power generating industry using bio-gas created by the poultry; a pillow making industry using feathers, a fertilizer manufacturing industry from manure and other poultry waste, a fish feed industry from intestines and rejected eggs, a bakery industry to make cakes and biscuits from certain kinds of rejected eggs, a charcoal industry from poultry litter and so (Shamsuddoha 2011).

This model has been run through small number of historic data from the case industry. Eggs/Chicks are given as throughput. After a certain period of time, different output derived from the various processes. Figure one is also demonstrated the number of input and various numbers of outputs which consist of different percentages. The table in the appendix has also shown the bunch of results which came from three different

random run. Decision makers can accept suitable one from the various run in light of profitability, sustainability and optimality.

In this simulation model, production personnel can easily work out the volume of wastes based on its farm input. This model will able to figure out volume of final output of eggs and meat, employment, wastes, by-products, based on its input. At this point, the researchers run the model based on historic data from case industry. After run the model, all the figures come out within a couple of second and it shows range of results for individual objects or artifact. Model has run through five random trials and appendix table shows three run results out of five. It also shows the averages of all five random run. The results are varying a morsel in every different random run. Policy/decision makers or entrepreneurs can easily pick right ideas among the trials. They can do experiments by deviating or deploying extreme condition data to see how the model works until find out the optimality or desired outcome. This is the way; poultry entrepreneurs can save time by doing experiments in the simulation environment rather doing it in the real life. Real life experiments are always expensive and time consuming to come out a decision. Thus, this simulation model can work like real scenario based on historic or imaginary data to find out the suitability of individual farm.

VI. FURTHER DIRECTION AND CONCLUSIONS

In a nutshell, the idea of the reverse supply chain process is effective enough to help surrounded environment for its protection and sustainability. It is now considerable ideas for the poultry entrepreneurs to utilize their poultry wastes to make economically viable by-products. Moreover, this kind of process not only utilizes poultry wastes but also keep our environment intact for future generation. Furthermore, clean hygienic environment prevent from common poultry diseases. Future research could test the entire process model to realize meticulous particulars of the total industry operation and its optimality.

VII. REFERENCES

1. Bala, B K. 1991. "System dynamics modelling and simulation of biogas production systems." *Renewable energy* no. 1 (5-6):723.
2. Boyazoglu, J. 2002. "Livestock research and environmental sustainability with special reference to the Mediterranean basin." *Small Ruminant Research* no. 45:193-200.
3. Burak Aksoy, Harry T. Cullinan, Norman E. Sammons Jr, Mario R. Edenb. 2008. "Identification of Optimal Poultry Litter Biorefinery Location in Alabama Through Minimization of Feedstock Transportation Cost." *Environmental Progress* no. 27 (4).
4. Burns, P. Robert, and R. Robert Stickney. 1980. "Growth of Tilapia aurea in ponds receiving poultry wastes." *Aquaculture* no. 20 (2):117-121.
5. *Cambridge Journal*. 2010. 2009 [cited http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=1854276 2010].
6. Corbett, C J, and P R Kleindorfer. 2003. "Environmental management and operations management: introduction to the third special issue." *Production and Operations Management* no. 12 (3):287–289.
7. Cottrill, K. 2000. "Return to sender." *TraNc World* no. 262 (7):17-28.
8. Daly, H. 1999. Steady State Economics 2nd ed. Washington DC: Island Press.
9. *Discovery Bangladesh*. 2009. 2009 [cited http://www.discoverybangladesh.com/meetbangladesh/fisheries_livestock.html 2009].
10. Edwards, D. R. , and T. C. Daniel. 1992. "Environmental Impacts of On-Farm Poultry Waste Disposal A Review." Bioresource Technology no. 41 9-33.
11. Gungor, A., and S. M. Gupta. 1999. "Issues in environmentally conscious manufacturing and product recovery: a survey." *Computers and Industrial Engineering* no. 36 (4):811-853.
12. Gupta, Gian, and Simone Charles. 1999. "Trace elements in soils fertilized with poultry litter." *Poultry Science* no. 78:1695–1698.
13. Jennings, P D, and P A Zandbergen. 1995. "Ecologically sustainable organizations: an institutional approach." *The Academy of Management review* no. 20 (4):1015-1052.
14. Kocabasoglu, Canan, Carol Prahinski, and Robert D Klassen. 2007. "Linking forward and reverse supply chain investments: the role of business uncertainty." *Journal of Operations Management* no. 25:1141-1160.
15. Krumwiedea, Dennis W, and Chwen Sheub. 2002. "A model for reverse logistics entry by third-party providers." *Omega* no. 30:325-333.
16. Linton, Jonathan D, Robert Klassen, and Vaidyanathan Jayaraman. 2007. "Sustainable supply chains: An introduction." *Journal of Operations Management* no. 25 (6):1075–1082.
17. March, S., and G. Smith. 1995. "Design and Natural Science Research on Information Technology." *Decision Support Systems* no. 15:251-266.
18. Meadows, D, D Meadows, and J Randers. 1992. *Beyond the Limits: Global Collapse or a Sustainable Future*. Post Mills, VT: Chelsea Green.
19. Meadows, D, D Meadows, J Randers, and W Behrens. 1972. *The Limits to Growth*. New York: Universe.
20. Mill, J S. 1848. *Principles of Political Economy*. Vol. 2. New York: Collier. Reprint, 1900.
21. Prahinski, Carol, and Canan Kocabasoglu. 2006. "Empirical research opportunities in reverse supply chains." *Omega: The International Journal of Management Science* no. 34 (6):519-532.
22. Ricardo, D. 1973. *Principles of Political Economy and Taxation*. 2nd ed. London: Dent.
23. Rivera-Cruz, Marı´a del Carmen , Antonio Trujillo Narcı´a, Georgina Co´rdova Ballona, Josef Kohler, Fuensanta Caravaca, and Antonio Rolda´n. 2008. "Poultry manure and banana waste are effective biofertilizer carriers for promoting plant growth and soil sustainability in banana crops." *Soil Biology & Biochemistry* no. 40 3092-3095.
24. Seuring, Stefan, and Martin Muller. 2008. "From a literature review to a conceptual framework for sustainable supply chain management." *Journal of cleaner production* no. 16 (15):1699-1710.
25. Shamsuddoha, Mohammad. 2010. A sustainable supply chain process model for Bangladeshi poultry industry. In *Doctoral Students Colloquium 2010*. Perth, Australia: Curtin Business School.

26. 2011. Applying reverse supply chain in the poultry industry. In *Emerging Research Initiatives and Developments in Business: CGSB Research Forum 2011*, edited by Therese Jefferson, Mohammad Shamsuddoha and Ellen Young. Perth, Australia: Curtin University.
27. Shamsuddoha, Mohammad, Desmond Klass, and Mohammed Quaddus. 2011. Economic, social and environmental benefits through poultry forward and reverse supply chain. Perth: Curtin University.
28. Shamsuddoha, Mohammad, and Mir Hossain Sohel. 2008. "Poultry rearing - an alternative income generating activity for rural women development of Bangladesh." *The Chittagong University Journal of Business Administration, Bangladesh* no. 20 (1):119-132.
29. Shih, J C H. 1993. "Recent development in poultry waste digestion and feather utilization: a review." *Poultry science* no. 72 (9):1617-1620.
30. Simon, H. 1969. *The sciences of the artificial*. Cambridge: MIT Press.
31. Venable, John R. 2006a. A Framework for Design Science Research Activities In *Information Resource Management Association Conference*. Washington, DC, USA.
———. 2006b. The Role of Theory and Theorising in Design Science Research. In *1st International Conference on Design Science (DESRIST)*, edited by A. Hevner and S. Chatterjee. Claremont, California, USA.
32. WCED. 1987. *Our Common Future (The Brundtland Report)*. New York: Oxford University Press (World Commission on Environment and Development).

Appendix

Simulation Object	Performance Measure	Run 1	2	3	-95%	Average	95%
Parent	Number Entered	126049	125854	12594	125870	125978	126086
Hatchery	Average use	0.98214	0.9801	0.9781	0.97145	0.97758	0.98371
	Completed Jobs	123584	123321	123438	123348	123486	123623
	Waiting %	1.92102	2.0157	2.0066	1.9266	2.016	2.1053
	Working %	98.0789	97.9842	97.993	97.894	97.984	98.073
DOC	Average use	0.99702	0.9990	0.99802	0.99621	0.99782	0.99942
	Completed Jobs	121372	119065	118118	117845.9	119358	120870
	Waiting %	0.18247	0.0581	0.13764	0.01892	0.09673	0.17454
	Working %	96.3543	94.368	93.63599	93.41781	94.68303	95.9482
	Stopped %	3.46321	5.57305	6.22637	3.91115	5.22024	6.52934
Broiler	Average use	0.9623	0.94841	0.93948	0.93872	0.94901	0.9593
	Completed Jobs	121254	118930	118053	117786.8	119269.6	120752
	Waiting %	3.78818	5.73922	6.34199	4.18983	5.37626	6.5627
	Working %	96.21182	94.2607	93.65801	93.4373	94.62374	95.8101
Broiler Distribution	Average use	0.95337	0.94147	0.93353	0.93311	0.94206	0.95101
	Completed Jobs	120617	118311	117464	117177.5	118642.8	120108
	Waiting %	4.24983	6.14024	6.82672	4.67892	5.87564	7.07236
	Working %	95.75017	93.8597	93.17328	92.92764	94.12436	95.3210
Meat	Completed Job	24256	23598	23545	23444.53	23794	24143.4
	Minimum Time	7.14849	7.09257	7.13195	7.09691	7.12719	7.15746
	Average Time	54.4592	105.423	97.35628	64.121	89.61688	115.112
	Maximum Time	88.7196	185.440	222.9809	110.1935	172.0078	233.822
	St. Dev.	26.85664	51.2512	54.37815	30.73827	49.39187	68.0454
Open Market	Number Completed	71966	71054	70494	70525.75	71179.6	71833.4
	Average Time	54.60199	104.505	97.30777	64.30787	89.4088	114.509
	Maximum Time	88.77556	185.520	223.0291	110.2434	172.0509	233.858
	St. Dev.	26.8235	51.4231	54.66891	30.81873	49.52552	68.2323
Processed Chicken Food	Completed Job	24395	23659	23425	23098.21	23669.2	24240.1
	Minimum Time	7.09889	7.09019	7.19029	7.08709	7.14707	7.20705
	Average Time	54.52388	104.905	97.137	64.28575	89.55578	114.825
	Maximum Time	88.69045	185.666	222.9963	110.1918	172.0418	233.891
	St Dev.	26.8652	51.3463	54.51471	30.76992	49.44347	68.1170

Distributor	Average use	0.96726	0.94742	0.93353	0.93092	0.94663	0.96234
	Completed Jobs	121338	119019	118080	117816	119326	120836
	Waiting %	3.76598	5.40034	6.30692	4.14448	5.32097	6.49747
	Working %	96.23402	94.5996	93.69308	93.50253	94.67903	95.8555
Poultry Litter Processing	Average use	0.09127	0.10615	0.09127	0.08086	0.09444	0.10803
	Completed Jobs	624	648	614	612.2231	628	643.776
	Waiting %	90.12971	89.7124	90.44101	89.72824	90.08604	90.4438
	Working %	9.87029	10.2875	9.55899	9.55616	9.91396	10.2717
Fish Products	Completed Jobs	8438	8396	8368	8362.627	8398.4	8434.17
	Minimum Time	4.28486	4.70163	4.85171	4.28845	4.62051	4.95257
	Average Time	2350.026	2361.35	2352.455	2347.399	2353.553	2359.70
	Maximum Time	4700.047	4702.52	4701.977	4700.426	4701.707	4702.98
	St. Dev.	1355.039	1359.22	1357.809	1353.923	1356.643	1359.36
Fertilizer	Number Completed	300	305	297	291.8998	300.2	308.500
	Minimum Time	5.84391	1.76518	5.42791	2.23881	4.34219	6.44557
	Average Time	11.94876	11.8159	11.86979	11.8233	11.88579	11.9482
	Maximum	20.63569	20.2931	20.12158	18.27979	19.59449	20.9092
	St. Dev.	2.49184	2.66169	2.57243	2.43787	2.54559	2.65331
Bio Gas	Completed Jobs	324	343	317	315.342	327.8	340.258
	Minimum Time	4.37181	6.14561	4.09626	4.05864	5.13232	6.206
	Average Time	11.91246	11.9048	11.81185	11.79522	11.91936	12.0434
	Maximum Time	18.39559	20.6930	20.7299	18.49554	19.73374	20.9719
	St. Dev.	2.51251	2.53745	2.46606	2.4755	2.51122	2.54694
Bakery Products	Completed Jobs	10069	10105	10115	10049.28	10082.4	10115.5
	% In System	21.60494	23.6151	23.34385	21.91508	22.87315	23.8312
Broiler	Average queue size	0.09226	0.09127	0.08631	0.08628	0.09365	0.10102
	Average Queuing Time	0.00929	0.00933	0.00921	0.00918	0.00931	0.00944
	Maximum Queuing Time	0.1724	0.20424	0.17973	0.17299	0.18939	0.20578
	St Dev.	0.01744	0.01772	0.01729	0.01722	0.01755	0.01787
	Items Entered	48604	47526	47260	47138.51	47768.4	48398.2
Meat	% In System less than time limit	8.86791	1.22468	4.64217	0	3.7124	7.92352
Resource 1	Utilization %	9.27454	9.04741	9.35308	9.06135	9.34153	9.62171
	Average Use	2.31863	2.26185	2.33827	2.26534	2.33538	2.40543