OPTIMISATION OF PRODUCTION PLANNING AND CONTROL

IN

JOBSHOPS

BY

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CERTIFICATION

This work has not been presented elsewhere for the award of a degree or any other purpose.

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We certify that this work was carried out by **Engr. Idris, Musibaudeen Olatunde** in the Department of Mechanical Engineering of the Federal University of Technology, Akure.

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DEDICATION

This work is dedicated to Allah (SWT) the Creator, the Cherisher and the Owner of everything in this world and other worlds. He owns me and what I owned.

ABSTRACT

Smooth production planning and control in jobshops has been hindered by inherent problems and peculiarities that surround management decisions in meeting the organisational objectives while satisfying the customers' requests. In solving these problems and streamlining the peculiarities, this study has developed mathematical models for eight strategic decisions that are pertinent in effective production planning and control in jobshops. These strategic decisions are: Demand Management, Manpower Planning, Tools and Equipment Planning, Material Requirement Planning, Job Scheduling, Cost Estimation, Due Dates, and Floor Shop Control and Record Management. Demand Management Model that was developed, determined the optimal forecast hour of demand and the optimal quantity of materials needed in the planning horizon using Exponential Smoothing Technique as the basis. The Manpower Planning Model determined the optimal number of manpower and its associated cost. The model permits internal transfer of full-time and part-time manpower with utilisation of excess and make up for shortage labour-hour, which served as control measure. Tools and Equipment Planning Model was also developed through which the optimal quantity of Tools and Equipment and cost, based on purchase, hire or contract strategy were determined. The development of Materials Requirement Planning Model was done and the optimal quantity and cost of material were determined based on modified Economic Order Quantity Model. A job-scheduling model was among the models developed to determine the commencement time and minimise the makespan with inclusion of a dynamic operational schedule and re-schedule of jobs based on priority and first-come-first-served principle. Cost Estimation Model based on modification of Aderoba (1997a)'s model with inclusion of bargaining permissibility was developed. A due-date

model was formulated by modifying Akinnuli and Aderoba's (2000) model to include uncertainty in due dates and job crashing through adjustment of manpower, tools and equipment, and the scheduled jobs. A shop floor control and record management tools were designed to assign shop-order priority and work-in-progress quantity information for effective control in the areas of job location, shop order, accounting, efficiency and facility productivity. The tools track and monitor the flow of jobs, tools and equipment, material and manpower in the system. The eight (8) models were integrated using a heuristic method to evolve a hybrid model. Based on this, a software, JOBSIS_2007, in PHP (Hypertext Preprocessor) programming language, which costs maximum of 16% of the existing proprietary softwares, was developed for rapid implementation of the model. The validity of the model was tested using a jobshop located in Osogbo, Osun State, Nigeria. The period used for this purpose was classified into pre-implementation and implementation period. Pre- and Post- implementation results were compared using ANOVA, with the results from the implementation period. Based on this, it was revealed, among other things, that the model developed has enhanced capacity utilisation, improved marginal profit and created adequate records and documentations for planning and control of production activities in the company. This study finally recommended salient points that could promote efficient usage of the model.

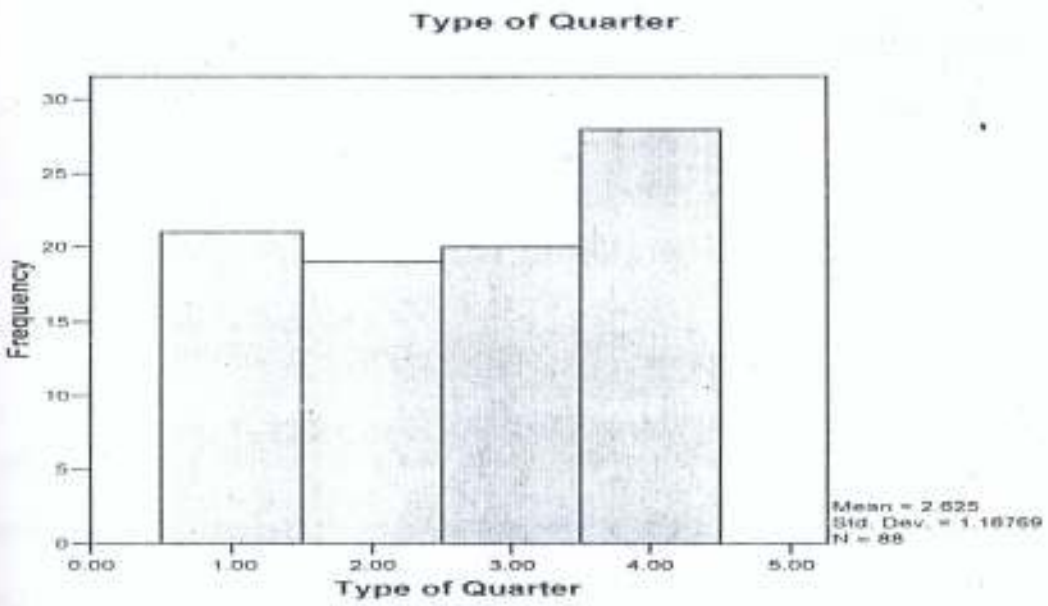

Fig. 4.1 Histogram for Distribution of Jobs on Quarterly Basis

Table 4.1 above reveals that production of machine parts has the highest percentage of 28.4 while production of metal chairs and metal windows were seldom done with 1.1% each. This information provides job records that are not previously available, to guide shop manager on production planning and control of the company to make adequate provision for the resources that are needed for the execution of highly demanded jobs.

Table 4.2 and Figure 4.1 show significant difference between the changes in demands between Qtr. 1 and Qtr. 2 (- 2.3%) and the changes in demands between Qtr. 3 and Qtr. 4 (9.1%). This shows that there is a fall in demand in Qtr 2 when compared with Qtr. 1, this might be due to loss of customers' goodwill because of poor performances of the company in meeting most of the due due dates in Qtr. 1. However, there is significant increase in demand in Qtr. 4, when the model was used for production planning and control. This significant increase (9.1%) might due to

good performances of the company in meeting most of the due due dates in Qtr. 3.

This result confirmed the observation of Weber *et. al.* (1991), Choi and Hartley (1995) and Akinyemi *et. al.* (2002) that firm's conformance to their due due dates on prior job is a significant reputation which attract new jobs.

4.3 VARIATION BETWEEN DUE DATES AND COMPLETION DATES

4.3.1 Variations in Quarter 1

Table 4.3 shows the code of the jobs processed in Qtr. 1, the date of arrival of each job, the day the customers were promised to come and collect their jobs (due dates), the actual date the job was completed and the variations between the due date and the actual date of completing their jobs.

Table 4.3 Due Dates of Jobs Processed in Quarter 1

Job No	Arrival Date	Due Date	Completion Date	Variation
01/001	09/01/07	12/01/07	17/01/07	5
01/002	09/01/07	10/01/07	13/01/07	3
01/003	11/01/07	12/01/07	12/01/07	0
01/004	15/01/07	16/01/07	17/01/07	1
01/005	15/01/07	17/01/07	17/01/07	0
01/006	15/01/07	17/01/07	18/01/07	1
01/007	18/01/07	19/01/07	19/01/07	0
01/008	24/01/07	25/01/07	29/01/07	4
02/001	06/02/07	07/02/07	09/02/07	2
02/002	12/02/07	15/02/07	21/02/07	6
02/003	12/02/07	14/02/07	16/02/07	4
02/004	13/02/07	15/02/07	15/02/07	0
02/005	15/02/07	21/02/07	23/02/07	2
02/006	21/02/07	23/02/07	23/02/07	0
03/001	07/03/07	08/03/07	12/03/07	4
03/002	12/03/07	14/03/07	14/03/07	0
03/003	12/03/07	13/03/07	16/03/07	3
03/004	13/03/07	15/03/07	15/03/07	0
03/005	14/03/07	15/03/07	19/03/07	4
03/006	20/03/07	22/03/07	23/03/07	1
03/007	20/03/07	26/03/07	30/03/07	4

4.3.2 Variations in Quarter 2

In Qtr. 2 nineteen (19) jobs were processed Table 4.4 shows the code of each of the jobs, the dates of arrival, the due dates, the actual dates and the variations between the promised and the actual dates.

Table 4.4 Due Dates of Jobs Processed in Quarter 2

Job No	Arrival Date	Due Date	Completion Date	Variation
04/001	03/04/2007	05/04/2007	11/04/2007	6
04/002	03/04/2007	09/04/2007	10/04/2007	1
04/003	05/04/2007	11/04/2007	13/04/2007	2
04/004	10/04/2007	13/04/2007	18/04/2007	5
04/005	11/04/2007	13/04/2007	14/04/2007	1
04/006	11/04/2007	12/04/2007	16/04/2007	4
04/007	16/04/2007	18/04/2007	18/04/2007	0
04/008	16/04/2007	18/04/2007	20/04/2007	2
04/009	25/04/2007	26/04/2007	30/04/2007	4
05/001	02/05/2007	03/05/2007	04/05/2007	1
05/002	14/05/2007	16/05/2007	16/05/2007	0
05/003	14/05/2007	16/05/2007	18/05/2007	2
05/004	16/05/2007	18/05/2007	19/05/2007	1
05/005	16/05/2007	17/05/2007	19/05/2007	2
06/001	06/06/2007	11/06/2007	14/06/2007	3
06/002	06/06/2007	11/06/2007	12/06/2007	1
06/003	12/06/2007	14/06/2007	15/06/2007	1
06/004	13/06/2007	15/06/2007	15/06/2007	0
06/005	25/06/2007	27/06/2007	29/06/2007	2

4.3.3 Variations in Quarter 3

During Qtr. 3, when the model was implemented, twenty (20) different jobs were processed. Table 4.5 shows the jobs no, arrival dates, due dates, actual dates of completion and the variations that occurred between the due dates and the actual dates.

Table 4.5 Due Dates of Jobs Processed in Quarter 3

Job No	Arrival Date	Due Date	Completion Date	Variation
07/001	03/07/2007	05/07/2007	05/07/2007	0
07/002	04/07/2007	06/07/2007	06/07/2007	0
07/003	09/07/2007	11/07/2007	13/07/2007	2
07/004	09/07/2007	12/07/2007	12/07/2007	0
07/005	11/07/2007	12/07/2007	15/07/2007	3
07/006	25/07/2007	26/07/2007	26/07/2007	0
08/001	08/08/2007	09/08/2007	09/08/2007	0
08/002	08/08/2007	12/08/2007	11/08/2007	-1
08/003	14/08/2007	16/08/2007	16/08/2007	0
08/004	16/08/2007	18/08/2007	19/08/2007	1
08/005	16/08/2007	18/08/2007	19/08/2007	1
08/006	20/08/2007	22/08/2007	22/08/2007	0
09/001	03/09/2007	06/09/2007	07/09/2007	1
09/002	10/09/2007	12/09/2007	14/09/2007	2
09/003	12/09/2007	15/09/2007	15/09/2007	0
09/004	18/09/2007	19/09/2007	20/09/2007	1
09/005	18/09/2007	19/09/2007	20/09/2007	1
09/006	19/09/2007	21/09/2007	21/09/2007	0
09/007	19/09/2007	20/09/2007	24/09/2007	3
09/008	26/09/2007	29/09/2007	29/09/2007	0

4.3.4 Variations in Quarter 4

Table 4.6 shows the jobs no, arrival dates, due dates, actual dates of completion and the variations that occurred between the due dates and the actual dates for the jobs that were processed in Qtr. 4.

Table 4.6 Due Dates of Jobs Processed in Quarter 4

Job No	Arrival Date	Due Date	Completion Date	Variation
10/001	04/10/2007	05/10/2007	05/10/2007	0
10/002	04/10/2007	05/10/2007	07/10/2007	2
10/003	09/10/2007	11/10/2007	11/10/2007	0
10/004	10/10/2007	12/10/2007	12/10/2007	0
10/005	10/10/2007	11/10/2007	12/10/2007	1
10/006	18/10/2007	19/10/2007	20/10/2007	1
10/007	19/10/2007	22/10/2007	22/10/2007	0
10/008	24/10/2007	25/10/2007	26/10/2007	1
10/009	24/10/2007	26/10/2007	27/10/2007	1
10/010	24/10/2007	26/10/2007	2710/2007	1
11/001	05/11/2007	08/11/2007	08/11/2007	0
11/002	06/11/2007	08/11/2007	08/11/2007	0
11/003	06/11/2007	10/11/2007	10/11/2007	0
11/004	07/11/2007	08/11/2007	12/11/2007	4
11/005	12/11/2007	14/11/2007	14/11/2007	0
11/006	15/11/2007	18/11/2007	18/11/2007	0
11/007	20/11/2007	21/11/2007	22/11/2007	1
11/008	20/11/2007	22/11/2007	22/11/2007	0
11/009	20/11/2007	23/11/2007	23/11/2007	0
11/010	22/11/2007	26/11/2007	27/11/2007	1
11/011	22/11/2007	26/11/2007	28/11/2007	2
11/012	22/11/2007	28/11/2007	28/11/2007	0
11/013	22/11/2007	28/11/2007	28/11/2007	0
12/001	06/12/2007	13/12/2007	13/12/2007	0
12/002	10/12/2007	13/12/2007	13/12/2007	0
12/003	10/12/2007	12/12/2007	13/12/2007	1
12/004	10/12/2007	14/12/2007	15/12/2007	1
12/005	18/12/2007	21/12/2007	20/12/2007	-1

Variations between the due dates and job completion dates, that is, the failure to meet the due dates that occurred in the four quarters were statistically analysed to find if there is significant difference between the variations that occurred when the model was not use (Pre-Implementation Period) and when the model was used (Implementation Period). This is shown in Table 4.7 using ANOVA (Analysis of Variation)

Table 4.7 Results of ANOVA in Jobs Due Dates

Multiple Comparisons

Dependent Variable: Variation between Promised Date and Day of Job Completion

Tukey HSD

(I) Type of Quarter	(J) Type of Quarter	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Quarter 1 (Pre-usage of Computer)	Quarter 2 (Preusage of Computer)	.09524	.45944	.997	-1.1090	1.2995
	Quarter 3 (Post-usage of Computer)	1.39524*	.45337	.015	.2069	2.5836
	Quarter 4 (Post-usage of Computer)	1.52381*	.41888	.003	.4258	2.6218
Quarter 2 (Preusage of Computer)	Quarter 1 (Pre-usage of Computer)	-.09524	.45944	.997	-1.2995	1.1090
	Quarter 3 (Post-usage of Computer)	1.30000*	.46486	.032	.0815	2.5185
	Quarter 4 (Post-usage of Computer)	1.42857*	.43130	.007	.2980	2.5591
Quarter 3 (Post-usage of Computer)	Quarter 1 (Pre-usage of Computer)	-1.39524*	.45337	.015	-2.5836	-.2069
	Quarter 2 (Preusage of Computer)	-1.30000*	.46486	.032	-2.5185	-.0815
	Quarter 4 (Post-usage of Computer)	.12857	.42482	.990	-.9850	1.2421
Quarter 4 (Post-usage of Computer)	Quarter 1 (Pre-usage of Computer)	-1.52381*	.41888	.003	-2.6218	-.4258
	Quarter 2 (Preusage of Computer)	-1.42857*	.43130	.007	-2.5591	-.2980
	Quarter 3 (Post-usage of Computer)	-.12857	.42482	.990	-1.2421	.9850

*. The mean difference is significant at the .05 level.

The ANOVA results presented in Table 4.7 revealed the following Statistical facts:

i. There is no significant difference between the variation that occurred in Qtr. 1 and Qtr.2 (**0.997** > 0.05)

ii. There is significant difference between the variation that occurred in Qtr. 1 and Qtr. 3. (**0.015** < 0.05).

iii. There is high significant difference between the variation that occurred in Qtr. 1 and Qtr.4 (**0.003** < **0.05**).

iv. There is significant difference between the variation that occurred in Qtr. 2 and Qtr.3 (**0.032** < 0.05).

v. There is high significant difference between the variation that occurred in Qtr. 2 and Qtr. 4 (**0.007** < 0.05)

vi. There is no significant difference between the variation that occurred in Qtr. 3 and Qtr. 4 (**0.990** > 0.05)

The 1st statistical fact that there is no significant difference between the failures to meet the promised dates that occurred in Qtr. 1 and Qtr. 2 implies that the method used for predicting due dates in these two quarters has not improve the situation. However, 2nd and 3rd statistical facts that there are significant differences between the failures to meet the due due dates that occurred between Qtr. 1 and Qtr. 3 also occurred between Qtr.1 and Qtr. 4 show that the failures minimised in Qtr. 3 and Qtr. 4 when compared with failures Qtr. 1. This also was the case when failures in Qtr. 4 were compared with failures Qtr. 1 and Qtr. 2. From these facts, it can be infer that the model used to predict due dates in Qtr. 3 and Qtr. 4 has greatly reduced the failures in meeting the due dates that was obvious in Qtr. 1 and Qtr. 2.

The study also investigated failures in meeting due dates for this company, these were due to jobs characteristics. From the ANOVA result, shown in Table 5.8, it shows that there is no significant difference between the dates variations and the job characteristics (**0.034** < 0.05). This shows that variations between the due dates and jobs completion dates of the company did not depend on the job characteristics but on

amalgamation of various strategic decisions as done in the model developed. This confirmed the position of Chang (1994) that to have an effective rule for due date determination, production managers of jobshops should develop a rule that will base on the characteristics of their own production system and analysis of the historical production data.

Table 4.8 Variation in Dates and Job Characteristics

ANOVA

Variation between Promised Date and Day of Job Completion

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	57.150	13	4.396	1.980	.034
Within Groups	164.304	74	2.220		
Total	221.455	87			

4.4 CAPACITY UTILISATION IN THE JOB SHOP

The study also analysed the capacity utilisation of the company during the Pre-Implementation and Implementation Period. Table 4.9 shows the available manpower hour, the used hour and the percentage utilised. While Table 4.10 shows the available equipment hour, the used hour and the percentage utilised.

Table 4.9 Capacity Utilization: Manpower

Section	QTR 1			QTR 2			QTR 3			QTR 4		
	Avail-able (hrs)	Used (hrs)	% Used (hrs)	Avail-able (hrs)	Used (hrs)	% Used (hrs)	Avail-able (hrs)	Used (hrs)	% Used (hrs)	Avail-able (hrs)	Used (hrs)	% Used (hrs)
Design & Engineering	1440	102	7.08	1440	112	7.78	1440	73	5.07	1440	120	8.33
Turning	1440	95	6.60	1440	90	6.25	1440	80	5.56	1440	115	7.99
Milling	960	82	8.54	960	79	8.23	960	30	3.13	960	96	10.00
Welding & Cutting	960	132	13.75	960	109	11.35	960	148	15.42	960	156	16.25
Assembly & Finishing	1920	99	5.16	1920	115	5.99	1920	87	4.53	1920	127	6.61
Electrical	1440	28	1.94	1440	26	1.81	1440	37	2.57	1440	34	2.36
Wood	1440	20	1.39	1440	23	1.60	1440	37	2.57	1440	26	1.81

Table 4.10 Capacity Utilisation: Equipment

Section	QTR 1			QTR 2			QTR 3			QTR 4		
	Avail-able (hrs)	Used (hrs)	% Used (hrs)	Avail-able (hrs)	Used (hrs)	% Used (hrs)	Avail-able (hrs)	Used (hrs)	% Used (hrs)	Avail-able (hrs)	Used (hrs)	% Used (hrs)
Design & Engineering	1440	102	7.08	1440	112	7.78	1440	5.07	5.07	1440	120	8.33
Turning	960	95	9.90	960	90	9.38	960	8.33	5.56	960	115	11.98
Milling	480	82	17.08	480	79	16.46	480	6.25	3.13	480	96	20.00
Welding & Cutting	1440	132	9.17	1440	109	7.57	1440	10.28	15.42	1440	156	10.83
Assembly & Finishing	1440	99	6.88	1440	115	7.99	1440	6.04	4.53	1440	127	8.82
Electrical	480	28	5.83	480	26	5.42	480	7.71	2.57	480	34	7.08
Wood	480	20	4.17	480	23	4.79	480	7.71	2.57	480	26	5.42

From the capacity utilisation tables shown above, it can be deduced that there is under utilisation of resources in both manpower and equipment. However, there was gradual increase in the percentage of capacity utilised during the period of using the model (i.e. Qtr. 3 and Qtr. 4). This is well illustrated in Figures 4.2 and 4.3 for each section of the company.

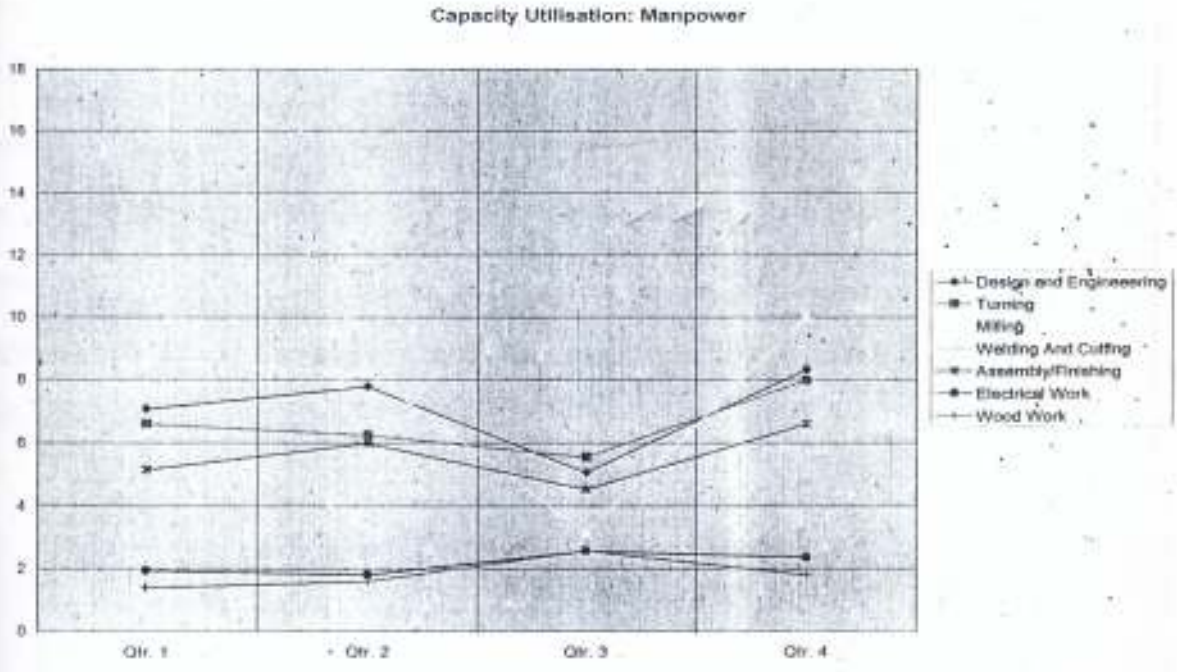

Fig. 4.2 Capacity Utilisation: Manpower

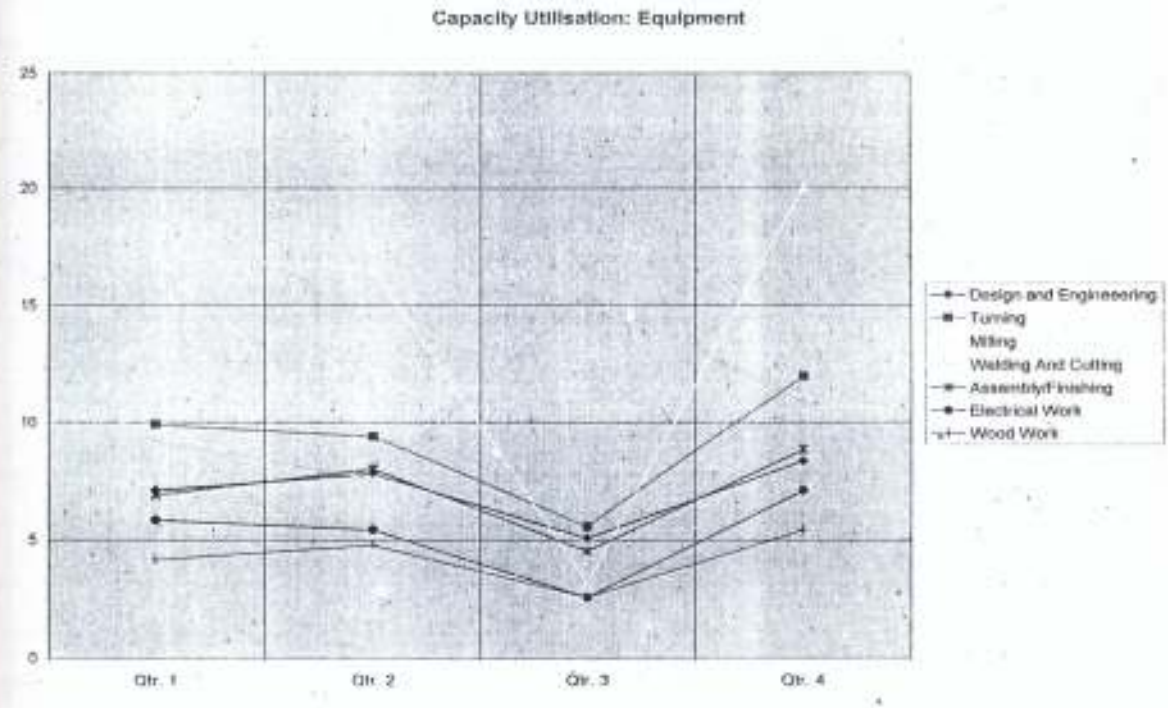

Fig. 4.3 Capacity Utilisation: Equipment

4.5 CASH FLOW IN THE JOBSHOP

One of the problems in jobshops and in particular in the company used as case study, was deficit in annual cash flow, the model developed in this study has an in-built facility under Shop Floor Control and Record Management (Section 3.8) to keep records of financial incomes and expenditures. From these records, the amount spent in each quarter on manpower, material, factory maintenance, factory utilities, equipment maintenance also amount that was supposed to be set aside as return on investment on factory building and equipment were known. Based on this, Table 4.11 below was produce

Table 4.11 Cash Flow Analysis Table

S/N	Particular	Qtr. 1		Qtr. 2		Qtr. 3		Qtr. 4	
		Budget	Actual	Budget	Actual	Budget	Actual	Budget	Actual
1	Return On Investment (Factory Building)	-	(28,840)		(28,840)	28,840	28,840	28,840	28,840
2	Return On Investment (Tools & Equipment)		(67,987.5)		(67,987.5)	67,987.5	67,987.5	67,987.5	67,987.5
3	Building Maintenance Cost		42,000		37,000	37,000	36,850	38,620	35,470
4	Equipment Maintenance Cost		84,500		89,500	87,190	84,500	86,190	80,500
5	Factory Utility Cost		16,500		18,000	18,000	18,240	17,420	18,500
6	Manpower Cost		190,500		190,500	190,500	190,500	195,700	195,700
7	Material/Inventory Cost		85,429.5		88,821.33	89,237.69	93,180.31	95,204.98	122,534.7
8	Total Expenditure		(515,757) 418,930		(520,649) 423,821	518,755	520,098	529,962	549,532
9	Income	**491,040**		**291,140**		**804,047**		**1,026,259**	
10	Profit/Loss	**24,717 (Loss)**		**229,509 (Loss)**		**283,949 (Profit)**		**476,727 (Profit)**	
11	Remark	**4.79% (Loss)**		**44.08 (Loss)**		**54.60 (Profit)**		**86.75% (Profit)**	

Table 4.11 shows that at the end of Qtr.1 the company spent the ₦ 515,757 (return on equipment and factory building inclusive) as expenditure and realised ₦ 491,040 as income a lost of 4.79%. In Qtr.2, ₦ 520,649 was spent and ₦ 291,140 was realised, a loss of 44.08%. However, the situation changed in Qtr. 3 and Qtr. 4 when the company employed the service of the model. The company made a profit of 54.60% and 86.75% in Qtr. 3 and Qtr. 4 respectively. This profit margin was due to the increase in demand as well as the efficiency of the model to have taken into consideration all necessary details to produce a realistic cost estimation far better than the previous estimation that was based on the manager's hunches or intuitive. Figure 4.4 shows the diagrammatic representation of Table 4.11

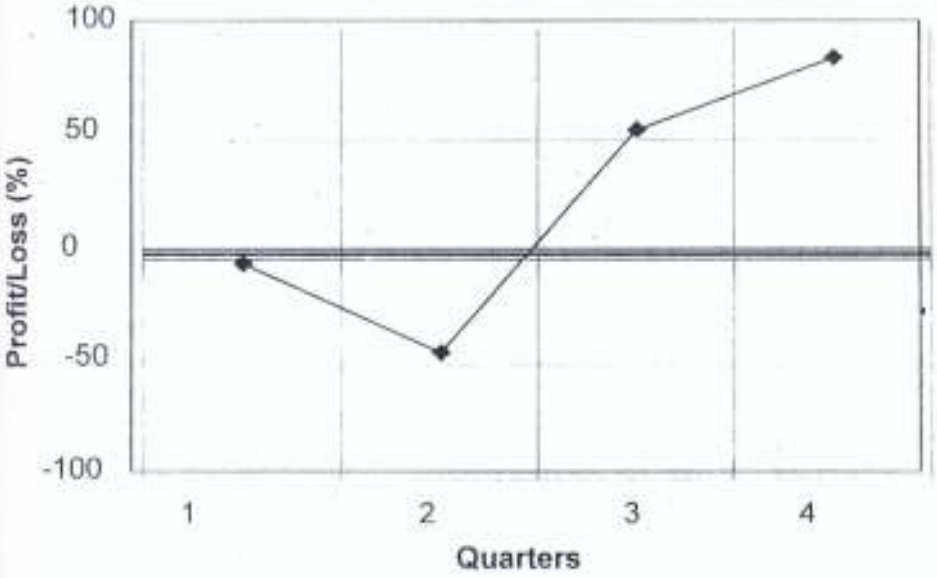

Fig. 4.4 Cash Flow Analysis Graph

4.6 SOFTWARE COSTS COMPARISON

The comparison of the cost of JOBSIS_2007 with costs of similar proprietary softwares are presented in Table 4.12. From this table it was discovered that a saving of a minimum of 83% was achieved with the adoption of locally developed software. This high level of cost deduction will attract the jobshop professionals in the developing countries that are characterised by low capital outlay.

Table 4.12: Software Costs Comparison

S/N	Software	Manufacturer	Cost (Equivalent in ₦)	% Cost Reduction by adopting JOBSIS_2007	Source
1	JOBSIS_2007	Exclusive work of research	₦ 50,000	-	-
2	Job Master 2008	Link it software Corp. USA	₦ 300,000	83.33%	http://www.the-job-master.com
3	Exact JobBOSS	Exact Holding North America	₦ 465,000	89.25%	http://www.exactamerica.com
4	E2-Manufacturing Software	Shoptech Corporation	₦ 410,000	87.80%	http://www.shoptech.com
5	DBA Software	DBA Software Incorporation	₦ 400,000	87.50%	http://www.dbamanufacturing.com
6	AyaNova	Aya Nova Service Management Software	₦ 320,000	84.38%	http://www.ayanova.com

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendations drawn from this study are hereby presented below

5.1 CONCLUSIONS

This study identified Demand Management, Manpower Planning, Tools and Equipment Planning, Material Requirement Planning, Cost Estimation, Due Date Determination, Job Scheduling and Record/Control Management as salient strategic decisions that are pertinent in effective production planning and control in jobshops. Mathematical models were developed for these strategic decisions, which were also integrated using a heuristic method to have a global integrated model, a precursor in this regard, for solving the problems of jobshops in developing countries, as well as developed nations. The study went ahead to develop application software named JOBSIS_2007 for effective and quick implementation of the model.

The resulting integrated model was validated using a jobshop located in Osogbo, Osun State, Nigeria. The period used for this purpose was divided into four quarters; each quarter consists of three months. Qtr. 1 and Qtr. 2 (pre-implementation period) were used to collect the needed data when the production planning and control of the company was based on intuitive of the production manager. During Qtr. 3 and Qtr. 4 (implementation period) data were collected when the production planning and control of the company was based on the model developed in this study. The results from pre-implementation period were statistically compared (using Analysis of Variance, ANOVA), with the results from the implementation period. Based on this comparison, the following conclusions were drawn:

i. That the company has no provision for quick and efficient approach to cost estimation, job scheduling and due date determination prior to the usage of the model developed.

ii. That as a result of poor performances of the company in Qtr. 1 to meet most of the promised dates, the company witnessed a decline in demand in Qtr. 2 this resulted to under-utilisation of resources and deficit in financial turn-over.

iii. That the company was at the edge of folding up because of increase in financial deficit from 4.79% in Qtr. 1 to 44.08% in Qtr. 2! This situation was reversed when the model was used in Qtr. 3 and Qtr. 4 and the company bounced back with profits of 54.60% and 86.75% for Qtr. 3 and Qtr. 4 respectively.

iv. That the company experienced gradual increase in demand during the implementation period which resulted to increase in utilisation of the resources.

v. That the problem of backlog of uncompleted jobs experienced in Qtr. 1 and Qtr. 2 by the company was highly reduced when the model developed in this study was used to determine the due dates.

vi. That the model developed was able to provide facilities for keeping records of accepted and rejected jobs; production processes along with human and non human resources.

5.2 RECOMMENDATIONS

Considering the nature of the models in this study, the following recommendations are hereby suggested:

i. That during the *Set Up stage* that is, planning stage of implementation, effort should be made to input accurate and current data, which should be reviewed from time to time to reflect changes in shop floor situation.

ii. That accurate specification of job to be processed should be made and well input during the *Order Stage* to aid the system to either reject or accept the job based on the available resources and if accepted to produce an accurate production schedule, job cost and estimated due date

iii. That this model is recommended for global utilisation in solving the problems of production planning and control in different categories of jobshops given its efficacy.

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Appendix I (a) : Sample of Manpower Utilization Card

MANPOWER UTILIZATION CARD

Activity Centre:.....

Name of Operator:.....

Issued by:.....**for the month**.....

Date	Job Code	Operational Time		General Comment/Remark by the Operator
		Operation Commence at	Operation End at	

Remark by Centre Supervisor.....

.....

Name, Signature and Date:.....

Appendix I (b) : Sample of Equipment Utilization Card

EQUIPMENT UTILIZATION CARD

Activity Centre:.....

Card No:..... **Date Issued**..... **by:**.....

Job Code		When Released to the Centre	When Released to the Machine	When Completed on the Machine	When Released From the Centre	Operator's Name and Signature
	Date					
	Time					
	Date					
	Time					
	Date					
	Time					
	Date					
	Time					
	Date					
	Time					
	Date					
	Time					
	Date					
	Time					
	Date					
	Time					
	Date					
	Time					
	Date					
	Time					
	Date					
	Time					
	Date					
	Time					
	Date					
	Time					
	Time					

Supervisor' s Remark:.....

.....

Name, Signature and Date:.....

Appendix I (c) : Sample of Maintenance Record

MAINTENANCE RECORD

Activity Centre::.....

Card No:..... **Issued by:**.....

Date	Type of Maintenance	Cost of Maintenance	Idle Time of Equipment		Remark by the Maintenance Supervisor
			Maintenance Commence at	Maintenance End at	

Remark by Centre Supervisor.....

.....

Name, Signature and Date:.....

Appendix I (d) : Sample of Stock Record Card

STOCK RECORD CARD

Type of Material::..

Material Code:...................... **Card No:...............................**

Date Supplied	Qty. Supplied	Qty Rejected	Balance	Unit Price	Supplier's Name	Receiver's Name and Signature

Appendix I (e) : Sample of Material Flow Record

MATERIAL FLOW RECORD

Description of Material::.....

Material Code :.....

Date Released or Returned	Qty Released or Returned	Qty in Stock	Released for Job Code No	Released for Activity Centre	Receiver's Name and Signature

Store Keeper' s Comment:.....

.....

Name, Signature and Date:.....

Appendix I (f) : Sample of Job Card

JOB CARD

Arrival Date::.....

Customer's Name:.....

Customer's Address:.....

Job Description:.....

Job Code:..... Card No:.....

Operational Sequence	PROCESSING TIME			Material Needed	
	Optimistic	Most Likely	Pessimistic	Type	Qty

Suggested Due Date (Best Scenario)	Suggested Due Date (Worst Scenario)	Actual Date of Completion	Date of Collection

Amount Charged	Amount Deposit	Balance	Remark

Prepared by:.....

Signature and Date:.....

Appendix I (g) : Sample of Factory Utility Card

FACTORY UTILITY CARD

Name of Utility::.....

Activity Centre:.....

Card No:..... **Date Issued:**.....**by:**.....

Date	TIME			Remark
	START	END	DURATION	

Supervisor's Remark.....

.....

Name, Signature and Date:.....

Appendix I (h) : Sample of Staff Personal Data Card

STAFF PERSONAL DATA

Affix Passport

1 NAME:.....

2 ADDRESS:.....

.....

3 E-MAIL/ GSM NO:.....

4 HIGHEST QUALIFICATION:.....

5 DATE OF APPOINTMENT:.....

6 STATUS WHEN EMPLOYED:.....

7 PRESENT STATUS:.....

8 STAFF CODE/ID. NO:.....

9 MONTHLY SALARY:.....

10 CENTRE OF ASSIGNMENT:.....

11 ALTERNATE CENTRE(S) OF ASSIGNMENT:

a. .....

b. .....

c. .....

d. .....

PREPARED BY: .....

STATUS: .....

SIGNATURE AND DATE:.....

Appendix I (i) : Sample of Equipment Profile Card

EQUIPMENT PROFILE

1 DESCRIPTION.....

2 MODEL.....

3 DATE OF PURCHASE.....

4 DATE OF COMMISSION:.....

5 PURCHASE COST:.....

6 INSTALLATION COST:.....

7 EQUIPMENT CODE:.....

8 EXPECTED LIFE SPAN:.....Yrs

9 CENTRE OF ASSIGNMENT:.....

10 ALTERNATE CENTRE(S) OF ASSIGNMENT:

a. .....

b. .....

c. .....

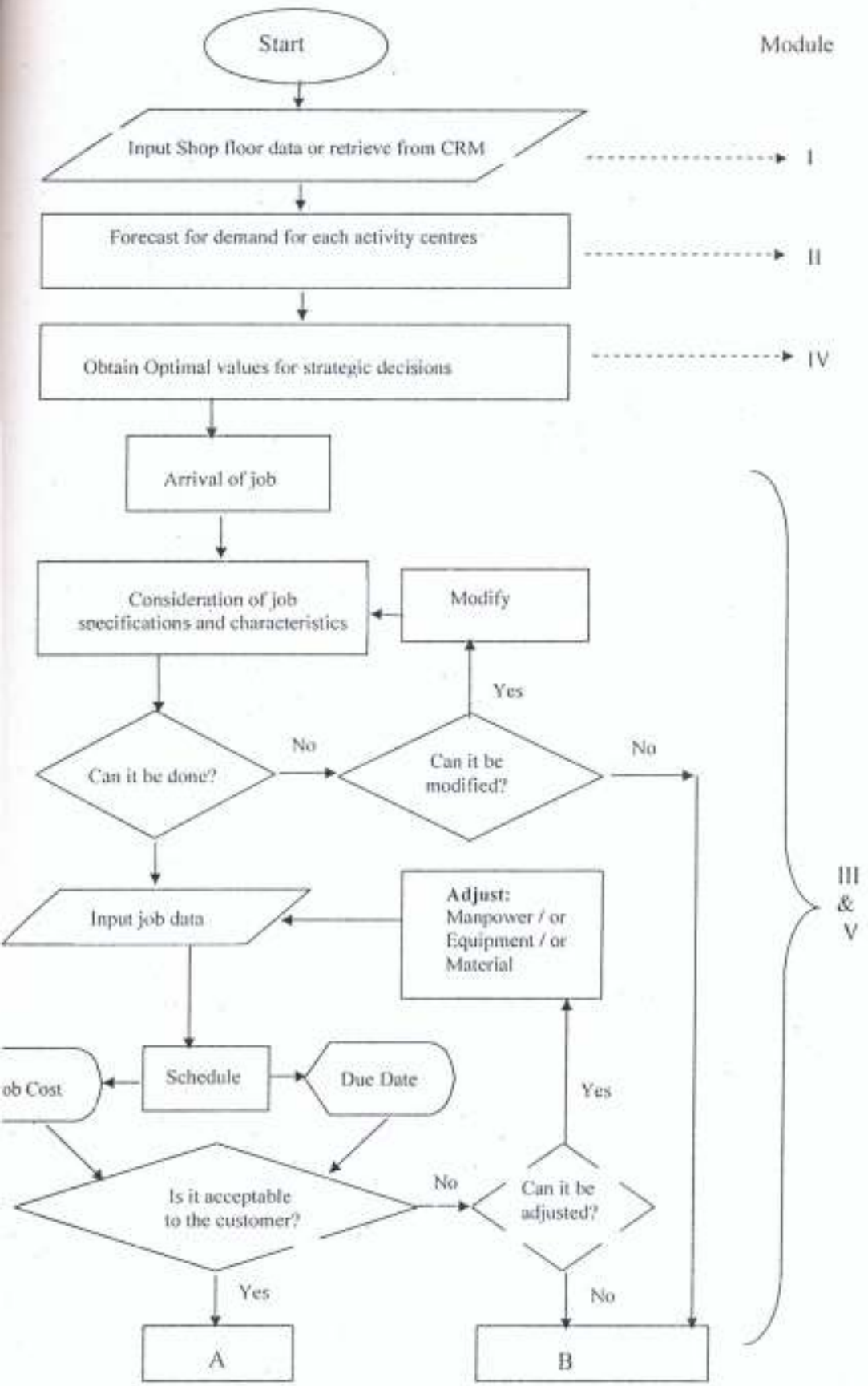
d. .....

PREPARED BY: .....

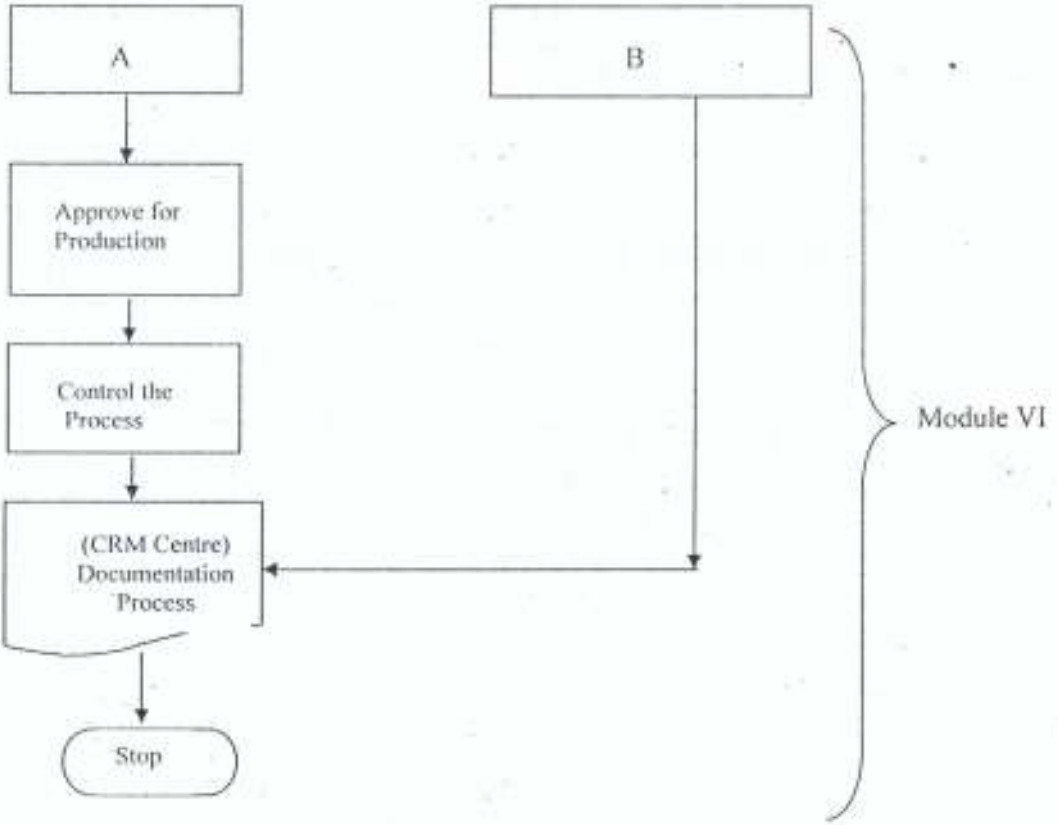
STATUS: .....

SIGNATURE AND DATE:.....

Appendix II: Flow Chart for JOBSIS_2007

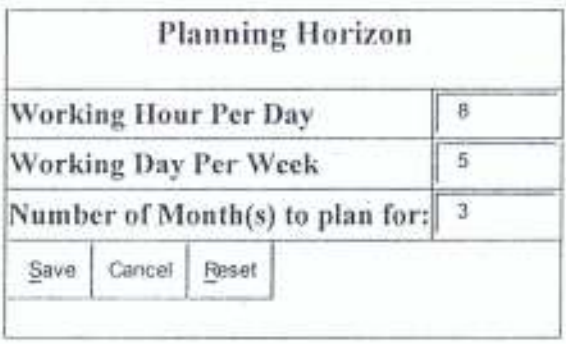


Appendix II : Flow Chart Contd.



Appendix III (a) : Company Profile Window

Appendix III (b) : Planning Horizon Window



Appendix III (c) Activity Section Window

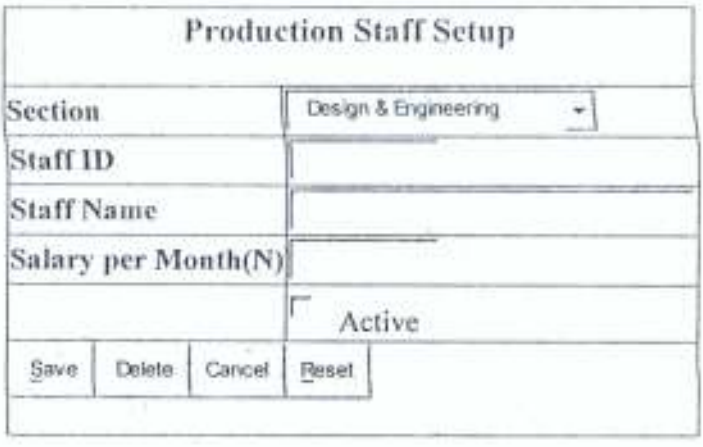
Activity Center Setup			
Activity Center Name			
Centre Area (Sq.m)			
Previous Actual Demand Hour (Hr)		Previous Forecast Demand Hour (Hr)	
Smoothing Constant		Manpower Efficiency in the Centre (%)	
Proposed Forecast Hour		Ave. Waiting Time (Minutes)	
Manpower Time Factor(%)		Utilities Time Factor (%)	
Status	☐ Active		
Save | Delete | Cancel | Reset			

Appendix III (d) : Equipment Unit Setup window

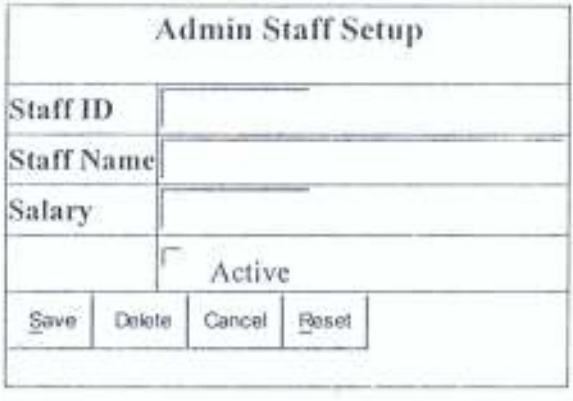
Equipment Unit Setup (Design & Engineering)			
Equipment Code No			
Purchase Cost(N)		Installation Cost(N)	
Expected Life Span (Yr)		☑ Active	
Add More Equipment | Back to Main			

#	Unit Description	Status	Delete
1	DE001	☑ Active	☐
2	DE002	☑ Active	☐
3	DE003	☑ Active	☐

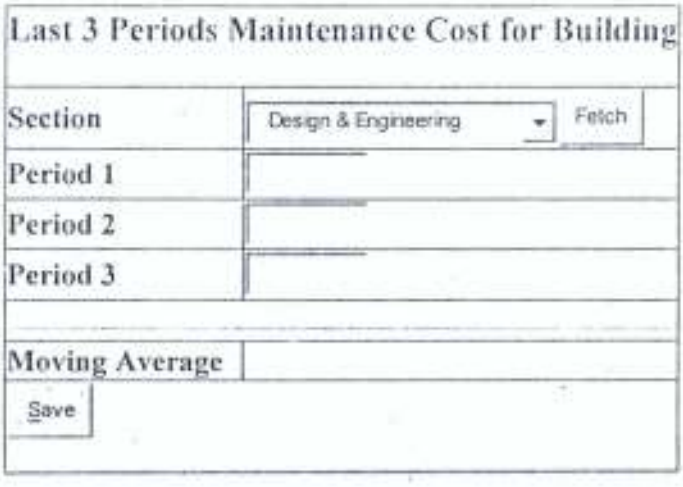
Appendix III (e) : Production Staff Window



Appendix III (f) : Administrative Staff Window



Appendix III (g) : Building Maintenance Window



Appendix III (h) : Utilities Costs Window

Last 3 Periods Maintenance Cost for Utilities	
Section	Design & Engineering ▾ Fetch
Period 1	
Period 2	
Period 3	
Moving Average	
Save	

Appendix III (i) : Equipment Maintenance Window

Last 3 Periods Maintenance Cost for Equipment	
Section	Design & Engineering ▾ Fetch
Period 1	
Period 2	
Period 3	
Moving Average	
Save	

Appendix III (j) : Customer Registration Window

Customer Registration	
Customer's Company Name	
Contact Person	
Address	
Status	Active

Save | Delete | Cancel | Reset

Appendix III (k) : Material Registration Window

Material Setup	
Description	
Status	Active

Save | Delete | Cancel | Reset

Appendix III (l) : Material Set Up Window

Material Stock New Update			
Description	Cable Wire		
Order Date	yyyy/mm/dd	Transaction Date	10/03/2008 03:47
Quantity			
Total Purchase Cost/Unit (N)		Usage Price/Unit (N)	

Save | Cancel | Reset

Appendix III (m) : Job Registrati

Jo ation	
Customer Name:	CHBAY Engineering Consult
Job Description	
Status	Active

Save | Delete | Cancel | Reset

Appendix III (n) : Material Costing Window

Material/Value

Job Description: 07380 - Steel Window Door					Save
#	Material	Quantity	Unit Cost	Amount	
1	Cable Wire		39.11		
2	Mild Steel Rod (High Grad		386.39		
3	Mild Steel Rod (Low Grade		353.39		
4	Mild Steel Sheet (High Gr		520.16		
5	Mild Steel Sheet (Low Gra		497.06		
6	Wood		117.65		

Job Description: [illegible] Commencement Date: 2008/03/

Available Sections	No of Equip.to be Engaged	Operational Sequence	Mode of Operation	Estimated Production Time (Hr)
Assembly & Finishing	1	1	Full Time	Time:
Design & Engineering	1	1	Full Time	Time:
Electrical	1	1	Full Time	Time:
Milling	1	1	Full Time	Time:
Turning	1	1	Full Time	Time:
Welding & Cutting	1	1	Full Time	Time:
Wood	1	1	Full Time	Time:

Save | Clear | Back to Main

#	Date	Section	Unit	Order	Method	Duration(hrs)	Time	Activate
1	2007-07-04	Design & Engineering	DE001	1	Full Time	4.00	8 – 12	Pending
2	2007-07-04	Welding & Cutting	WDC001	2	Full Time	4.00	12 – 16	Pending
3	2007-07-04	Welding & Cutting	WDC002	2	Full Time	4.00	12 – 16	Pending
4	2007-07-04	Welding & Cutting	WDC003	2	Full Time	4.00	12 – 16	Pending
5	2007-07-05	Welding & Cutting	WDC002	2	Full Time	2.00	8 – 10	Pending
6	2007-07-05	Assembly & Finishing	ASF001	3	Full Time	5.00	10 – 15	Pending

Appendix III (p) : Job Processing Window

Job Processing

#	Description	Customer	Transaction Date	Process	Delete
1	07/001 :Metal Window/Door	FAMAK Engineering Company	2007-07-03	(•) Active ( ) Pending ( ) Completed	[ ] Delete
2	07/002:Machine Parts	MTAT Automobile Company	2007-07-04	(•) Active ( ) Pending ( ) Completed	[ ] Delete
3	07/003 :Machine Parts	ARIYO Enterprises	2007-07-09	(•) Active ( ) Pending ( ) Completed	[ ] Delete
4	07/004: Local Oven	BARAKAT Electrical Company	2007-07-09	(•) Active ( ) Pending ( ) Completed	[ ] Delete
5	07/005 : Shaft Cutting	ADELEKE Automobile Company	2007-07-11	(•) Active ( ) Pending ( ) Completed	[ ] Delete
6	07/006: Cylinder Boring	Ar-Rahman Motor Mechanic	2007-07-25	(•) Active ( ) Pending ( ) Completed	[ ] Delete
7	08/001: Cylinder Boring	CHIBAY Engineering Consult	2007-08-08	(•) Active ( ) Pending ( ) Completed	[ ] Delete
8	08/002: Local Oven	COAST Farm	2007-08-08	(•) Active ( ) Pending ( ) Completed	[ ] Delete
9	08/003: Metal Doors	SALAFI Group of Company	2007-08-14	(•) Active ( ) Pending ( ) Completed	[ ] Delete
10	08/004: Machine Parts	BAYUS Enterprises	2007-08-16	(•) Active ( ) Pending ( ) Completed	[ ] Delete
11	08/005: Burglary Proof	FAMAK Engineering Company	2007-08-16	(•) Active ( ) Pending ( ) Completed	[ ] Delete
12	08/006: Local Oven	ARIYO Enterprise	2007-08-20	(•) Active ( ) Pending ( ) Completed	[ ] Delete

		s			
13	09/001: Metal Chairs	ARIYO Enterprises	2007-09-03	◉ Active ○ Pending ○ Completed	☐ Delete
14	09/002: Machine Parts	MTAT Automobile Company	2007-09-10	◉ Active ○ Pending ○ Completed	☐ Delete
15	09/003: Local Ovens	Al-BARKAH Poultry	2007-09-12	◉ Active ○ Pending ○ Completed	☐ Delete
16	09/004: Cylinder Boring	MTAT Automobile Company	2007-09-18	◉ Active ○ Pending ○ Completed	☐ Delete
17	09/005: Shaft Cutting	SALAFI Group of Company	2007-09-18	◉ Active ○ Pending ○ Completed	☐ Delete
18	09/006: Local Ovens	BARAKAT Electrical Company	2007-09-19	◉ Active ○ Pending ○ Completed	☐ Delete
19	09/007: Shaft Cutting	Ar-Rahman Motor Mechanic	2007-09-19	◉ Active ○ Pending ○ Completed	☐ Delete
20	09/008: Machine Parts	SALAFI Group of Company	2007-09-26	◉ Active ○ Pending ○ Completed	☐ Delete

Appendix III (q) : Inventory Window

Material List

#	Material	Stock	Total Purchase Cost/Unit(N)	Usage Price/Unit(N)			New
1	Cable Wire	82.00	35.55	39.11	Edit	Inventory	
2	Mild Steel Rod (High Grad	57.00	351.26	386.39	Edit	Inventory	
3	Mild Steel Rod (Low Grade	61.00	321.26	353.39	Edit	Inventory	
4	Mild Steel Sheet (High Gr	73.00	472.87	520.16	Edit	Inventory	
5	Mild Steel Sheet (Low Gra	13.00	451.87	497.06	Edit	Inventory	
6	Wood	59.00	106.95	117.65	Edit	Inventory	

Appendix IV (a) : Shedule of Production Process for Job 07/004

Job Description: [illegible] Commencement Date:

#	Date	Section	Unit	Order	Method	Duration(hrs)	Time	Activate
1	2007-07-10	Design & Engineering	DE002	1	Full Time	3.00	8 - 11	Pending
2	2007-07-10	Welding & Cutting	WDC002	2	Full Time	5.00	11 - 16	Pending
3	2007-07-10	Welding & Cutting	WDC003	2	Full Time	1.00	11 - 12	Pending
4	2007-07-10	Electrical	ELE001	3	Full Time	3.00	13 - 16	Pending
5	2007-07-11	Electrical	ELE001	3	Full Time	4.00	8 - 12	Pending
6	2007-07-11	Wood	WDW001	4	Full Time	4.00	12 - 16	Pending
7	2007-07-12	Wood	WDW001	4	Full Time	2.00	8 - 10	Pending
8	2007-07-12	Assembly & Finishing	ASF001	5	Full Time	5.00	10 - 15	Pending

Appendix IV (b) : Shedule of Production Process for Job 08/002

Job Description: 08/002 - Local Oven Commencement Date:

#	Date	Section	Unit	Order	Method	Duration(hrs)	Time	Activate
1	2007-08-09	Design & Engineering	DE002	1	Full Time	4.00	8 - 12	Pending
2	2007-08-09	Welding & Cutting	WDC001	2	Full Time	4.00	12 - 16	Pending
3	2007-08-09	Welding & Cutting	WDC002	2	Full Time	4.00	12 - 16	Pending
4	2007-08-09	Welding & Cutting	WDC001	2	Full Time	4.00	12 - 16	Pending
5	2007-08-10	Welding & Cutting	WDC002	2	Full Time	4.00	8 - 12	Pending
6	2007-08-10	Electrical	ELE001	3	Full Time	4.00	12 - 16	Pending
7	2007-08-11	Electrical	ELE001	3	Full Time	6.00	8 - 14	Pending
8	2007-08-11	Wood	WDW001	4	Full Time	2.00	14 - 16	Pending
9	2007-08-12	Wood	WDW001	4	Full Time	4.00	8 - 12	Pending
10	2007-08-12	Assembly & Finishing	ASF001	5	Full Time	4.00	12 - 16	Pending
11	2007-08-12	Assembly & Finishing	ASF002	5	Full Time	1.00	12 - 13	Pending

Appendix IV (c) : Shedule of Production Process for Job 09/001

Job Description: 09-001 Metal Chairs Commencement Date:

#	Date	Section	Unit	Order	Method	Duration(hrs)	Time	Activate
1	2007-09-04	Design & Engineering	DE001	1	Full Time	3.00	8 - 11	Pending
2	2007-09-04	Welding & Cutting	WDC001	2	Full Time	5.00	11 - 16	Pending
3	2007-09-04	Welding & Cutting	WDC002	2	Full Time	5.00	11 - 16	Pending
4	2007-09-04	Welding & Cutting	WDC003	2	Full Time	5.00	11 - 16	Pending
5	2007-09-05	Welding & Cutting	WDC001	2	Full Time	5.00	8 - 13	Pending
6	2007-09-05	Wood	WDW001	3	Full Time	3.00	13 - 16	Pending
7	2007-09-06	Wood	WDW001	3	Full Time	5.00	8 - 13	Pending
8	2007-09-06	Assembly & Finishing	ASF001	4	Full Time	3.00	13 - 16	Pending
9	2007-09-06	Assembly & Finishing	ASF002	4	Full Time	2.00	13 - 15	Pending

Appendix IV (d) : Shedule of Production Process for Job 10/004

Job Description: Bevel Gear Cutting Commencement Date: 2007/12/

#	Date	Section	Unit	Order	Method	Duration(hrs)	Time	Activate
1	2007-10-11	Design & Engineering	DE001	1	Full Time	4.00	8 - 12	Pending
2	2007-10-11	Milling	MLL 001	2	Full Time	4.00	12 - 16	Pending
3	2007-10-12	Milling	MLL 001	2	Full Time	2.00	8 - 10	Pending
4	2007-10-12	Assembly & Finishing	ASF001	3	Full Time	3.00	10 - 13	Pending

Appendix IV (e) : Shedule of Production Process for Job 11/001

Job Description: [illegible] Commencement Date: 2007/12/

#	Date	Section	Unit	Order	Method	Duration(hrs)	Time	Activate
1	2007-11-06	Design & Engineering	DE001	1	Full Time	6.00	8 - 14	Pending
2	2007-11-06	Welding & Cutting	WDC001	2	Full Time	2.00	14 - 16	Pending
3	2007-11-06	Welding & Cutting	WDC002	2	Full Time	2.00	14 - 16	Pending
4	2007-11-06	Welding & Cutting	WDC001	2	Full Time	2.00	14 - 16	Pending
5	2007-11-07	Welding & Cutting	WDC002	2	Full Time	7.00	8 - 15	Pending
6	2007-11-07	Assembly & Finishing	ASF001	3	Full Time	1.00	15 - 16	Pending
7	2007-11-07	Assembly & Finishing	ASF002	3	Full Time	1.00	15 - 16	Pending
8	2007-11-07	Assembly & Finishing	ASF001	3	Full Time	1.00	15 - 16	Pending
9	2007-11-08	Assembly & Finishing	ASF002	3	Full Time	7.00	8 - 15	Pending

Appendix IV (f) : Shedule of Production Process for Job 12/003

Job Description: [illegible] Commencement Date: 2007/12/

#	Date	Section	Unit	Order	Method	Duration(hrs)	Time	Activate
1	2007-12-11	Design & Engineering	DE002	1	Full Time	4.00	8 - 12	Pending
2	2007-12-11	Welding & Cutting	WDC001	2	Full Time	4.00	12 - 16	Pending
3	2007-12-11	Welding & Cutting	WDC002	2	Full Time	4.00	12 - 16	Pending
4	2007-12-11	Welding & Cutting	WDC001	2	Full Time	4.00	12 - 16	Pending
5	2007-12-12	Welding & Cutting	WDC002	2	Full Time	3.00	8 - 11	Pending
6	2007-12-12	Assembly & Finishing	ASF001	3	Full Time	5.00	11 - 16	Pending
7	2007-12-12	Assembly & Finishing	ASF002	3	Full Time	5.00	11 - 16	Pending

Appendix V (a) : Customer Invoice for Job 07/004

Customer Invoice

Description--07/004: Local Oven

XXXX
Km XX Ikirun Osogbo
Road, Osogbo. Osun -
State. Nigeria
18/12/2007.

BARAKAT Electrical
Company
No 3B Oba William
Ayeni Shopping
Complex, Ikirun

#	Item Description	Quantity	Unit Price	Amount	
1	Wood	12.00	117.65	1,411.80	
2	Mild Steel Sheet (High Gr	8.00	520.16	4,161.28	
3	Mild Steel Rod (High Grad	2.00	386.39	772.78	
4	Cable Wire	16.00	39.11	625.76	
			Subtotal		6,971.62

		Equipment		Manpower		Building		Utilities		Admin		
Section	Time(hr)	Rate/ hr	Amou nt	Rate/ hr	Amou nt	Rate/ hr	Amou nt	Rate/ hr	Amou nt	Rate/ hr	Amou nt	
Design & Engineer ing	3.00	45.75	137.2 5	314.5 2	1,037.9 1	15.34	57.53	6.38	43.03	53.66	160.9 8	1,436.7 0
Welding & Cutting	6.00	112.6 0	675.6 2	547.5 7	3,613.9 6	49.41	354.1 2	20.53	264.8 9	172.8 3	1,036. 96	5,945.5 5
Assembl y & Finishin g	5.00	58.09	290.4 4	918.1 5	4,820.3 0	47.34	327.4 6	19.67	244.9 5	165.6 0	827.9 8	6,511.1 3
Electrica l	7.00	475.0 7	3,325. 48	2,658. 05	20,466. 95	138.3 0	1,048. 74	57.47	784.4 8	483.7 2	3,386. 02	29,011. 67
Wood	6.00	542.3 0	3,253. 79	3,836. 09	28,770. 71	157.3 5	1,048. 97	65.39	784.6 6	550.3 5	3,302. 09	37,160. 22
	SubTotal		7,682. 58		2,836.82		2,122.01		58,709.84		8,714.02	
											Grand Total	73,364. 04

Estimated Due Date ---- 2007-07-12

Appendix V (b) : Customer Invoice for Job 08/002

Customer Invoice

Description--08/002: Local Oven

XXXX
Km XX Ikirun Osogbo Road, Osogbo. Osun State. Nigeria
18/12/2007.

COAST Farm
Km 12 Olomodidan-Ajaloro Rd. Ido Osun

#	Item Description	Quantity	Unit Price	Amount	
1	Cable Wire	16.00	39.11	625.76	
2	Mild Steel Rod (High Grad	6.00	386.39	2,318.34	
3	Mild Steel Sheet (High Gr	12.00	520.16	6,241.92	
4	Wood	13.00	117.65	1,529.45	
			Subtotal		10,715.47

		Equipment		Manpower		Building		Utilities		Admin		
Section	Time(hr)	Rate/hr	Amount	Rate/hr	Amount	Rate/hr	Amount	Rate/hr	Amount	Rate/hr	Amount	
Design & Engineering	4.00	45.75	183.00	314.52	1,383.88	15.34	72.87	6.38	54.51	53.66	214.64	1,908.90
Welding & Cutting	16.00	112.60	1,801.66	547.57	9,637.23	49.41	848.23	20.53	634.50	172.83	2,765.23	15,686.85
Assembl & Finishin	5.00	58.09	290.44	918.15	4,820.30	47.34	327.46	19.67	244.95	165.60	827.98	6,511.13
Electrica	10.00	475.07	4,750.69	2,658.05	29,238.51	138.30	1,463.63	57.47	1,094.83	483.72	4,837.16	41,384.81
Wood	6.00	542.30	3,253.79	3,836.09	28,770.71	157.35	1,048.97	65.39	784.66	550.35	3,302.09	37,160.22
	SubTotal		10,279.57		3,761.17		2,813.44		73,850.63		11,947.10	

Grand Total 94,845.67

Estimated Due Date ---- 2007-08-12

Appendix V (c) : Customer Invoice for Job 09/001

Customer Invoice

Description--09/001: Metal Chairs

XXXX
Km XX Ikirun Osogbo
Road, Osogbo, Osun
State, Nigeria
18/12/2007.

ARIYO Enterprises
Plot 54 Wole Ola Estate,
Ifetedo

#	Item Description	Quantity	Unit Price	Amount	
1	Mild Steel Rod (Low Grade	8.00	353.39	2,827.12	
2	Mild Steel Sheet (Low Gra	21.00	497.06	10,438.26	
			Subtotal		**13,265.38**

		Equipment		Manpower		Building		Utilities		Admin		
Section	Time(hr)	Rate/ hr	Amou nt	Rate/ hr	Amou nt	Rate/ hr	Amou nt	Rate/ hr	Amou nt	Rate/ hr	Amou nt	
Design & Engineer ing	3.00	45.75	137.2 5	314.5 2	1,037.9 1	15.34	57.53	6.38	43.03	53.66	160.9 8	1,436.7 0
Welding & Cutting	20.00	112.6 0	2,252. 07	547.5 7	12,046. 54	49.41	1,045. 88	20.53	782.3 4	172.8 3	3,456. 54	19,583. 37
Assembl y & Finishin g	5.00	58.09	290.4 4	918.1 5	4,820.3 0	47.34	327.4 6	19.67	244.9 5	165.6 0	827.9 8	6,511.1 3
Wood	8.00	542.3 0	4,338. 39	3,836. 09	38,360. 94	157.3 5	1,363. 66	65.39	1,020. 05	550.3 5	4,402. 79	49,485. 84
	SubTotal		**7,018. 15**		**2,794.54**		**2,090.38**		**56,265.70**		**8,848.28**	

	Grand Total	**76,549. 23**
Estimated Due Date ---- 2007-09-06		

Appendix V (d) : Customer Invoice for Job 07/004

Customer Invoice

Description--10/004: Gear Cutting

XXXX
Km XX Ikirun Osogbo Road, Osogbo, Osun State, Nigeria
18/12/2007.

Al-BARKAH Poultry
54 Oke Omi Funfun Street, Osogbo

#	Item Description	Quantity	Unit Price	Amount	
1	Mild Steel Rod (High Grad	4.00	397.46	1,589.84	
			Subtotal		1,589.84

		Equipment		Manpower		Building		Utilities		Admin		
Section	Time(hr)	Rate/ hr	Amount	Rate/ hr	Amount	Rate/ hr	Amount	Rate/ hr	Amount	Rate/ hr	Amount	
Design & Engineering	4.00	96.15	384.59	682.45	3,057.36	33.45	156.08	12.96	108.88	115.45	461.81	4,168.73
Milling	6.00	255.61	1,533.64	848.88	6,213.78	94.70	726.04	36.70	506.49	326.90	1,961.43	10,941.38
Assembly & Finishing	3.00	59.40	178.20	944.39	2,974.82	49.11	237.37	19.03	165.59	169.53	508.59	4,064.57
SubTotal			2,096.43		1,119.49		780.96		12,245.97		2,931.83	

	Grand Total	15,932.24
Estimated Due Date ---- 2007-10-12		

Appendix V (e) : Customer Invoice for Job 11/001

Customer Invoice

Description--11/001:Metal Doors

XXXX
Km XX Ikirun Osogbo Road, Osogbo, Osun State. Nigeria
18/12/2007.

BAYUS Enterprises
17 Ota Efun, Osogbo

#	Item Description	Quantity	Unit Price	Amount
1	Mild Steel Rod (Low Grade	10.00	360.28	3,602.80
2	Mild Steel Sheet (High Gr	12.00	524.70	6,296.40
3	Mild Steel Sheet (Low Gra	7.00	502.87	3,520.09
			Subtotal	**13,419.29**

		Equipment		Manpower		Building		Utilities		Admin		
Section	Time(hr)	Rate/ hr	Amou nt	Rate/ hr	Amou nt	Rate/ hr	Amou nt	Rate/ hr	Amou nt	Rate/ hr	Amou nt	
Design & Engineering	6.00	96.15	576.89	682.45	4,586.05	33.45	222.97	12.96	155.55	115.45	692.72	6,234.17
Welding & Cutting	13.00	114.43	1,487.57	560.45	8,233.07	51.26	727.83	19.86	507.74	176.93	2,300.14	13,256.36
Assembly & Finishing	10.00	59.40	593.99	944.39	9,916.05	49.11	581.15	19.03	405.41	169.53	1,695.30	13,191.91
	SubTotal		**2,658.45**		**1,531.95**		**1,068.70**		**22,735.17**		**4,688.16**	

Grand Total **38,812.92**

Estimated Due Date ---- 2007-11-08

Appendix V (f) : Customer Invoice for Job 12/003

Customer Invoice

Description--12/003: Water Tanks

XXXX
Km XX Ikirun Osogbo Road, Osogbo, Osun State, Nigeria
18/12/2007.

JOYFUL Bakery
No 15b Atetoro Street,
Osogbo

#	Item Description	Quantity	Unit Price	Amount	
1	Mild Steel Rod (Low Grade	7.00	360.28	2,521.96	
2	Mild Steel Sheet (High Gr	14.00	524.70	7,345.80	
			Subtotal		9,867.76

		Equipment		Manpower		Building		Utilities		Admin		
Section	Time(hr)	Rate/ hr	Amount	Rate/ hr	Amount	Rate/ hr	Amount	Rate/ hr	Amount	Rate/ hr	Amount	
Design & Engineering	4.00	96.15	384.59	682.45	3,057.36	33.45	156.08	12.96	108.88	115.45	461.81	4,168.73
Welding & Cutting	15.00	114.43	1,716.43	560.45	9,499.70	51.26	830.34	19.86	579.25	176.93	2,654.00	15,279.73
Assembly & Finishing	10.00	59.40	593.99	944.39	9,916.05	49.11	581.15	19.03	405.41	169.53	1,695.30	13,191.91
	SubTotal		2,695.01		1,567.57		1,093.55		22,473.12		4,811.12	

	Grand Total	35,035.89
	Estimated Due Date ---- 2007-12-12	

Appendix VI (a) : Cost Rates for Quarter 3

Cost Rates Sheet For Quarter 3

	Equipment Cost Rate	Manpower Cost Rate	Building Cost Rate	Utilities Cost Rate	Admin Cost Rate
Section	N/hr	N/hr	N/hr	N/hr	N/hr
Design & Engineering	45.75	314.52	15.34	6.38	53.66
Turning	300.81	936.98	80.17	33.31	280.40
Milling	283.01	829.91	91.29	37.94	319.32
Welding & Cutting	112.60	547.57	49.41	20.53	172.83
Assembly & Finishing	58.09	918.15	47.34	19.67	165.60
Electrical	475.07	2,658.05	138.30	57.47	483.72
Wood	542.30	3,836.09	157.35	65.39	550.35

Appendix VI (b) : Cost Rates for Quarter 4

Cost Rates Sheet For Quarter 4

	Equipment Cost Rate	Manpower Cost Rate	Building Cost Rate	Utilities Cost Rate	Admin Cost Rate
Section	N/hr	N/hr	N/hr	N/hr	N/hr
Design & Engineering	96.15	682.45	33.45	12.96	115.45
Turning	291.56	961.97	83.16	32.23	287.06
Milling	255.61	848.88	94.70	36.70	326.90
Welding & Cutting	114.43	560.45	51.26	19.86	176.93
Assembly & Finishing	59.40	944.39	49.11	19.03	169.53
Electrical	407.38	2,744.25	143.46	55.60	495.21
Wood	528.49	3,940.71	163.22	63.26	563.43

Appendix VII (a) : Daily Production Shedule for 10th July 2007

Work Sheet

Engaged Date: 2007-07-10 Fetch

#	Date	Job Description	Section	Unit	Operational Sequence	Mode of Operation	Duration(hrs)	Start & End Time
1	2007-07-10	07/003 :Machine Parts	Design & Engineering	DE001	1	Full Time	4.00	8 - 12
2	2007-07-10	07/003 :Machine Parts	Welding & Cutting	WDC001	2	Full Time	4.00	12 - 16
3	2007-07-10	07/003 :Machine Parts	Welding & Cutting	WDC002	2	Full Time	3.00	12 - 15
4	2007-07-10	07/003 :Machine Parts	Turning	TRN 002	3	Full Time	4.00	12 - 16
5	2007-07-10	07/003 :Machine Parts	Turning	TRN 001	3	Full Time	4.00	12 - 16
6	2007-07-10	07/004: Local Oven	Design & Engineering	DE002	1	Full Time	3.00	8 - 11
7	2007-07-10	07/004: Local Oven	Welding & Cutting	WDC002	2	Full Time	5.00	11 - 16
8	2007-07-10	07/004: Local Oven	Welding & Cutting	WDC003	2	Full Time	1.00	11 - 12
9	2007-07-10	07/004: Local Oven	Electrical	ELE001	3	Full Time	3.00	13 - 16

Appendix VII (b) : Daily Production Shedule for 22nd August 2007

Work Sheet

Engaged Date: 2007-08-22 Fetch

#	Date	Job Description	Section	Unit	Operational Sequence	Mode of Operation	Duration(hrs)	Start & End Time
1	2007-08-22	08/006: Local Oven	Electrical	ELE001	3	Full Time	2.00	8 - 10
2	2007-08-22	08/006: Local Oven	Wood	WDW001	4	Full Time	6.00	10 - 16
3	2007-08-22	08/006: Local Oven	Assembly & Finishing	ASF001	5	Full Time	2.00	14 - 16
4	2007-08-22	08/006: Local Oven	Assembly & Finishing	ASF002	5	Full Time	2.00	14 - 16

Appendix VII (c) : Daily Production Shedule for 21 September 2007

Work Sheet

Engaged Date: 2007-09-21 Fetch

#	Date	Job Description	Section	Unit	Operational Sequence	Mode of Operation	Duration(hrs)	Start & End Time
1	2007-09-21	09/006: Local Ovens	Electrical	ELE001	3	Full Time	2.00	8 - 10
2	2007-09-21	09/006: Local Ovens	Wood	WDW001	4	Full Time	5.00	10 - 15
3	2007-09-21	09/006: Local Ovens	Assembly & Finishing	ASF001	5	Full Time	3.00	13 - 16
4	2007-09-21	09/006: Local Ovens	Assembly & Finishing	ASF002	5	Full Time	1.00	13 - 14

Appendix VII (d) : Daily Production Schedule for 18th October 2007

Work Sheet

Engaged Date: 2007-10-18 Fetch

#	Date	Job Description	Section	Unit	Operational Sequence	Mode of Operation	Duration(hrs)	Start & End Time
1	2007-10-18	10/006: Prod. of Pulleys	Design & Engineering	DE001	1	Full Time	4.00	8 - 12
2	2007-10-18	10/006: Prod. of Pulleys	Welding & Cutting	WDC001	2	Full Time	4.00	12 - 16
3	2007-10-18	10/006: Prod. of Pulleys	Welding & Cutting	WDC002	2	Full Time	1.00	12 - 13
4	2007-10-18	10/006: Prod. of Pulleys	Milling	MLL 001	3	Full Time	4.00	12 - 16

Appendix VII (e) : Daily Production Shedule for 14th November 2007

Work Sheet

Engaged Date: 2007-11-14 Fetch

#	Date	Job Description	Section	Unit	Operational Sequence	Mode of Operation	Duration(hrs)	Start & End Time
1	2007-11-14	11/005: Machine Part	Milling	MLL 001	3	Full Time	5.00	8 - 13
2	2007-11-14	11/005: Machine Part	Welding & Cutting	WDC001	4	Full Time	3.00	13 - 16
3	2007-11-14	11/005: Machine Part	Welding & Cutting	WDC002	4	Full Time	1.00	13 - 14
4	2007-11-14	11/005: Machine Part	Assembly & Finishing	ASF001	5	Full Time	3.00	11 - 14

Appendix VII (f) : Daily Production Shedule for 11th December 2007

Work Sheet

Engaged Date:	2007-12-11	Fetch

#	Date	Job Description	Section	Unit	Operational Sequence	Mode of Operation	Duration(hrs)	Start & End Time
1	2007-12-11	12/001: Local Ovens	Electrical	ELE001	3	Full Time	7.00	8 - 15
2	2007-12-11	12/001: Local Ovens	Wood	WDW001	4	Full Time	1.00	15 - 16
3	2007-12-11	12/002: Machine Parts	Design & Engineering	DE001	1	Full Time	4.00	8 - 12
4	2007-12-11	12/002: Machine Parts	Turning	TRN 002	2	Full Time	4.00	12 - 16
5	2007-12-11	12/002: Machine Parts	Turning	TRN 001	2	Full Time	4.00	12 - 16
6	2007-12-11	12/003: Water Tanks	Design & Engineering	DE002	1	Full Time	4.00	8 - 12
7	2007-12-11	12/003: Water Tanks	Welding & Cutting	WDC001	2	Full Time	4.00	12 - 16
8	2007-12-11	12/003: Water Tanks	Welding & Cutting	WDC002	2	Full Time	4.00	12 - 16
9	2007-12-11	12/003: Water Tanks	Welding & Cutting	WDC001	2	Full Time	4.00	12 - 16
10	2007-12-11	12/004: Local Ovens	Design & Engineering	DE003	1	Full Time	4.00	8 - 12
11	2007-12-11	12/004: Local Ovens	Welding & Cutting	WDC002	2	Full Time	4.00	12 - 16
12	2007-12-11	12/004: Local Ovens	Electrical	ELE001	3	Full Time	1.00	15 - 16

Appendix VIII (a) : Shedule of Jobs in Design and Engineering Section

Work Sheet

Section: Design & Engineering Fetch

#	Date	Job Description	Section	Unit	Operational Sequence	Mode of Operation	Duration(hrs)	Start & End Time
1	2007-07-04	07/001 :Metal Window/Door	Design & Engineering	DE001	1	Full Time	4.00	8 - 12
2	2007-07-05	07/002:Machine Parts	Design & Engineering	DE001	1	Full Time	4.00	8 - 12
3	2007-07-10	07/003 :Machine Parts	Design & Engineering	DE001	1	Full Time	4.00	8 - 12
4	2007-07-10	07/004: Local Oven	Design & Engineering	DE002	1	Full Time	3.00	8 - 11
5	2007-07-12	07/005 : Shaft Cutting	Design & Engineering	DE001	1	Full Time	3.00	8 - 11
6	2007-07-26	07/006: Cylinder Boring	Design & Engineering	DE001	1	Full Time	3.00	8 - 11
7	2007-08-09	08/001: Cylinder Boring	Design & Engineering	DE001	1	Full Time	4.00	8 - 12
8	2007-08-09	08/002: Local Oven	Design & Engineering	DE002	1	Full Time	4.00	8 - 12
9	2007-08-15	08/003: Metal Doors	Design & Engineering	DE001	1	Full Time	4.00	8 - 12
10	2007-08-17	08/004: Machine Parts	Design & Engineering	DE001	1	Full Time	4.00	8 - 12
11	2007-08-17	08/005: Burglary Proof	Design & Engineering	DE002	1	Full Time	4.00	8 - 12
12	2007-08-21	08/006: Local Oven	Design & Engineering	DE001	1	Full Time	4.00	8 - 12
13	2007-09-04	09/001: Metal Chairs	Design & Engineering	DE001	1	Full Time	3.00	8 - 11
14	2007-09-11	09/002: Machine Parts	Design & Engineering	DE001	1	Full Time	4.00	8 - 12
15	2007-09-13	09/003: Local Ovens	Design & Engineering	DE001	1	Full Time	4.00	8 - 12
16	2007-09-19	09/004: Cylinder Boring	Design & Engineering	DE001	1	Full Time	3.00	8 - 11
17	2007-09-19	09/005: Shaft Cutting	Design & Engineering	DE002	1	Full Time	3.00	8 - 11
18	2007-09-20	09/006: Local Ovens	Design & Engineering	DE001	1	Full Time	4.00	8 - 12
19	2007-09-20	09/007: Shaft Cutting	Design & Engineering	DE002	1	Full Time	4.00	8 - 12
20	2007-09-27	09/008: Machine Parts	Design & Engineering	DE001	1	Full Time	3.00	8 - 11

Work Sheet

Section: Electrical Fetch

#	Date	Job Description	Section	Unit	Operational Sequence	Mode of Operation	Duration(hrs)	Start & End Time
1	2007-07-10	07/004: Local Oven	Electrical	ELE001	3	Full Time	3.00	13 - 16
2	2007-07-11	07/004: Local Oven	Electrical	ELE001	3	Full Time	4.00	8 - 12
3	2007-08-10	08/002: Local Oven	Electrical	ELE001	3	Full Time	4.00	12 - 16
4	2007-08-11	08/002: Local Oven	Electrical	ELE001	3	Full Time	6.00	8 - 14
5	2007-08-21	08/006: Local Oven	Electrical	ELE001	3	Full Time	4.00	12 - 16
6	2007-08-22	08/006: Local Oven	Electrical	ELE001	3	Full Time	2.00	8 - 10
7	2007-09-13	09/003: Local Ovens	Electrical	ELE001	3	Full Time	4.00	12 - 16
8	2007-09-14	09/003: Local Ovens	Electrical	ELE001	3	Full Time	4.00	8 - 12
9	2007-09-20	09/006: Local Ovens	Electrical	ELE001	3	Full Time	4.00	12 - 16
10	2007-09-21	09/006: Local Ovens	Electrical	ELE001	3	Full Time	2.00	8 - 10

Work Sheet

Section: Wood Fetch

#	Date	Job Description	Section	Unit	Operational Sequence	Mode of Operation	Duration(hrs)	Start & End Time
1	2007-07-11	07/004: Local Oven	Wood	WDW001	4	Full Time	4.00	12 - 16
2	2007-07-12	07/004: Local Oven	Wood	WDW001	4	Full Time	2.00	8 - 10
3	2007-08-11	08/002: Local Oven	Wood	WDW001	4	Full Time	2.00	14 - 16
4	2007-08-12	08/002: Local Oven	Wood	WDW001	4	Full Time	4.00	8 - 12
5	2007-08-22	08/006: Local Oven	Wood	WDW001	4	Full Time	6.00	10 - 16
6	2007-09-05	09/001: Metal Chairs	Wood	WDW001	3	Full Time	3.00	13 - 16
7	2007-09-06	09/001: Metal Chairs	Wood	WDW001	3	Full Time	5.00	8 - 13
8	2007-09-14	09/003: Local Ovens	Wood	WDW001	4	Full Time	4.00	12 - 16
9	2007-09-15	09/003: Local Ovens	Wood	WDW001	4	Full Time	2.00	8 - 10
10	2007-09-21	09/006: Local Ovens	Wood	WDW001	4	Full Time	5.00	10 - 15

Appendix VIII (d) : Schedule of Jobs in Turning Section in Qtr. 4

Work Sheet

Section: Turning Fetch

#	Date	Job Description	Section	Unit	Operational Sequence	Mode of Operation	Duration(hrs)	Start & End Time
1	2007-10-05	10/001: Machine Parts	Turning	TRN 002	3	Full Time	4.00	12 - 16
2	2007-10-05	10/002: Shaft Cutting	Turning	TRN 002	2	Full Time	4.00	12 - 16
3	2007-10-05	10/002: Shaft Cutting	Turning	TRN 001	2	Full Time	4.00	12 - 16
4	2007-10-06	10/001: Machine Parts	Turning	TRN 001	3	Full Time	3.00	8 - 11
5	2007-10-11	10/003: Machine Parts	Turning	TRN 002	4	Full Time	5.00	11 - 16
6	2007-10-11	10/003: Machine Parts	Turning	TRN 001	4	Full Time	2.00	11 - 13
7	2007-10-11	10/005: Shaft Cutting	Turning	TRN 001	3	Full Time	4.00	12 - 16
8	2007-10-11	10/005: Shaft Cutting	Turning	TRN 002	3	Full Time	3.00	13 - 16
9	2007-10-22	10/007: Shaft Cutting	Turning	TRN 002	3	Full Time	4.00	12 - 16
10	2007-10-22	10/007: Shaft Cutting	Turning	TRN 001	3	Full Time	3.00	12 - 15
11	2007-10-25	10/008: Cylinder Boring	Turning	TRN 002	2	Full Time	4.00	12 - 16
12	2007-10-25	10/008: Cylinder Boring	Turning	TRN 001	2	Full Time	4.00	12 - 16
13	2007-10-25	10/010: Machine Parts	Turning	TRN 002	3	Full Time	4.00	12 - 16
14	2007-10-25	10/010: Machine Parts	Turning	TRN 001	3	Full Time	3.00	12 - 15
15	2007-11-08	11/004: Shaft Cutting	Turning	TRN 002	2	Full Time	4.00	12 - 16
16	2007-11-08	11/004: Shaft Cutting	Turning	TRN 001	2	Full Time	4.00	12 - 16
17	2007-11-13	11/005: Machine Part	Turning	TRN 002	2	Full Time	4.00	12 - 16
18	2007-11-13	11/005: Machine Part	Turning	TRN 001	2	Full Time	4.00	12 - 16
19	2007-11-17	11/006: Machine Part	Turning	TRN 002	3	Full Time	1.00	15 - 16

20	2007-11-17	11/006: Machine Part	Turning	TRN 001	3	Full Time	1.00	15 - 16
21	2007-11-18	11/006: Machine Part	Turning	TRN 002	3	Full Time	3.00	8 - 11
22	2007-11-21	11/007: Cylinder Boring	Turning	TRN 002	2	Full Time	4.00	12 - 16
23	2007-11-21	11/007: Cylinder Boring	Turning	TRN 001	2	Full Time	3.00	12 - 15
24	2007-11-21	11/008:Machine Parts	Turning	TRN 001	3	Full Time	5.00	11 - 16
25	2007-11-21	11/008:Machine Parts	Turning	TRN 002	3	Full Time	4.00	12 - 16
26	2007-11-22	11/008:Machine Parts	Turning	TRN 001	3	Full Time	1.00	8 - 9
27	2007-11-22	11/009:Machine Parts	Turning	TRN 002	2	Full Time	4.00	12 - 16
28	2007-11-22	11/009:Machine Parts	Turning	TRN 001	2	Full Time	4.00	12 - 16
29	2007-12-11	12/002: Machine Parts	Turning	TRN 002	2	Full Time	4.00	12 - 16
30	2007-12-11	12/002: Machine Parts	Turning	TRN 001	2	Full Time	4.00	12 - 16
31	2007-12-12	12/002: Machine Parts	Turning	TRN 002	2	Full Time	1.00	8 - 9
32	2007-12-19	12/005: Machine Parts	Turning	TRN 002	3	Full Time	4.00	12 - 16
33	2007-12-19	12/005: Machine Parts	Turning	TRN 001	3	Full Time	4.00	12 - 16
34	2007-12-20	12/005: Machine Parts	Turning	TRN 002	3	Full Time	1.00	8 - 9

Appendix VIII (e) : Schedule of Jobs in Milling Section in Qtr. 4

Work Sheet

Section: Milling Fetch

#	Date	Job Description	Section	Unit	Operational Sequence	Mode of Operation	Duration(hrs)	Start & End Time
1	2007-10-06	10/001: Machine Parts	Milling	MLL 001	4	Full Time	5.00	11 – 16
2	2007-10-10	10/003: Machine Parts	Milling	MLL 001	3	Full Time	5.00	11 – 16
3	2007-10-11	10/003: Machine Parts	Milling	MLL 001	3	Full Time	3.00	8 – 11
4	2007-10-11	10/004: Gear Cutting	Milling	MLL 001	2	Full Time	4.00	12 – 16
5	2007-10-12	10/004: Gear Cutting	Milling	MLL 001	2	Full Time	2.00	8 – 10
6	2007-10-18	10/006: Prod. of Pulleys	Milling	MLL 001	3	Full Time	4.00	12 – 16
7	2007-10-19	10/006: Prod. of Pulleys	Milling	MLL 001	3	Full Time	2.00	8 – 10
8	2007-10-25	10/010: Machine Parts	Milling	MLL 001	4	Full Time	4.00	12 – 16
9	2007-10-26	10/010: Machine Parts	Milling	MLL 001	4	Full Time	3.00	8 – 11
10	2007-11-13	11/005: Machine Part	Milling	MLL 001	3	Full Time	4.00	12 – 16
11	2007-11-14	11/005: Machine Part	Milling	MLL 001	3	Full Time	5.00	8 – 13
12	2007-11-16	11/006: Machine Part	Milling	MLL 001	2	Full Time	3.00	13 – 16
13	2007-11-17	11/006: Machine Part	Milling	MLL 001	2	Full Time	7.00	8 – 15
14	2007-11-22	11/009:Machine Parts	Milling	MLL 001	3	Full Time	4.00	12 – 16
15	2007-11-23	11/009:Machine Parts	Milling	MLL 001	3	Full Time	4.00	8 – 12
16	2007-11-26	11/012:Prod. of Pulleys	Milling	MLL 001	3	Full Time	4.00	12 – 16
17	2007-11-26	11/013: Gear Cutting	Milling	MLL 001	2	Full Time	4.00	12 – 16
18	2007-11-27	11/012:Prod. of Pulleys	Milling	MLL 001	3	Full Time	7.00	8 – 15
19	2007-	11/013: Gear	Milling	MLL	2	Full Time	1.00	15 –

	11-27	Cutting		001				16
20	2007-11-28	11/013: Gear Cutting	Milling	MLL001	2	Full Time	3.00	8 - 11
21	2007-12-12	12/002: Machine Parts	Milling	MLL001	3	Full Time	7.00	9 – 16
22	2007-12-13	12/002: Machine Parts	Milling	MLL001	3	Full Time	2.00	8 – 10
23	2007-12-20	12/005: Machine Parts	Milling	MLL001	4	Full Time	7.00	9 – 16
24	2007-12-21	12/005: Machine Parts	Milling	MLL001	4	Full Time	2.00	8 – 10

Appendix VIII (f) : Schedule of Jobs in Welding and Cutting Section in Qtr. 4

Work Sheet

Section: Welding & Cutting Fetch

#	Date	Job Description	Section	Unit	Operational Sequence	Mode of Operation	Duration(hrs)	Start & End Time
1	2007-10-05	10/001: Machine Parts	Welding & Cutting	WDC001	2	Full Time	4.00	12 - 16
2	2007-10-05	10/001: Machine Parts	Welding & Cutting	WDC002	2	Full Time	1.00	12 - 13
3	2007-10-10	10/003: Machine Parts	Welding & Cutting	WDC001	2	Full Time	3.00	12 - 15
4	2007-10-11	10/005: Shaft Cutting	Welding & Cutting	WDC001	2	Full Time	4.00	12 - 16
5	2007-10-18	10/006: Prod. of Pulleys	Welding & Cutting	WDC001	2	Full Time	4.00	12 - 16
6	2007-10-18	10/006: Prod. of Pulleys	Welding & Cutting	WDC002	2	Full Time	1.00	12 - 13
7	2007-10-22	10/007: Shaft Cutting	Welding & Cutting	WDC001	2	Full Time	4.00	12 - 16
8	2007-10-25	10/009: Water Tanks	Welding & Cutting	WDC001	2	Full Time	2.00	14 - 16
9	2007-10-25	10/009: Water Tanks	Welding & Cutting	WDC002	2	Full Time	2.00	14 - 16
10	2007-10-25	10/009: Water Tanks	Welding & Cutting	WDC001	2	Full Time	2.00	14 - 16
11	2007-10-25	10/010: Machine Parts	Welding & Cutting	WDC001	2	Full Time	3.00	13 - 16
12	2007-10-25	10/010: Machine Parts	Welding & Cutting	WDC002	2	Full Time	2.00	13 - 15
13	2007-10-26	10/009: Water Tanks	Welding &	WDC002	2	Full Time	2.00	8 – 10

			Cutting					
14	2007-11-06	11/001:Metal Doors	Welding & Cutting	WDC001	2	Full Time	2.00	14 – 16
15	2007-11-06	11/001:Metal Doors	Welding & Cutting	WDC002	2	Full Time	2.00	14 – 16
16	2007-11-06	11/001:Metal Doors	Welding & Cutting	WDC001	2	Full Time	2.00	14 – 16
17	2007-11-07	11/001:Metal Doors	Welding & Cutting	WDC002	2	Full Time	7.00	8 – 15
18	2007-11-07	11/002:Local Ovens	Welding & Cutting	WDC001	2	Full Time	4.00	12 – 16
19	2007-11-07	11/002:Local Ovens	Welding & Cutting	WDC003	2	Full Time	3.00	12 – 15
20	2007-11-07	11/003: Burglary Proof	Welding & Cutting	WDC001	2	Full Time	3.00	13 – 16
21	2007-11-07	11/003: Burglary Proof	Welding & Cutting	WDC003	2	Full Time	3.00	13 – 16
22	2007-11-07	11/003: Burglary Proof	Welding & Cutting	WDC003	2	Full Time	2.00	14 – 16
23	2007-11-08	11/003: Burglary Proof	Welding & Cutting	WDC001	2	Full Time	8.00	8 – 16
24	2007-11-08	11/003: Burglary Proof	Welding & Cutting	WDC002	2	Full Time	6.00	8 – 14
25	2007-11-14	11/005: Machine Part	Welding & Cutting	WDC001	4	Full Time	3.00	13 – 16
26	2007-11-14	11/005: Machine Part	Welding & Cutting	WDC002	4	Full Time	1.00	13 – 14
27	2007-11-18	11/006: Machine Part	Welding & Cutting	WDC001	4	Full Time	4.00	11 – 15
28	2007-11-21	11/008:Machine Parts	Welding & Cutting	WDC001	2	Full Time	3.00	13 – 16
29	2007-11-21	11/008:Machine Parts	Welding & Cutting	WDC002	2	Full Time	2.00	13 – 15
30	2007-11-23	11/009:Machine Parts	Welding & Cutting	WDC001	4	Full Time	4.00	12 – 16
31	2007-	11/010:Water	Welding	WDC001	2	Full Time	4.00	12 –

	11-26	Tanks	& Cutting					16
32	2007-11-26	11/011: Repair of Chairs	Welding & Cutting	WDC0012		Full Time	4.00	12 – 16
33	2007-11-26	11/011: Repair of Chairs	Welding & Cutting	WDC0022		Full Time	4.00	12 – 16
34	2007-11-26	11/011: Repair of Chairs	Welding & Cutting	WDC0032		Full Time	3.00	12 – 15
35	2007-11-26	11/012:Prod. of Pulleys	Welding & Cutting	WDC0022		Full Time	4.00	12 – 16
36	2007-11-26	11/012:Prod. of Pulleys	Welding & Cutting	WDC0032		Full Time	1.00	12 – 13
37	2007-11-28	11/013: Gear Cutting	Welding & Cutting	WDC0013		Full Time	4.00	11 – 15
38	2007-12-10	12/001: Local Ovens	Welding & Cutting	WDC0012		Full Time	4.00	12 – 16
39	2007-12-10	12/001: Local Ovens	Welding & Cutting	WDC0022		Full Time	3.00	12 – 15
40	2007-12-11	12/003: Water Tanks	Welding & Cutting	WDC0012		Full Time	4.00	12 – 16
41	2007-12-11	12/003: Water Tanks	Welding & Cutting	WDC0022		Full Time	4.00	12 – 16
42	2007-12-11	12/003: Water Tanks	Welding & Cutting	WDC0012		Full Time	4.00	12 – 16
43	2007-12-11	12/004: Local Ovens	Welding & Cutting	WDC0022		Full Time	4.00	12 – 16
44	2007-12-12	12/003: Water Tanks	Welding & Cutting	WDC0022		Full Time	3.00	8 – 11
45	2007-12-13	12/002: Machine Parts	Welding & Cutting	WDC0014		Full Time	6.00	10 – 16
46	2007-12-19	12/005: Machine Parts	Welding & Cutting	WDC0012		Full Time	4.00	12 – 16
47	2007-12-19	12/005: Machine Parts	Welding & Cutting	WDC0022		Full Time	3.00	12 – 15

Appendix VIII (g) : Schedule of Jobs in Assembly and Fitting Section in Qtr. 4

Work Sheet

Section: Assembly & Finishing Fetch

#	Date	Job Description	Section	Unit	Operational Sequence	Mode of Operation	Duration(hrs)	Start & End Time
1	2007-10-05	10/001: Machine Parts	Assembly & Finishing	ASF001	3	Full Time	3.00	12 - 15
2	2007-10-05	10/002: Shaft Cutting	Assembly & Finishing	ASF001	3	Full Time	3.00	12 - 15
3	2007-10-11	10/003: Machine Parts	Assembly & Finishing	ASF001	5	Full Time	3.00	13 - 16
4	2007-10-11	10/005: Shaft Cutting	Assembly & Finishing	ASF001	4	Full Time	3.00	12 - 15
5	2007-10-12	10/004: Gear Cutting	Assembly & Finishing	ASF001	3	Full Time	3.00	10 - 13
6	2007-10-19	10/006: Prod. of Pulleys	Assembly & Finishing	ASF001	4	Full Time	3.00	10 - 13
7	2007-10-22	10/007: Shaft Cutting	Assembly & Finishing	ASF001	4	Full Time	3.00	12 - 15
8	2007-10-25	10/008: Cylinder Boring	Assembly & Finishing	ASF001	3	Full Time	3.00	12 - 15
9	2007-10-26	10/009: Water Tanks	Assembly & Finishing	ASF001	3	Full Time	4.00	10 - 14
10	2007-10-26	10/010: Machine Parts	Assembly & Finishing	ASF002	5	Full Time	3.00	11 – 14

11	2007-11-07	11/001:Metal Doors	Assembly & Finishing	ASF001	3	Full Time	1.00	15 – 16
12	2007-11-07	11/001:Metal Doors	Assembly & Finishing	ASF002	3	Full Time	1.00	15 – 16
13	2007-11-07	11/001:Metal Doors	Assembly & Finishing	ASF001	3	Full Time	1.00	15 – 16
14	2007-11-08	11/001:Metal Doors	Assembly & Finishing	ASF002	3	Full Time	7.00	8 – 15
15	2007-11-08	11/002:Local Ovens	Assembly & Finishing	ASF001	4	Full Time	2.00	14 – 16
16	2007-11-08	11/002:Local Ovens	Assembly & Finishing	ASF003	4	Full Time	1.00	14 – 15
17	2007-11-08	11/004: Shaft Cutting	Assembly & Finishing	ASF001	3	Full Time	3.00	12 – 15
18	2007-11-09	11/003: Burglary Proof	Assembly & Finishing	ASF001	3	Full Time	8.00	8 – 14
19	2007-11-10	11/003: Burglary Proof	Assembly & Finishing	ASF001	3	Full Time	6.00	8 – 14
20	2007-11-14	11/005: Machine Part	Assembly & Finishing	ASF001	5	Full Time	3.00	11 – 14
21	2007-11-18	11/006: Machine Part	Assembly & Finishing	ASF001	5	Full Time	3.00	12 – 15
22	2007-11-21	11/007: Cylinder Boring	Assembly & Finishing	ASF001	3	Full Time	3.00	12 – 15
23	2007-11-22	11/008:Machine Parts	Assembly & Finishing	ASF001	4	Full Time	5.00	9 – 14
24	2007-11-23	11/009:Machine Parts	Assembly & Finishing	ASF001	5	Full Time	4.00	12 – 16
25	2007-11-26	11/010:Water Tanks	Assembly & Finishing	ASF001	3	Full Time	4.00	12 – 16
26	2007-11-26	11/011: Repair of Chairs	Assembly & Finishing	ASF001	3	Full Time	4.00	12 – 16
2	2007	11/011: Repair	Assembl	ASF00	3	Full Time	3.00	12 –

7	-11-26	of Chairs	y & Finishing	2				15
28	2007-11-27	11/012:Prod. of Pulleys	Assembly & Finishing	ASF001	4	Full Time	1.00	15 – 16
29	2007-11-27	11/012:Prod. of Pulleys	Assembly & Finishing	ASF002	4	Full Time	1.00	15 – 16
30	2007-11-27	11/012:Prod. of Pulleys	Assembly & Finishing	ASF001	4	Full Time	1.00	15 – 16
31	2007-11-28	11/012:Prod. of Pulleys	Assembly & Finishing	ASF002	4	Full Time	2.00	8 – 10
32	2007-11-28	11/013: Gear Cutting	Assembly & Finishing	ASF001	4	Full Time	3.00	12 – 15
33	2007-12-12	12/003: Water Tanks	Assembly & Finishing	ASF001	3	Full Time	5.00	11 – 16
34	2007-12-12	12/003: Water Tanks	Assembly & Finishing	ASF002	3	Full Time	5.00	11 – 16
35	2007-12-13	12/002: Machine Parts	Assembly & Finishing	ASF001	5	Full Time	2.00	14 – 16
36	2007-12-13	12/002: Machine Parts	Assembly & Finishing	ASF002	5	Full Time	2.00	14 – 16
37	2007-12-14	12/004: Local Ovens	Assembly & Finishing	ASF001	5	Full Time	1.00	15 – 16
38	2007-12-14	12/004: Local Ovens	Assembly & Finishing	ASF002	5	Full Time	1.00	15 – 16
39	2007-12-14	12/004: Local Ovens	Assembly & Finishing	ASF001	5	Full Time	1.00	15 – 16
40	2007-12-15	12/004: Local Ovens	Assembly & Finishing	ASF002	5	Full Time	4.00	8 – 12
41	2007-12-21	12/005: Machine Parts	Assembly & Finishing	ASF001	5	Full Time	5.00	10 – 15

```
<?php
$deductval=$vtime;
while ($deductval > 0){

        //To select equipunit Id

        //initialises the variables
        $olddate="";
        $oldremtime="";
        $oldequipunitid="";

        $selequipunit=selequipunitfunc($pequipid);
        while ($equipunitrow = mysql_fetch_array($selequipunit)){
                $equipunitid=$equipunitrow["equipunit_id"];

                //ends
                //New Starts from here with full method

                $vfullmethod="full";
                $vovermethod="over";

        $posfulldate=possibledate($pdate,$vfullmethod,$equipid,$equipunitid,$workti
meval,$pconc);

        $chkremainfulltime=confdate($posfulldate,$vfullmethod,$equipid,$equipuniti
d,$worktimeval,$pconc);
        $posoverdate=possibledate($pdate,$vovermethod,$equipid,$equipunitid,$wor
ktime2val,$pconc);

        $chkremainovertime=confdate($posoverdate,$vovermethod,$equipid,$equipu
nitid,$worktime2val,$pconc);
                if ($posfulldate <= $posoverdate){
                        $newdate=$posfulldate;
                        $newmethod=$vfullmethod;
                        $newremtime=$chkremainfulltime;
                        $newequipunitid=$equipunitid;
                }else{
                        $newdate=$posoverdate;
                        $newmethod=$vovermethod;
                        $newremtime=$chkremainovertime;
                        $newequipunitid=$equipunitid;
                }

//To compare the date
                if (($olddate <= $newdate) and ($olddate!="")){
                        $olddate=$olddate;
                        $oldequipunitid=$oldequipunitid;
                        $oldremtime=$oldremtime;
```

```
                $oldmethod=$oldmethod;

        }else{
                $olddate=$newdate;
                $oldremtime=$newremtime;
                $oldequipunitid=$newequipunitid;
                $oldmethod=$newmethod;
        }

    }//end while

                $realremtime=$oldremtime;
                $realequipunitid=$oldequipunitid;
                $realposdate=$olddate;
                $vmethod=$oldmethod;
                if ($vmethod=="full"){
                        $dayend=16;$daystart=08;//Opening and Closing Time
of the day
                }else{
                $dayend=20;$daystart=16;
                }
                //To confirm this segment
// Handling concurenccy issue
    $countquipunit=countquipunitfunc($pjobid,$pequipid,$vmethod,$realposdate)
;
    while ($countquipunitrow = mysql_fetch_array($countquipunit)){
        $countno=$countquipunitrow["countno"];
        //echo "Count No= $countno";
    }

    if ($countno >= $vconc){
        $pdate=incrdate($realposdate);
<tr><td height="75%">
    <table border="1" bordercolor="#000000" width="100%"
height="100%" class="tblstyle" align="center">
    <tr height="5%"><th width="5%">#</th><th
width="36%">Item Description</th><th
width="12%">Quantity</th><th width="13%">Unit
Price</th><th width="18%">Amount</th><th
width="15%"></th></tr>
    <tr><td colspan="5" valign="top">
        <table border="1" bordercolor="#000000"
width="100%" class="tblstyle" align="center">
                    <?php
                        $incr=1;
                    while ($matcostrow =
mysql_fetch_array($matcostlist)){

    $matid=$matcostrow["mat_id"];
```

```
      $matdescrip=$matcostrow["mat_descrip"];

      $matquant=$matcostrow["mat_quant"];

      $matcost=$matcostrow["mat_cost"];
                              $matamount=$matquant * $matcost;
                              $totalmatamount=$matamount +
$totalmatamount;
                              ?>
                        <tr><td width="5%"><?php echo
$incr++?></td><td width="42%"><?php echo
$matdescrip?></td><td width="13%"><?php echo
$matquant?></td><td width="15%"><?php echo
number_format($matcost,2) ?></td><td align="right"
width="20%"><?php echo
number_format($matamount,2)?></td></tr>
                        <?
                              }
                  ?>
      </table>
      </td><td width="15%"></td></tr>
      <tr height="5%"><td></td><td colspan="3"
align="right"><b>Subtotal</b></td><td
colspan="2"align="right"><b><?php echo
number_format($totalmatamount,2)?></b></td></tr>
      <tr height="5%"><td colspan="6">
      <br>
      <table border="1" bordercolor="#000000" width="100%"
class="tblstyle" align="center">
      <tr><th colspan="2"></th><th
colspan="2">Equipment</th><th
colspan="2">Manpower</th><th colspan="2">Building</th><th
colspan="2">Utilities</th><th
colspan="2">Admin</th><th></th></tr>
      <tr><th>Section</th><th>Time(hr)</th><th>Rate/hr</th
><th>Amount</td><th>Rate/hr</th><th>Amount</th><th>Rate/h
r</th><th>Amount</th><th>Rate/hr</th><th>Amount</th><th>R
ate/hr</th><th>Amount</th><th></th></tr>
      <?php
      include("fsCalculationFunc.inc");
      ?>
<?php
      ////////////////////////////////Cost
Determination//////////////////////
            //$jobequipcostsql="select
a.equip_id,sum(a.schedule_time)TimeSpent from fs_schedule
a group by a.equip_id";
            $jobequipcostsql="select
a.equip_id,b.equip_descrip,waitingtime,mantimefactor,util
ityfactor,sum(a.schedule_time)TimeSpent,max(a.schedule_da
```

```
te)date from fs_schedule a,fs_equipment b where
a.equip_id=b.equip_id and a.job_id='$jobid' group by
a.equip_id";
                $jobequipcostsel =
MYSQL_QUERY($jobequipcostsql);
                $SectionalEquipGrandCost=0;
                $SectionalEquipAmount=0;
     while ($jobequipcostrow =
mysql_fetch_array($jobequipcostsel)){
                $equipid=$jobequipcostrow["equip_id"];

     $equip_descrip=$jobequipcostrow["equip_descrip"];

     $waitingtime=$jobequipcostrow["waitingtime"];

     $mantimefactor=$jobequipcostrow["mantimefactor"];

     $utilityfactor=$jobequipcostrow["utilityfactor"];
                $TimeSpent=$jobequipcostrow["TimeSpent"];
                $probabledate=$jobequipcostrow["date"];
                $fieldtype="Equipment";
                $Buildfieldtype="Building";
                $Utilityfieldtype="Utilities";
                $fieldManpowertype="Manpower";

     $EquipmentRate=EquipmentRatefunc($equipid,$fieldtype
);
     $BuildingRate=BuildingRatefunc($equipid,$Buildfieldt
ype);
     $UtilityRate=UtilityRatefunc($equipid,$Utilityfieldt
ype);
     $ManpowerRate=ManPowerRatefunc($equipid,$fieldManpow
ertype);
     $AdminRate=AdminRatefunc($equipid,$fieldManpowertype
);              $SectionalEquipAmount=$EquipmentRate
*$TimeSpent;
     $SectionalBuildAmount=$BuildingRate * ($TimeSpent +
($waitingtime/60));
                $SectionalUtilityAmount=$UtilityRate *
((100 + $utilityfactor)/100) *
($TimeSpent+($waitingtime/60));
                $SectionalManpowerAmount=$ManpowerRate *
$TimeSpent * ((100 + $mantimefactor)/100);
                $SectionalAdminAmount=$AdminRate *
$TimeSpent;

     $SectionalManpEquipAmount=$SectionalEquipAmount +
$SectionalManpowerAmount + $SectionalBuildAmount +
$SectionalUtilityAmount + $SectionalAdminAmount;
```

```
    $SectionalEquipGrandCost=$SectionalEquipGrandCost +
$SectionalEquipAmount;

    $SectionalBuildGrandCost=$SectionalBuildGrandCost +
$SectionalBuildAmount;

    $SectionalUtilityGrandCost=$SectionalUtilityGrandCos
t + $SectionalUtilityAmount;

    $SectionalManpGrandCost=$SectionalManpGrandCost +
$SectionalManpowerAmount;

    $SectionalAdminGrandCost=$SectionalAdminGrandCost +
$SectionalAdminAmount;
    ?>
    <tr><td><?php echo $equip_descrip?></td><td><?php
echo number_format($TimeSpent,2)?></td><td
align="right"><?php echo
number_format($EquipmentRate,2)?></td><td
align="right"><?php echo
number_format($SectionalEquipAmount,2)?></td><td
align="right"><?php echo
number_format($ManpowerRate,2)?></td><td
align="right"><?php echo
number_format($SectionalManpowerAmount,2)?></td><td
align="right"><?php echo
number_format($BuildingRate,2)?></td><td
align="right"><?php echo
number_format($SectionalBuildAmount,2)?></td><td
align="right"><?php echo
number_format($UtilityRate,2)?></td><td
align="right"><?php echo
number_format($SectionalUtilityAmount,2)?></td><td
align="right"><?php echo
number_format($AdminRate,2)?></td><td align="right"><?php
echo number_format($SectionalAdminAmount,2)?></td><td
align="right"><?php echo
number_format($SectionalManpEquipAmount,2)?></td></tr>
<?
    }

?>
    <tr><td colspan="3"
align="right"><b>SubTotal</b></td><td
align="right"><b><?php echo
number_format($SectionalEquipGrandCost,2)?></b></td><td
colspan="2" align="right"><b><?php echo
number_format($SectionalBuildGrandCost,2)?></b></td><td
colspan="2" align="right"><b><?php echo
number_format($SectionalUtilityGrandCost,2)?></b></td><td
```

```
colspan="2" align="right"><b><?php echo
number_format($SectionalManpGrandCost,2)?></b></td><td
colspan="2" align="right"><b><?php echo
number_format($SectionalAdminGrandCost,2)?></b></td></tr>
     </table>
     </td><td align="right"><?php echo
$overheadamount?></td></tr>
     <tr height="5%"><td></td><td colspan="9"
align="right"><b>Grand Total</b></td><td colspan="2"
align="right"><b><?php echo
number_format($SectionalEquipGrandCost+$SectionalManpGran
dCost+$totalmatamount,2)?></b></td></tr>
     <tr height="5%"><td></td><td colspan="11"
align="left"><b><i>Estimated Completion Date ---- <?php
echo $probabledate?></i></b></td></tr>
</td></tr>
</table>
</form>
</body>
</html>
```

```
<html>
<head><title>Customer List</title>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<SCRIPT LANGUAGE="JavaScript1.1">
<!--
function customersetup(customerid){
//customerid=22;
window.open('fs_customersetup.php?customerid='+customerid
+'',"Notification");
}
-->
</SCRIPT>
<?php
if ($_POST[btnnew]) {
          $url_redirect = "Location:
fs_customersetup.php?";
          header($url_redirect);
          exit;
}
include("fsmysqlinc.inc");
$custsql="select  cust_id,
cust_descrip,contact_person,cust_address,join_date from
fs_customer order by  cust_descrip  asc";
$selcust = MYSQL_QUERY($custsql);
?>
</head>
<body class="body">
<center>
```

```
<center><font color="green" size=4>Customer
List</font></center>
<form method="Post" name="custselection">
<table border="1" bordercolor="#000000" width="80%"
class="tblstyle" align="center">
     <tr bgcolor="#D0ECE0"><th>#
</th><th>Description</th><th>Contact
Person</th><th>Address</th><th>action</th><th>
     <input type="submit" value="New" name="btnnew"
class="colorbtn">
</th></tr>
                                                  <?php
                                                  $incrno=1;
                                                  while
($mydescriprow = mysql_fetch_array($selcust)){
               $selcustid=$mydescriprow["cust_id"];

     $seldescrip=$mydescriprow["cust_descrip"];
     $contactperson=$mydescriprow["contact_person"];
     $custaddress=$mydescriprow["cust_address"];
     $join_date=$mydescriprow["join_date"];
     $clickbtn="btn$selcustid";
     ?>
     <tr><td><?echo $incrno++?></td><td><?echo
$seldescrip?></td><td><?echo
$contactperson?></td><td><?echo $custaddress?></td><td><a
href="fs_customersetup.php?customerid=<?php echo
$selcustid?>" class="whitelink">Edit</a></td></tr>
<?}?>
</table>
</form>
</body>
</html>
```

```
<html>
<head><title>Customer Registration</title>
<script src="libraries/functions.js"
type="text/javascript" language="javascript"></script>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<?php
include("fsmysqlinc.inc");
include("fsqueryfunctions.inc");
$customerid=$_GET[customerid];
if ($customerid !=""){
     $descripsql="select
cust_id,cust_descrip,cust_address,contact_person,effstatu
s from fs_customer where cust_id='$customerid'";
     $descripreg = MYSQL_QUERY($descripsql);
     $custid= mysql_result($descripreg,0,"cust_id");
     $descrip=
mysql_result($descripreg,0,"cust_descrip");
```

```
      $custadd=
mysql_result($descripreg,0,"cust_address");
      $contpers=
mysql_result($descripreg,0,"contact_person");
      $effstatus= mysql_result($descripreg,0,"effstatus");
}
if ($_POST[regbtn]) {
      $cust_idsql="select cust_id from fs_customer where
cust_id='$customerid'";
      $cust_idreg = MYSQL_QUERY($cust_idsql);
      if    ($custrow=mysql_fetch_array($cust_idreg)){
            $custregsql="update fs_customer set
cust_descrip='" . addslashes($_POST[customername]) .
"',cust_address='" . addslashes($_POST[custadd]) .
"',contact_person='" . addslashes($_POST[contpers]) .
"',effstatus='$_POST[status]' where
cust_id='$customerid'";
      }else{
            $custregsql="insert into
fs_customer(cust_descrip,cust_address,contact_person,effs
tatus,creation_date) values('" .
addslashes($_POST[customername]) . "','" .
addslashes($_POST[custadd]) . "','" .
addslashes($_POST[contpers]) .
"','$_POST[status]',now())";
      }
      echo $custregsql;
            $custreg = MYSQL_QUERY($custregsql);
            $url_redirect = "Location:
fs_customerlist.php";
            header($url_redirect);
            exit;
}
if ($_POST[deletebtn]) {
            $customerid=$_POST[custid];
                  $deductval=$deductval;
      }else{
//End
            if ($realremtime == 0) {
                  if ($deductval <= $worktimeval) {
                        $realval=$deductval;
                        $deductval=0;
                        $starttime="8AM";
                        $endtime=$realval + 8;
                        $periodrange="$starttime - $endtime";
                  }else{
                        $deductval=$deductval - $worktimeval;

                        $realval=$worktimeval;
                  }
```

```
            }else if ($deductval > $realremtime) {
                  $realval=$realremtime;

                  $deductval=$deductval - $realremtime;
                  $starttime=$dayend - $realremtime;
                  $endtime=$dayend;
                  $periodrange="$starttime - $endtime";
            }else{
                  $realval=$deductval;
                  $deductval=0;
                  $starttime=$dayend - $realremtime;
                  $endtime=$starttime + $realval;

                  $periodrange="$starttime - $endtime";
            }//Ends realremtime=0
//To this level

      $insertquery=insertschedfunc($realposdate,$pjobid,$pequipid,$realequipunitid
,$vconc,$vorder,$vmethod,$realval,$starttime,$endtime);
            }
}

?>
```

```
<html>
<head><title>Company Profile</title>
<script src="libraries/functions.js"
type="text/javascript" language="javascript"></script>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<?php
include("fsmysqlinc.inc");
include("fsqueryfunctions.inc");
      $companynamesql="select
company_name,company_address,company_area,company_cost,co
mpany_lifespan from fs_companyprofile";
      $companynamereg = MYSQL_QUERY($companynamesql);
      $companyname=
mysql_result($companynamereg,0,"company_name");
      $companyaddress=
mysql_result($companynamereg,0,"company_address");
      $companyarea=
mysql_result($companynamereg,0,"company_area");
      $companycost=
mysql_result($companynamereg,0,"company_cost");
      $companylifespan=
mysql_result($companynamereg,0,"company_lifespan");
if ($_POST[regbtn]) {
            $custregsql="update fs_companyprofile set
company_name='" . addslashes($_POST[customername]) .
"',company_address='" .
```

```
addslashes($_POST[companyaddress]) .
"',company_area='$_POST[companyarea]',company_cost='$_POS
T[companycost]',company_lifespan='$_POST[companylifespan]
'";
    echo $custregsql;
        $custreg = MYSQL_QUERY($custregsql);
        $url_redirect = "Location:
fs_companyprofile.php";
        header($url_redirect);
    exit;
}
if ($_POST[cancelbtn]) {
        $url_redirect = "Location:
fs_companyprofile.php?";
        header($url_redirect);
        exit;
}
?>
</head>
<body class="body">
<center>
<table border="1" bordercolor="silver" class="tblstyle">
<th colspan="4" align="center"><font color="green"
size=4>Company Profile</font></th>
<form method="Post" name="customersetup">
    <tr><td><b>Company Name</b> </td><td
colspan="3"><input type="text" name="customername"
size="40" maxlength="35" value="<?echo
$companyname?>"><input type="hidden" name="custid"
value="<?echo $customerid?>"></td></tr>
    <tr><td><b>Address</b> </td><td
colspan="3"><textarea name="companyaddress" rows="5"
cols="35"><?echo $companyaddress?></textarea></td></tr>
    <tr><td><b>Company Area (sq.m)</b> </td><td><input
type="text" name="companyarea" size="10" maxlength="35"
value="<?echo $companyarea?>"></td>
    <td><b>Cost of Building</b> </td><td><input
type="text" name="companycost" size="10" maxlength="35"
value="<?echo $companycost?>"></td>
    </tr>
    <tr><td><b>Expected Life Span (Year)</b></td><td
colspan="3"><input type="text" name="companylifespan"
size="10" maxlength="10" value="<?echo
$companylifespan?>"></td></tr>
    <tr><td colspan="4" align="center"><input
type="submit" value=" Save " name="regbtn"
class="colorbtn" onclick="return submitclick()">
    <input type="submit" value="Cancel" name="cancelbtn"
class="colorbtn"> <input type="reset" value="Reset"
class="colorbtn"></td></tr>
</form>
```

```
</table>
</body>
</html>
```

```
<html>
<head><title>Job Invoice</title>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<?php
include("fsmysqlinc.inc");
?>
</head>
<body class="body">
<center>
<center><font color="green" size=4>Cost Rates
Sheet</font></center>
<form method="Post" name="custselection">
<table border="1" bordercolor="#000000" width="90%"
height="100%" class="tblstyle" align="center">
<tr><td height="25%">
</td></tr>
<tr><td height="75%">
     <table border="1" bordercolor="#000000" width="100%"
height="100%" class="tblstyle" align="center">
     <table border="1" bordercolor="#000000" width="100%"
class="tblstyle" align="center">
     <tr><th colspan="1"></th><th>Equipment Cost
Rate</th><th>Manpower Cost Rate</th><th>Building Cost
Rate</th><th >Utilities Cost Rate</th><th>Admin Cost
Rate</th><th></th></tr>
     <tr><th>Section</th><th>N/hr</th><th>N/hr</th><th>N/
hr</th><th>N/hr</th><th>N/hr</th><th></th></tr>
     <?php
     include("fsCalculationFunc.inc");
     ?>
<?php
     ////////////////////////////////Cost
Determination////////////////////
          $jobequipcostsql="select
b.equip_id,b.equip_descrip,b.waitingtime,b.mantimefactor,
b.utilityfactor from fs_equipment b";
               $jobequipcostsel =
MYSQL_QUERY($jobequipcostsql);
               $SectionalEquipGrandCost=0;
               $SectionalEquipAmount=0;
     while ($jobequipcostrow =
mysql_fetch_array($jobequipcostsel)){
               $equipid=$jobequipcostrow["equip_id"];

     $equip_descrip=$jobequipcostrow["equip_descrip"];

     $waitingtime=$jobequipcostrow["waitingtime"];
```

```
    $mantimefactor=$jobequipcostrow["mantimefactor"];

    $utilityfactor=$jobequipcostrow["utilityfactor"];
              $fieldtype="Equipment";
              $Buildfieldtype="Building";
              $Utilityfieldtype="Utilities";
              $fieldManpowertype="Manpower";

    $EquipmentRate=EquipmentRatefunc($equipid,$fieldtype
);

    $BuildingRate=BuildingRatefunc($equipid,$Buildfieldt
ype);

    $UtilityRate=UtilityRatefunc($equipid,$Utilityfieldt
ype);
    $ManpowerRate=ManPowerRatefunc($equipid,$fieldManpow
ertype);

    $AdminRate=AdminRatefunc($equipid,$fieldManpowertype
);
    ?>
    <tr><td><?php echo $equip_descrip?></td><td
align="right"><?php echo
number_format($EquipmentRate,2)?></td><td
align="right"><?php echo
number_format($ManpowerRate,2)?></td><td
align="right"><?php echo
number_format($BuildingRate,2)?></td><td
align="right"><?php echo
number_format($UtilityRate,2)?></td><td
align="right"><?php echo
number_format($AdminRate,2)?></td><td
align="right"></td></tr>
<?
    }
?>
    </table>
    </td><td align="right"><?php //echo
$overheadamount?></td></tr>
</td></tr>
</table>
</form>
</body>
</html>
```

```
<html>
<head><title>Job Invoice</title>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
```

```
<?php
include("fsmysqlinc.inc");
$jobid=$_GET[jobid];
$custid=$_GET[custid];
$jobdescrip=$_GET[jobdescription];
     $companynamesql="select
company_name,company_address,company_area from
fs_companyprofile";
     $companynamereg = MYSQL_QUERY($companynamesql);
     $companyname=
mysql_result($companynamereg,0,"company_name");
     $companyaddress=
mysql_result($companynamereg,0,"company_address");
     $companyarea=
mysql_result($companynamereg,0,"company_area");
$custsql="select  cust_id,
cust_descrip,contact_person,cust_address,join_date from
fs_customer where cust_id='$custid'";
$selcust= MYSQL_QUERY($custsql);
               while ($mydescriprow =
mysql_fetch_array($selcust)){
                    $selcustid=$mydescriprow["cust_id"];

     $seldescrip=$mydescriprow["cust_descrip"];

     $custaddress=$mydescriprow["cust_address"];
          }
//Select order materials
$matcostsql="select a.mat_id,a.mat_descrip, b.mat_quant,
b.mat_cost from fs_material a,fs_materialorder b where
a.mat_id=b.mat_id and b.job_id='$jobid'";
$matcostlist = MYSQL_QUERY($matcostsql);
//Schedule Cost
/*   $jobcostsql="select
sum(a.schedule_time)worktime,sum(a.schedule_time *
b.equip_cost)amount,max(schedule_date)date from
fs_schedule a,fs_equipment b where a.job_id='$jobid' and
a.equip_id=b.equip_id";
          $jobcost = MYSQL_QUERY($jobcostsql);
while ($jobcostrow = mysql_fetch_array($jobcost)){
          $worktime=$jobcostrow["worktime"];
          $overheadamount=$jobcostrow["amount"];
          $probabledate=$jobcostrow["date"];
          }
*/
?>
</head>
<body class="body">
<center>
```

```
<center><font color="green" size=4>Customer
Invoice</font><br><b>Description--<?php echo
$jobdescrip?></center>
<form method="Post" name="custselection">
<table border="1" bordercolor="#000000" width="90%"
height="100%" class="tblstyle" align="center">
<tr><td height="25%">
     <table border="0" bordercolor="#000000" width="100%"
height="100%" class="tblstyle" align="center">
     <tr><th width="25%"></th><th width="25%"></th><th
width="25%"></th><th width="25%"></th></tr>
     <tr><td colspan="3"></td><td align="left"><?php echo
$companyname?><br><?php echo $companyaddress?><br><?php
echo date("d/m/Y");?>.</td></tr>
     <tr><td align="left"><?php echo
$seldescrip?><br><?php echo $custaddress?></td><td
colspan="3">  </td></tr>
     </table>
</td></tr>
<tr><td height="75%">
     <table border="1" bordercolor="#000000" width="100%"
height="100%" class="tblstyle" align="center">
     <tr height="5%"><th width="5%">#</th><th
width="36%">Item Description</th><th
width="12%">Quantity</th><th width="13%">Unit
Price</th><th width="18%">Amount</th><th
width="15%"></th></tr>
     <tr><td colspan="5" valign="top">
          <table border="1" bordercolor="#000000"
width="100%" class="tblstyle" align="center">
                    <?php
                         $incr=1;
                    while ($matcostrow =
mysql_fetch_array($matcostlist)){

     $matid=$matcostrow["mat_id"];

     $matdescrip=$matcostrow["mat_descrip"];

     $matquant=$matcostrow["mat_quant"];

     $matcost=$matcostrow["mat_cost"];
                         $matamount=$matquant * $matcost;
                         $totalmatamount=$matamount +
$totalmatamount;
                         ?>
                    <tr><td width="5%"><?php echo
$incr++?></td><td width="42%"><?php echo
$matdescrip?></td><td width="13%"><?php echo
$matquant?></td><td width="15%"><?php echo
number_format($matcost,2) ?></td><td align="right"
```

```
width="20%"><?php echo
number_format($matamount,2)?></td></tr>
                    <?
                              }
                ?>
     </table>
     </td><td width="15%"></td></tr>
     <tr height="5%"><td></td><td colspan="3"
align="right"><b>Subtotal</b></td><td
colspan="2"align="right"><b><?php echo
number_format($totalmatamount,2)?></b></td></tr>
     <tr height="5%"><td colspan="6">
     <br>
     <table border="1" bordercolor="#000000" width="100%"
class="tblstyle" align="center">
     <tr><th colspan="2"></th><th
colspan="2">Equipment</th><th
colspan="2">Manpower</th><th colspan="2">Building</th><th
colspan="2">Utilities</th><th
colspan="2">Admin</th><th></th></tr>
     <tr><th>Section</th><th>Time(hr)</th><th>Rate/hr</th
><th>Amount</td><th>Rate/hr</th><th>Amount</th><th>Rate/h
r</th><th>Amount</th><th>Rate/hr</th><th>Amount</th><th>R
ate/hr</th><th>Amount</th><th></th></tr>
     <?php
     include("fsCalculationFunc.inc");
     ?>
<?php
     ////////////////////////////////Cost
Determination//////////////////////
          //$jobequipcostsql="select
a.equip_id,sum(a.schedule_time)TimeSpent from fs_schedule
a group by a.equip_id";
          $jobequipcostsql="select
a.equip_id,b.equip_descrip,waitingtime,mantimefactor,util
ityfactor,sum(a.schedule_time)TimeSpent,max(a.schedule_da
te)date from fs_schedule a,fs_equipment b where
a.equip_id=b.equip_id and a.job_id='$jobid' group by
a.equip_id";
               $jobequipcostsel =
MYSQL_QUERY($jobequipcostsql);
               $SectionalEquipGrandCost=0;
               $SectionalEquipAmount=0;
     while ($jobequipcostrow =
mysql_fetch_array($jobequipcostsel)){
               $equipid=$jobequipcostrow["equip_id"];

     $equip_descrip=$jobequipcostrow["equip_descrip"];

     $waitingtime=$jobequipcostrow["waitingtime"];
```

```
    $mantimefactor=$jobequipcostrow["mantimefactor"];

    $utilityfactor=$jobequipcostrow["utilityfactor"];
                $TimeSpent=$jobequipcostrow["TimeSpent"];
                $probabledate=$jobequipcostrow["date"];
                $fieldtype="Equipment";
                $Buildfieldtype="Building";
                $Utilityfieldtype="Utilities";
                $fieldManpowertype="Manpower";

    $EquipmentRate=EquipmentRatefunc($equipid,$fieldtype
);
    $BuildingRate=BuildingRatefunc($equipid,$Buildfieldt
ype);
    $UtilityRate=UtilityRatefunc($equipid,$Utilityfieldt
ype);
    $ManpowerRate=ManPowerRatefunc($equipid,$fieldManpow
ertype);
    $AdminRate=AdminRatefunc($equipid,$fieldManpowertype
);              $SectionalEquipAmount=$EquipmentRate
*$TimeSpent;
    $SectionalBuildAmount=$BuildingRate * ($TimeSpent +
($waitingtime/60));
                $SectionalUtilityAmount=$UtilityRate *
((100 + $utilityfactor)/100) *
($TimeSpent+($waitingtime/60));
                $SectionalManpowerAmount=$ManpowerRate *
$TimeSpent * ((100 + $mantimefactor)/100);
                $SectionalAdminAmount=$AdminRate *
$TimeSpent;

    $SectionalManpEquipAmount=$SectionalEquipAmount +
$SectionalManpowerAmount + $SectionalBuildAmount +
$SectionalUtilityAmount + $SectionalAdminAmount;

    $SectionalEquipGrandCost=$SectionalEquipGrandCost +
$SectionalEquipAmount;

    $SectionalBuildGrandCost=$SectionalBuildGrandCost +
$SectionalBuildAmount;

    $SectionalUtilityGrandCost=$SectionalUtilityGrandCos
t + $SectionalUtilityAmount;

    $SectionalManpGrandCost=$SectionalManpGrandCost +
$SectionalManpowerAmount;

    $SectionalAdminGrandCost=$SectionalAdminGrandCost +
$SectionalAdminAmount;
    ?>
```

```
    <tr><td><?php echo $equip_descrip?></td><td><?php
echo number_format($TimeSpent,2)?></td><td
align="right"><?php echo
number_format($EquipmentRate,2)?></td><td
align="right"><?php echo
number_format($SectionalEquipAmount,2)?></td><td
align="right"><?php echo
number_format($ManpowerRate,2)?></td><td
align="right"><?php echo
number_format($SectionalManpowerAmount,2)?></td><td
align="right"><?php echo
number_format($BuildingRate,2)?></td><td
align="right"><?php echo
number_format($SectionalBuildAmount,2)?></td><td
align="right"><?php echo
number_format($UtilityRate,2)?></td><td
align="right"><?php echo
number_format($SectionalUtilityAmount,2)?></td><td
align="right"><?php echo
number_format($AdminRate,2)?></td><td align="right"><?php
echo number_format($SectionalAdminAmount,2)?></td><td
align="right"><?php echo
number_format($SectionalManpEquipAmount,2)?></td></tr>
<?
    }

?>
    <tr><td colspan="3"
align="right"><b>SubTotal</b></td><td
align="right"><b><?php echo
number_format($SectionalEquipGrandCost,2)?></b></td><td
colspan="2" align="right"><b><?php echo
number_format($SectionalBuildGrandCost,2)?></b></td><td
colspan="2" align="right"><b><?php echo
number_format($SectionalUtilityGrandCost,2)?></b></td><td
colspan="2" align="right"><b><?php echo
number_format($SectionalManpGrandCost,2)?></b></td><td
colspan="2" align="right"><b><?php echo
number_format($SectionalAdminGrandCost,2)?></b></td></tr>
    </table>
    </td><td align="right"><?php echo
number_format($totalmatamount,2)?></td></tr>

<tr><td><b>Grand Total</b></td><td
align="right"><b><?php echo
number_format($SectionalEquipGrandCost+$SectionalManpGran
dCost+$totalmatamount,2)?></b></td></tr>
    <tr height="5%"><td></td><td colspan="11"
align="left"><b><i>Estimated Completion Date ---- <?php
echo $probabledate?></i></b></td></tr>
</td></tr>
```

```
</table>
</form>
</body>
</html>
```

.....

```
<html>
<head><title>Customer List</title>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<SCRIPT LANGUAGE="JavaScript1.1">
<!--
function customersetup(customerid){
//customerid=22;
window.open('fs_customersetup.php?customerid='+customerid
+'',"Notification");
}
-->
</SCRIPT>
<?php
if ($_POST[btnnew]) {
          $url_redirect = "Location:
fs_customersetup.php?";
          header($url_redirect);
          exit;
}
include("fsmysqlinc.inc");
$custsql="select  cust_id,
cust_descrip,contact_person,cust_address,join_date from
fs_customer order by  cust_descrip  asc";
$selcust = MYSQL_QUERY($custsql);
?>
</head>
<body class="body">
<center>
<center><font color="green" size=4>Customer
List</font></center>
<form method="Post" name="custselection">
<table border="1" bordercolor="#000000" width="80%"
class="tblstyle" align="center">
     <tr bgcolor="#D0ECE0"><th>#
</th><th>Description</th><th>Contact
Person</th><th>Address</th><th>action</th><th>
     <input type="submit" value="New" name="btnnew"
class="colorbtn">
</th></tr>
                                                  <?php
                                                  $incrno=1;
                                                  while
($mydescriprow = mysql_fetch_array($selcust)){
               $selcustid=$mydescriprow["cust_id"];
```

```
    $seldescrip=$mydescriprow["cust_descrip"];
    $contactperson=$mydescriprow["contact_person"];
    $custaddress=$mydescriprow["cust_address"];
    $join_date=$mydescriprow["join_date"];
    $clickbtn="btn$selcustid";
    ?>
    <tr><td><?echo $incrno++?></td><td><?echo
$seldescrip?></td><td><?echo
$contactperson?></td><td><?echo $custaddress?></td><td><a
href="fs_customersetup.php?customerid=<?php echo
$selcustid?>" class="whitelink">Edit</a></td></tr>
<?}?>
</table>
</form>
</body>
</html>
```

```
<html>
<head><title>Customer Registration</title>
<script src="libraries/functions.js"
type="text/javascript" language="javascript"></script>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<?php
include("fsmysqlinc.inc");
include("fsqueryfunctions.inc");
$customerid=$_GET[customerid];
if ($customerid !=""){
     $descripsql="select
cust_id,cust_descrip,cust_address,contact_person,effstatu
s from fs_customer where cust_id='$customerid'";
     $descripreg = MYSQL_QUERY($descripsql);
     $custid= mysql_result($descripreg,0,"cust_id");
     $descrip=
mysql_result($descripreg,0,"cust_descrip");
     $custadd=
mysql_result($descripreg,0,"cust_address");
     $contpers=
mysql_result($descripreg,0,"contact_person");
     $effstatus= mysql_result($descripreg,0,"effstatus");
}
if ($_POST[regbtn]) {
     $cust_idsql="select cust_id from fs_customer where
cust_id='$customerid'";
     $cust_idreg = MYSQL_QUERY($cust_idsql);
     if   ($custrow=mysql_fetch_array($cust_idreg)){
          $custregsql="update fs_customer set
cust_descrip='" . addslashes($_POST[customername]) .
"',cust_address='" . addslashes($_POST[custadd]) .
"',contact_person='" . addslashes($_POST[contpers]) .
```

```
"',effstatus='$_POST[status]' where
cust_id='$customerid'";
     }else{
          $custregsql="insert into
fs_customer(cust_descrip,cust_address,contact_person,effs
tatus,creation_date) values('" .
addslashes($_POST[customername]) . "','" .
addslashes($_POST[custadd]) . "','" .
addslashes($_POST[contpers]) .
"','$_POST[status]',now())";
     }
     echo $custregsql;
          $custreg = MYSQL_QUERY($custregsql);
          $url_redirect = "Location:
fs_customerlist.php";
          header($url_redirect);
          exit;
}
if ($_POST[deletebtn]) {
          $customerid=$_POST[custid];

     $chkcustomersql="select * from fs_jobrecord where
cust_id='$customerid'";
     $chkcustomer = MYSQL_QUERY($chkcustomersql);
     if
     ($chkcustomerrow=mysql_fetch_array($chkcustomer)){
          echo "<h4 align=center><font color='red'>Delete
failed: Customer already in use!</font></h4>";
     }else{
          $delmatunitsql="delete from fs_customer where
cust_id='$customerid'";
                    $delmatunit =
MYSQL_QUERY($delmatunitsql);
                    $url_redirect = "Location:
fs_customerlist.php?";
                    header($url_redirect);
                    exit;
     }
}
/**/
if ($_POST[cancelbtn]) {
          $url_redirect = "Location:
fs_customerlist.php?";
          header($url_redirect);
          exit;
}
?>
</head>
<body class="body">
<center>
<table border="1" bordercolor="silver" class="tblstyle">
```

```
<th colspan="2" align="center"><font color="green"
size=4>Customer Setup</font></th>
<form method="Post" name="customersetup">
     <tr><td><b>Customer's Company Name</b>
</td><td><input type="text" name="customername" size="40"
maxlength="35" value="<?echo $descrip?>"><input
type="hidden" name="custid" value="<?echo
$customerid?>"></td></tr>
     <tr><td><b>Contact Person</b></td><td><input
type="text" name="contpers" size="40" maxlength="40"
value="<?echo $contpers?>"></td></tr>
     <tr><td><b>Address</b> </td><td><textarea
name="custadd" rows="5" cols="35"><?echo
$custadd?></textarea></td></tr>
     <?
     if
($effstatus=="Y"){$active="checked";}else{$active="";}

     ?>
     <tr><td><b>Status</b> </td><td><input
type="checkbox" id="status" name="status" <? echo
$active?> value="Y"> <label
for="status">Active</label></td></tr>

     <tr><td colspan="2" align="center"><input
type="submit" value=" Save " name="regbtn"
class="colorbtn" onclick="return submitclick()">
     <input type="submit" value=" Delete "
name="deletebtn" class="colorbtn" onclick="return
confirmLink(this, 'Delete this Customer?')">
     <input type="submit" value="Cancel" name="cancelbtn"
class="colorbtn"> <input type="reset" value="Reset"
class="colorbtn"></td></tr>
</form>
</table>
</body>
</html>
```

```
<html><head><title>Equipment List</title>
<SCRIPT LANGUAGE="JavaScript1.1">
<!--
var confirmMsg  = 'Do you really want to';
function confirmLink(theLink, theSqlQuery)
{
    // Confirmation is not required in the configuration
file
    if (confirmMsg == '') {
        return true;
    }
    var is_confirmed = confirm(confirmMsg + ' :\n' +
theSqlQuery);
    if (is_confirmed) {
```

```
        theLink.href += '&is_js_confirmed=1';
    }
    return is_confirmed;
} // end of the 'confirmLink()' function

-->
</SCRIPT>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<?php
include("fsmysqlinc.inc");
include("fsqueryfunctions.inc");
if ($_POST[newbtn]) {
          $url_redirect = "Location:
fs_equipmentsetup.php";
          header($url_redirect);
          exit;
}
$equipsql="select
equip_id,equip_descrip,equip_no,effstatus from
fs_equipment";
$equiplist = MYSQL_QUERY($equipsql);
?>
</head>
<body class="body">
<h3 align="center">Equipment List</h3>
<form method="Post" name="equipmentlist">
<table border="1" width="50%" class="tblstyle"
align="center">
<tr><td>
     <table border="1" width="100%" class="tblstyle"
align="center">
     <tr
bgcolor="#D0ECE0"><th><b>#</b></th><th><b>Equipment</b></
th><th><b>Available Unit of
Equip.</b></th><th></th><th></th></tr>
     <?php
     $incr=1;
while ($equiplistrow = mysql_fetch_array($equiplist)){
          $equipid=$equiplistrow["equip_id"];
          $equipdescrip=$equiplistrow["equip_descrip"];
          //$equipno=$equiplistrow["equip_no"];
          $equipno=countactiveunit($equipid);
          $effstatus=$equiplistrow["effstatus"];
          $chkname="chk$equipid";
     //for bgcolor
     if
(($incr/2)==(round($incr/2))){$bckcolor="#D0DCE0";}else{$
bckcolor="#ffffff";}
     if
($effstatus=="Y"){$active="checked";}else{$active="";}
```

```
?>
          <tr bgcolor="<?php echo $bckcolor ?>"><td><?php
echo $incr++?></td><td><?php echo $equipdescrip?>
</td><td><?php echo $equipno?> </td><td>
          <a
href="fs_equipmentsetup.php?equipmentid=<?php echo
$equipid?>" class="whitelink">Edit</a></td><td>
          <a
href="fs_equipmentunitsetup.php?equipmentid=<?php echo
$equipid?>" class="whitelink">Add Unit</a></td></tr>

<?php
          }
?>
</table>
</td><td width="10%" align="right" valign="top"><input
type="submit" name="newbtn" value=" New "
class="colorbtn"></td></tr>
</table>
</form>
</body>
</html>
```

```
<html>
<head><title>Equipment Registration</title>
<link href="dm_btn.css" rel="styleSheet" type="text/css">
<script src="libraries/functions.js"
type="text/javascript" language="javascript"></script>
<SCRIPT LANGUAGE="JavaScript1.1">
<!--
function submitclick (form) {
if (equipsetup.equipdescrip.value == '')
     {
          alert(' Description is a required field.');
          equipsetup.equipdescrip.focus();
          return false;
     }
if (equipsetup.equipno.value == '')
     {
          alert('Equipment No is a required field.');
          equipsetup.equipno.focus();
          return false;
     }
if (equipsetup.equipcost.value == '')
     {
          alert(' Cost is a required field.');
          equipsetup.equipcost.focus();
          return false;
     }
     return confirmLink(this, 'Save this Equipment?')
  //return true;
}
```

```
-->
</SCRIPT>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<?php
include("fsmysqlinc.inc");
include("fsqueryfunctions.inc");
$equipmentid=$_GET[equipmentid];
if ($equipmentid !=""){
     $descripsql="select
equip_id,equip_descrip,equip_no,equip_cost,equip_area,bud
getedhour,efficiency,purchase_cost,waitingtime,mantimefac
tor,utilityfactor,hiring_cost,contract_rate,overtime_rate
,effstatus,ActualDemand,ForcastDemand,SmoothingConst from
fs_equipment where equip_id='$equipmentid'";
     $descripreg = MYSQL_QUERY($descripsql);
     $eqid= mysql_result($descripreg,0,"equip_id");
     $descrip=
mysql_result($descripreg,0,"equip_descrip");
     $eqcost= mysql_result($descripreg,0,"equip_cost");
     $equiparea=
mysql_result($descripreg,0,"equip_area");
     $efficiency=
mysql_result($descripreg,0,"efficiency");
     $purchasecost=
mysql_result($descripreg,0,"purchase_cost");
     $waitingtime=
mysql_result($descripreg,0,"waitingtime");
     $mantimefactor=
mysql_result($descripreg,0,"mantimefactor");
     $utilityfactor=
mysql_result($descripreg,0,"utilityfactor");
     $hiringcost=
mysql_result($descripreg,0,"hiring_cost");
     $contractrate=
mysql_result($descripreg,0,"contract_rate");
     $overtimerate=
mysql_result($descripreg,0,"overtime_rate");
     $ActualDemand=
mysql_result($descripreg,0,"ActualDemand");
     $ForcastDemand=
mysql_result($descripreg,0,"ForcastDemand");
     $SmoothingConst=
mysql_result($descripreg,0,"SmoothingConst");
     $budgetedhour=(($ActualDemand - $ForcastDemand)*
$SmoothingConst)+$ForcastDemand);
     //$budgetedhour=
mysql_result($descripreg,0,"budgetedhour");
     $effstatus= mysql_result($descripreg,0,"effstatus");
////////////////////////////////////////////////////////
////
```

```
     $forcastratesql="select
a.Sal_Period1,a.Sal_Period2,a.Sal_Period3,a.Sal_Period4,(
a.Sal_Period2+a.Sal_Period3+a.Sal_Period4)sumtotal,b.budg
etedhour,b.efficiency from fs_quartermanpower
a,fs_equipment b where a.FieldType='Equipment' and
a.SectionName='$equipmentid' and
a.SectionName=b.equip_id";
     $forcastratereg = MYSQL_QUERY($forcastratesql);
     $SalPeriod1=
mysql_result($forcastratereg,0,"Sal_Period1");
     $SalPeriod2=
mysql_result($forcastratereg,0,"Sal_Period2");
     $SalPeriod3=
mysql_result($forcastratereg,0,"Sal_Period3");
     $SalPeriod4=
mysql_result($forcastratereg,0,"Sal_Period4");
     $sumtotal=
mysql_result($forcastratereg,0,"sumtotal");
     //$budgetedhour=
mysql_result($forcastratereg,0,"budgetedhour");
     //$efficiency =
mysql_result($forcastratereg,0,"efficiency");
     $MovingAverage=
($SalPeriod2+$SalPeriod3+$SalPeriod4)/3;
          //$MovingAverage= number_format($sumtotal,2);
          //$MovingAverage= $sumtotal;
     $ManPowerRate=($MovingAverage/($efficiency*$budgeted
hour));
////////////////////////////////////////////////////////
////
}
if ($_POST[regbtn]) {
     $equip_idsql="select equip_id from fs_equipment
where equip_id='$equipmentid'";
     $equip_idreg = MYSQL_QUERY($equip_idsql);
     if   ($equipow=mysql_fetch_array($equip_idreg)){
          $equipregsql="update fs_equipment set
equip_descrip='" . addslashes($_POST[equipdescrip]) .
"',equip_no='" . addslashes($_POST[equipno]) .
"',equip_cost='" . addslashes($_POST[equipcost]) .
                    edhour='$_POST[budgetedhour]',ActualDemand='$_PO
                                        stDemand]','$


efficiency]',effstatus='$_POST[status]',equip_area='$_PO
ST[equiparea]',waitingtime='$_POST[waitingtime]',mantimef
actor='$_POST[mantimefactor]',utilityfactor='$_POST[utili
tyfactor]' where equip_id='$equipmentid'";
     //echo "Equipment already exist!";
     }else{
          $equipregsql="insert into
fs_equipment(equip_descrip,equip_no,equip_cost,equip_area
```

```
,budgetedhour,waitingtime,mantimefactor,utilityfactor,eff
iciency,effstatus,ActualDemand,ForcastDemand,SmoothingCon
st,creation_date) values('" .
addslashes($_POST[equipdescrip]) . "','" .
addslashes($_POST[equipno]) . "','" .
addslashes($_POST[equipcost]) .
"','$_POST[equiparea]','$_POST[budgetedhour]','$_POST[wai
tingtime]','$_POST[mantimefactor]','$_POST[utilityfactor]
','$_POST[efficiency]','$_POST[status]','$_POST[ActualDem
and]','$_POST[ForcastDemand]','$_POST[SmoothingConst]',no
w())";
          //echo "Equipment Registered!";
     }
     //echo $equipregsql;
          $equipreg = MYSQL_QUERY($equipregsql);
          $url_redirect = "Location:
fs_equipmentunitsetup.php?equipmentid=$equipmentid";
          header($url_redirect);
          exit;
}
if ($_POST[deletebtn]) {
     $chkequipmentsql="select * from fs_schedule where
equip_id='$equipmentid'";
     $chkequipment = MYSQL_QUERY($chkequipmentsql);
     if
     ($chkequipmentrow=mysql_fetch_array($chkequipment)){
          echo "<h4 align=center><font color='red'>Delete
failed: Equipment already in use!</font></h4>";
     }else{
          $delequipunitsql="delete from fs_equipmentunit
where equip_id='$equipmentid'";
                    $delequipunit =
MYSQL_QUERY($delequipunitsql);
          $deleteequipsql="delete from fs_equipment where
equip_id='$equipmentid'";
                    $deleteequip =
MYSQL_QUERY($deleteequipsql);
                    $url_redirect = "Location:
fs_equipmentlist.php?";
                    header($url_redirect);
                    exit;
     }
}
/**/
if ($_POST[cancelbtn]) {
          $url_redirect = "Location:
fs_equipmentlist.php?";
          header($url_redirect);
          exit;
}
?>
```

```
</head>
<body class="body">
<center>
<table border="1" bordercolor="silver" class="tblstyle">
<th colspan="4" align="center"><font color="green"
size=4>Activity Center Setup</font></th>
<form method="Post" name="equipsetup">
     <tr><td><b>Activity Center Name</b> </td><td
colspan="3"><input type=text name="equipdescrip"
size="40" maxlength="25" value="<?echo $descrip?>"><input
type="hidden" name="equipid" value="<?echo
$equipmentid?>"></td></tr>
     <tr><td><b>Centre Area (Sq.m) </b></td><td><input
type="text" name="equiparea" size="15" maxlength="15"
value="<?echo $equiparea?>"></td>
          <td></td><td></td>
     </tr>
     <tr><td><b>Previous Actual Demand Hour
(Hr)</b></td><td><input type="text" name="ActualDemand"
size="15" maxlength="15" value="<?echo
$ActualDemand?>"></td>
          <td><b>Previous Forecast Demand Hour
(Hr)</b></td><td><input type="text" name="ForcastDemand"
size="15" maxlength="15" value="<?echo
$ForcastDemand?>"></td>
     </tr>
     <tr><td><b>Smoothing Constant</b></td><td><input
type="text" name="SmoothingConst" size="15"
maxlength="15" value="<?echo $SmoothingConst?>"></td>
     <td><b>Manpower Efficiency in the Centre
(%)</b></td><td><input type="text" name="efficiency"
size="15" maxlength="15" value="<?php echo
$efficiency?>"></td>
     </tr>
     <tr><td><b>Proposed Forecast Hour
</b></td><td><input type="text" name="budgetedhour"
readonly size="15" maxlength="15" value="<?echo
$budgetedhour?>"></td>
          <td><b>Ave. Waiting Time
(Minutes)</b></td><td><input type="text"
name="waitingtime"  size="15" maxlength="15"
value="<?echo $waitingtime?>"></td>
     </tr>
     <tr><td><b>Manpower Time Factor(%)
</b></td><td><input type="text" name="mantimefactor"
size="15" maxlength="15" value="<?echo
$mantimefactor?>"></td>
          <td><b>Utilities Time Factor
(%)</b></td><td><input type="text" name="utilityfactor"
size="15" maxlength="15" value="<?echo
$utilityfactor?>"></td>
```

```
     </tr>
     <tr><td colspan="4"><hr></td>
     </tr>
<!-- <tr><td><b>Purchase Cost </b></td><td><?echo
number_format($MovingAverage,2)?></td>
          <td><b>Rate/hr </b></td><td><?echo
number_format($ManPowerRate,2)?></td>
     </tr>
-->
     <?
     if
($effstatus=="Y"){$active="checked";}else{$active="";}
     ?>
     <tr><td><b>Status</b> </td><td><input
type="checkbox" id="status" name="status" <? echo
$active?> value="Y"> <label
for="status">Active</label></td></tr>
     <tr><td colspan="4" align="center"><input
type="submit" value=" Save " name="regbtn"
class="colorbtn" onclick="return submitclick()">
     <input type="submit" value=" Delete "
name="deletebtn" class="colorbtn" onclick="return
confirmLink(this, 'Delete this Equipment?')">
     <input type="submit" value="Cancel" name="cancelbtn"
class="colorbtn"> <input type="reset" value="Reset"
class="colorbtn"></td></tr>
</form>
</table>
</body>
</html>
```

```
<html>
<head><title>Equipment Unit Registration</title>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<script src="libraries/functions.js"
type="text/javascript" language="javascript"></script>
<SCRIPT LANGUAGE="JavaScript1.1">
<!--
function submitclick (form) {
if (equipunitsetup.equipunitdescr.value == '')
     {
          alert(' Description is a required field.');
          equipunitsetup.equipunitdescr.focus();
          return false;
     }
     return confirmLink(this, 'Save this Equipment
Unit?')
  //return true;
}
```

```
function
editclick(unitid,unitdescr,efstatus,purchasecost,installc
ost,lifeexpect){
equipunitsetup.equipunitid.value=unitid;
equipunitsetup.equipunitdescr.value=unitdescr;
equipunitsetup.purchasecost.value=purchasecost;
equipunitsetup.installationcost.value=installcost;
equipunitsetup.lifeexp.value=lifeexpect;
equipunitsetup.addunit.value='Modify Unit';
     if (efstatus
!='checked'){equipunitsetup.equipunitstatus.checked=false
;}else{equipunitsetup.equipunitstatus.checked=true;}
}
function newclick(form){
equipunitsetup.equipunitid.value='';
equipunitsetup.equipunitdescr.value='';
equipunitsetup.addunit.value=' Add Unit ';
equipunitsetup.purchasecost.value='';
equipunitsetup.installationcost.value='';
equipunitsetup.lifeexp.value='';

}
-->
</SCRIPT>
<?php
include("fsmysqlinc.inc");
include("fsqueryfunctions.inc");
$equipmentid=$_GET[equipmentid];
if ($equipmentid !=""){
     $descripsql="select
equip_id,equip_descrip,equip_no,equip_cost,effstatus from
fs_equipment where equip_id='$equipmentid'";
     $descripreg = MYSQL_QUERY($descripsql);
     $eqid= mysql_result($descripreg,0,"equip_id");
     $descrip=
mysql_result($descripreg,0,"equip_descrip");
     $eqno= mysql_result($descripreg,0,"equip_no");
     $eqcost= mysql_result($descripreg,0,"equip_cost");
     //$equipUnitPurCost=
mysql_result($descripreg,0,"equipUnit_PurCost");
     //$equipUnitInstCost=
mysql_result($descripreg,0,"equipUnit_InstCost");
     //$equipUnitLifeExp=
mysql_result($descripreg,0,"equipUnit_LifeExp");
     $effstatus= mysql_result($descripreg,0,"effstatus");
}
if ($_POST[addunit]) {
$equipmentunitid=$_POST[equipunitid];
     $equipunit_idsql="select equipunit_id from
fs_equipmentunit where equip_id='$equipmentid' and
equipunit_id='$equipmentunitid'";
```

```
      $equipunit_idreg = MYSQL_QUERY($equipunit_idsql);
      $equipUnitPurCost=$_POST[purchasecost];
      $equipUnitInstCost= $_POST[installationcost];
      $equipUnitLifeExp=$_POST[lifeexp];
      if    ($equipow=mysql_fetch_array($equipunit_idreg)){
            $equipunitregsql="update fs_equipmentunit set
equipunit_descrip ='" .
addslashes($_POST[equipunitdescr]) .
"',equipUnit_PurCost='$equipUnitPurCost',equipUnit_InstCo
st='$equipUnitInstCost',equipUnit_LifeExp='$equipUnitLife
Exp',effstatus='$_POST[equipunitstatus]' where
equip_id='$equipmentid' and
equipunit_id='$equipmentunitid'";
      //echo "Equipment already exist!";
      }else{
            $equipunitregsql="insert into
fs_equipmentunit(equip_id,equipunit_descrip,equipUnit_Pur
Cost,equipUnit_InstCost,equipUnit_LifeExp,effstatus)
values('$equipmentid','" .
addslashes($_POST[equipunitdescr]) .
"','$equipUnitPurCost','$equipUnitInstCost','$equipUnitLi
feExp','$_POST[equipunitstatus]')";
            //echo "Equipment Registered!";
      }
            $equipunitreg = MYSQL_QUERY($equipunitregsql);
            //echo $equipunitregsql;
            //$url_redirect = "Location:
fs_equipmentlist.php?";
            //header($url_redirect);
            //exit;
}
if ($_POST[deletebtn]) {
      //$equipmentunitid=$_POST[equipunitid];
      $selequipunit=selallequipunit($equipmentid);
      while ($equipunitrow =
mysql_fetch_array($selequipunit)){
            $equipunitid=$equipunitrow["equipunit_id"];
            $chkdelname="chk$equipunitid";

      $chkequipunitval=$_POST[("chk$equipunitid")];
            if ($chkequipunitval !=""){
                  $chkequipmentsql="select * from
fs_schedule where equip_id='$equipmentid' and
equipunit_id='$equipunitid'";
                  $chkequipment =
MYSQL_QUERY($chkequipmentsql);
                  if
      ($chkequipmentrow=mysql_fetch_array($chkequipment)){
                        echo "<h4 align=center><font
color='red'>Delete failed: Equipment already in
use!</font></h4>";
```

```
                    }else{
                        $delequipunitsql="delete from
fs_equipmentunit where equip_id='$equipmentid' and
equipunit_id='$equipunitid'";
                                        $delequipunit =
MYSQL_QUERY($delequipunitsql);
                    }
                    //echo $chkequipmentsql;
            }
        }
}
/**/
if ($_POST[cancelbtn]) {
        $url_redirect = "Location:
fs_equipmentlist.php?";
        header($url_redirect);
        exit;
}
?>
</head>
<body class="body">
<center>
<table border="1" bordercolor="silver" class="tblstyle"
width="75%">
<th colspan="4" align="center"><font color="green"
size=4> Equipment Unit Setup (<?echo
$descrip?>)</font><input type="hidden" name="equipid"
value="<?echo $equipmentid?>"></th>
<form method="Post" name="equipunitsetup">
    <tr><td><b>Equipment Code No</b></td><td
colspan="3"><input type="text" name="equipunitdescr"
maxlength="25" size="30"></td>
    </tr>
<tr><td><b>Purchase Cost(N)</b></td><td
colspan="0"><input type="text" name="purchasecost"
size="15" maxlength="15" value="<?echo
$purchasecost?>"></td><td><b>Installation
Cost(N)</b></td><td><input type="text"
name="installationcost" size="15" maxlength="15"
value="<?echo $installationcost?>"></td></tr>
<tr><td><b>Expected Life Span (Yr)</b> </td><td><input
type=text name="lifeexp" size="5" maxlength="5"
value="<?echo $expectedlifeExp?>"></td>
<td colspan="2"><input type="checkbox"
id="equipunitstatus" name="equipunitstatus" checked
value="Y"> <label
for="equipunitstatus"><b>Active</b></label>
    <input type="hidden" name="equipunitid"
value="<?echo $equipmentunitid?>">
</td></tr>
<tr><td colspan="3" align="center">
```

```
     <input type="submit" name="addunit" value="Add More
Equipment" class="colorbtn" onclick="return
submitclick()">
     <input type="button" name="newbtn" value="New"
class="colorbtn" onclick="return newclick()">
     <input type="submit" name="cancelbtn" value="Back to
Main" class="colorbtn"></td></tr>
     <tr><td colspan="4" align="center">
          <table border="1" bordercolor="silver"
class="tblstyle" width="100%">
          <tr bgcolor="#D0ECE0"><td>#</td><td> Unit
Description </td><td>Status</td><td></td><td><input
type="submit" name="deletebtn" value="Delete"
class="colorbtn" onclick="return confirmLink(this,
'Delete the Selected Equipment Unit(s)?')"></td></tr>
<?php
     $selequipunit=selallequipunit($equipmentid);
     while ($equipunitrow =
mysql_fetch_array($selequipunit)){
          $equipunitid=$equipunitrow["equipunit_id"];

     $equipunitdescrip=$equipunitrow["equipunit_descrip"]
;

     $equipUnitPurCost=$equipunitrow["equipUnit_PurCost"]
;

     $equipUnitInstCost=$equipunitrow["equipUnit_InstCost
"];

     $equipUnitLifeExp=$equipunitrow["equipUnit_LifeExp"]
;
          $uniteffstatus=$equipunitrow["effstatus"];
          $chkdelname="chk$equipunitid";
          $incrrow++;
               if
($uniteffstatus=="Y"){$unitactive="checked";}else{$unitac
tive="";}
?>
     <tr><td><?php echo $incrrow?></td><td><?php echo
$equipunitdescrip?></td>
     <td><input type="checkbox" id="unitstatus"
name="unitstatus" disabled <?php echo $unitactive?>
value="Y"> <label for="unitstatus">Active</label></td>
          <td><input type="button" name="editbtn"
value="Edit" class="colorbtn" onclick="return
editclick('<?php echo $equipunitid?>','<?php echo
$equipunitdescrip?>','<?php echo $unitactive?>','<?php
echo $equipUnitPurCost?>','<?php echo
$equipUnitInstCost?>','<?php echo
$equipUnitLifeExp?>')"></td>
```

```
          <td><input type="checkbox" name="<?php echo
$chkdelname?>" value="Y"></td>
          </tr>
<?php
}
?>
     </table>
</td></tr>
</form>
</table>
</body>
</html>
```

```
<html><head><title>Customer's Order</title>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<SCRIPT LANGUAGE="JavaScript1.1">
<!--
function calcamount(txtname,txtcost,txtamount) {
     //strenabled='document.getElementById("'+txtamount+'
").innerHTML=(materialvalue.'+txtname+'.value *
txtcost)';
     stransname='document.getElementById("'+txtamount+'")
.innerHTML';
     //stramount='document.getElementById("'+txtamount+'"
).innerHTML=(materialvalue.'+txtname+'.value * txtcost)';
     stramount='document.getElementById("'+txtamount+'").
innerHTML=(materialvalue.'+txtname+'.value *
txtcost).toFixed(2)';
     txtansname=eval(stransname);
          txtamount=eval(stramount);
          //txtansnameraw=txtamount*txtcost;
          //txtansname=(txtamount*txtcost).toFixed(2);
          //The next 2 lines do it also
     //strenabled='document.getElementById("'+txtamount+'
").innerHTML=(materialvalue.'+txtname+'.value *
txtcost)';
          //eval(strenabled);
}
-->
</SCRIPT>
<?php
include("fsmysqlinc.inc");
include("fsqueryfunctions.inc");
$jobid=$_GET[jobid];
$descript=$_GET[descript];
if ($_POST[savebtn]) {
     $jobid=$_POST[jobid];
     $matsql="select
mat_id,mat_descrip,mat_no,mat_cost,effstatus from
fs_material order by mat_descrip";
     $matlist = MYSQL_QUERY($matsql);
```

```
          $checkjobordersql="select * from
fs_materialorder where job_id='$jobid'";
                    $checkjoborder =
MYSQL_QUERY($checkjobordersql);
          if
($foundrow=mysql_fetch_array($checkjoborder)){
               $deletesql="delete from fs_materialorder
where job_id='$jobid'";
                         $deletefound =
MYSQL_QUERY($deletesql);
          }
while ($matlistrow = mysql_fetch_array($matlist)){
          $matid=$matlistrow["mat_id"];
          $matno=$matlistrow["mat_no"];
          $matcost=$matlistrow["mat_cost"];
          $textname=("txtname$matid");
          $hidprice=("hidprice$matid");
          $materialquant=$_POST[("$textname")];
          $materialprice=$_POST[("$hidprice")];
     if ($materialquant>0){
               $schedmatsql="insert into
fs_materialorder(job_id,mat_id, mat_quant,
mat_cost,creation_date)
values('$jobid','$matid','$materialquant','$materialprice
',now())";
                    $schedmat =
MYSQL_QUERY($schedmatsql);
     }
}
}
$matsql="select
a.mat_id,a.mat_descrip,max(b.stock_id)stockid,a.effstatus
from fs_material a,fs_materialstock b where
a.mat_id=b.mat_id group by a.mat_id,a.mat_descrip order
by a.mat_descrip";
$matlist = MYSQL_QUERY($matsql);
?>
</head>
<body class="body">
<h3 align="center">Material/Value</h3>
<form method="Post" name="materialvalue">
<table border="1" width="50%" class="tblstyle"
align="center">
<tr><td>
     <table border="1" width="100%" class="tblstyle"
align="center">
     <tr><td colspan="5" align="center">
               Job Description:<font color="orange"
size="4"> <?echo $descript?> </font><input type="hidden"
name="jobid" value="<?echo $jobid?>"></td></tr>
```

```
    <tr
bgcolor="#D0ECE0"><th><b>#</b></th><th><b>Material</b></t
h><th width="5%"><b>Quantity</b></th><th
align="right">Unit Cost</th><th>Amount</th></tr>
    <?php
    $incr=1;
while ($matlistrow = mysql_fetch_array($matlist)){
          $matid=$matlistrow["mat_id"];
          $matdescrip=$matlistrow["mat_descrip"];
          $stockid=$matlistrow["stockid"];
          //$matno=countactiveunit($matid);
          //$matcost=$matlistrow["mat_cost"];
          $effstatus=$matlistrow["effstatus"];
    //cost
          $matcostsql="select stock_price,stock_cost from
fs_materialstock where mat_id='$matid' and
stock_id='$stockid'";
          $matcostsel = MYSQL_QUERY($matcostsql);
          while ($matcostrow =
mysql_fetch_array($matcostsel)){
               $matcost=$matcostrow["stock_price"];
               //$matcost=$matcostrow["stock_cost"];
          }
          $chkname="chk$matid";
          $textname="txtname$matid";
          $textamount="txtamount$matid";
          $hidprice="hidprice$matid";
    //for bgcolor
    if
(($incr/2)==(round($incr/2))){$bckcolor="#D0DCE0";}else{$
bckcolor="#ffffff";}
    if
($effstatus=="Y"){$active="checked";}else{$active="";}
?>
          <tr bgcolor="<?php echo $bckcolor
?>"><td><?echo $incr++?></td><td><? echo $matdescrip?>
</td>
<td><input type="text" name="<?php echo $textname?>"
maxlength="10" size="6" onblur="return calcamount('<?php
echo $textname?>','<?php echo $matcost?>','<?php echo
$textamount?>');"></td>
<td align="right"><input type="hidden" name="<?php echo
$hidprice?>" value="<? echo $matcost?>"><? echo
$matcost?></td><td colspan="2"  align="right"><span
id="<?php echo $textamount?>"></span></td></tr>
<?
          }
?>
</table>
```

```
</td><td width="10%" align="right" valign="top"><input
type="submit" name="savebtn" value=" Save "
class="colorbtn"></td></tr>
</table>
</form>
</body>
</html>
```

```
<html>
<head><title>Job Selection</title>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<SCRIPT LANGUAGE="JavaScript1.1">
<!--
function submitclick (form) {
if (jobselection.jobcost.value == '')
     {
          alert(' Cost is a required field.');
          jobselection.jobcost.focus();
          return false;
     }
  return true;
}
function scheduleCost(scheduleid,descrip){
//scheduleid=22;
window.open('fs_jobcosting.php?jobid='+scheduleid+'&descr
ipt='+descrip+'', "Notification");
}
-->
</SCRIPT>
<?php
include("fsmysqlinc.inc");
//$jobsql="select
job_id,job_descrip,contact_person,transaction_date,start_
date,start_time,completed from fs_jobrecord order by
job_descrip asc";
$jobsql="select
a.job_id,a.job_descrip,b.cust_descrip,a.transaction_date,
(select min(c.schedule_date) date from fs_schedule c
where
c.job_id=a.job_id)startdate,a.start_date,a.start_time,a.c
ompleted from fs_jobrecord a,fs_customer b where
a.cust_id=b.cust_id order by b.cust_descrip,
a.job_descrip asc";
$seljob = MYSQL_QUERY($jobsql);
?>
</head>
<body class="body">
<center>
<center><font color="green" size=4>Job Selection
Form</font></center>
<form method="Post" name="jobselection">
```

```
<table border="1" bordercolor="#000000" width="80%"
class="tblstyle" align="center">
     <tr bgcolor="#D0ECE0"><th>#
</th><th>Description</th><th>Customer</th><th>Transaction
Date</th><th>Commencement
date</th><th>Status</th><th>action</th></tr>

                                                  <?php
                                                  $incrno=1;
                                                  while
($mydescriprow = mysql_fetch_array($seljob)){

     $seljobid=$mydescriprow["job_id"];

     $seldescrip=$mydescriprow["job_descrip"];
$contactperson=$mydescriprow["cust_descrip"];
$transactiondate=$mydescriprow["transaction_date"];
$startdate=$mydescriprow["startdate"];
//$starttime=$mydescriprow["start_time"];
$status=$mydescriprow["completed"];
$clickbtn="btn$seljobid";
?>
<tr><td><?echo $incrno++?></td><td><?echo
$seldescrip?></td><td><?echo
$contactperson?></td><td><?echo
$transactiondate?></td><td><?echo
$startdate?></td><td><?echo $status?></td>
     <td>
          <?php if($status=="C"){
          }else{?>
     <a href="fs_jobcosting.php?jobid=<?php echo
$seljobid ?>&descript=<? echo $seldescrip
?>">Edit</a></td>
          <?php }?>
     </tr>
          <?php
     }?>
</table>
</form>
</body>
</html>
```

```
<html>
<head><title>Job List</title>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<SCRIPT LANGUAGE="JavaScript1.1">
<!--
function schedule(scheduleid,descrip){
//scheduleid=22;
window.open('fs_jobregister.php?jobid='+scheduleid+'&desc
ript='+descrip+'', "Notification");
```

```
}
-->
</SCRIPT>
<?php
include("fsmysqlinc.inc");
if ($_POST[newbtn]) {
          $url_redirect = "Location:
fs_jobregister.php?";
          header($url_redirect);
     exit;
}
$jobsql="select
a.job_id,a.job_descrip,b.cust_descrip,a.transaction_date,
a.start_date,a.start_time,a.completed from fs_jobrecord
a,fs_customer b where a.cust_id=b.cust_id order by
b.cust_descrip, a.job_descrip asc";
$seljob = MYSQL_QUERY($jobsql);
?>
</head>
<body class="body">
<center>
<center><font color="green" size=4>Job Selection
Form</font></center>
<form method="Post" name="jobselection">
<table border="1" width="80%" class="tblstyle"
align="center">
<tr><td>
<table border="1" bordercolor="#000000" width="100%"
class="tblstyle" align="center">
     <tr bgcolor="#D0ECE0"><th>#
</th><th>Description</th><th>Customer</th><th>Transaction
Date</th><th>Status</th><th>action</th></tr>
                                        <?php
                                              $incrno=1;
                                              while
($mydescriprow = mysql_fetch_array($seljob)){
$seljobid=$mydescriprow["job_id"];
$seldescrip=$mydescriprow["job_descrip"];
$custdescrip=$mydescriprow["cust_descrip"];
$transactiondate=$mydescriprow["transaction_date"];
//$startdate=$mydescriprow["start_date"];
//$starttime=$mydescriprow["start_time"];

     $status=$mydescriprow["completed"];

     $clickbtn="btn$seljobid";
                                                   ?>
     <tr><td><?echo $incrno++?></td><td><?echo
$seldescrip?></td><td><?echo
$custdescrip?></td><td><?echo
$transactiondate?></td><td><?echo $status?></td>
```

```
          <td><a href="fs_jobregister.php?jobid=<?php
echo $seljobid ?>&descript=<? echo $seldescrip
?>">Edit</a></td>
     </tr>
          <?php
          }?>
</table>
</td><td width="10%" align="right" valign="top"><input
type="submit" name="newbtn" value=" New "
class="colorbtn"></td></tr>
</table>
</form>
</body>
</html>
```

```
<html>
<head><title>Invoice Job List</title>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<SCRIPT LANGUAGE="JavaScript1.1">
<!--
function schedule(scheduleid,descrip){
//scheduleid=22;
window.open('fs_jobregister.php?jobid='+scheduleid+'&desc
ript='+descrip+'', "Notification");
}
-->
</SCRIPT>
<?php
include("fsmysqlinc.inc");
if ($_POST[newbtn]) {
          $url_redirect = "Location:
fs_jobregister.php?";
          header($url_redirect);
     exit;
}
$jobsql="select
a.job_id,a.cust_id,a.job_descrip,b.cust_descrip,a.transac
tion_date,a.start_date,a.start_time,a.completed from
fs_jobrecord a,fs_customer b where a.cust_id=b.cust_id
order by b.cust_descrip, a.job_descrip asc";
$seljob = MYSQL_QUERY($jobsql);
?>
</head>
<body class="body">
<center>
<center><font color="green" size=4>Invoice Job
Selection</font></center>
<form method="Post" name="jobselection">
<table border="1" width="80%" class="tblstyle"
align="center">
<tr><td>
```

```
<table border="1" bordercolor="#000000" width="100%"
class="tblstyle" align="center">
     <tr bgcolor="#D0ECE0"><th>#
</th><th>Description</th><th>Customer</th><th>Transaction
Date</th><th>Status</th><th>action</th></tr>
                                        <?php
                                             $incrno=1;
                                             while
($mydescriprow = mysql_fetch_array($seljob)){

     $seljobid=$mydescriprow["job_id"];

     $custid=$mydescriprow["cust_id"];

     $seldescrip=$mydescriprow["job_descrip"];

     $custdescrip=$mydescriprow["cust_descrip"];

     $transactiondate=$mydescriprow["transaction_date"];

     //$startdate=$mydescriprow["start_date"];

     //$starttime=$mydescriprow["start_time"];

     $status=$mydescriprow["completed"];

     //$clickbtn="btn$seljobid";
                                                  ?>
     <tr><td><?echo $incrno++?></td><td><?echo
$seldescrip?></td><td><?echo
$custdescrip?></td><td><?echo
$transactiondate?></td><td><?echo $status?></td><td><a
href="fs_customerinvoice.php?jobid=<?echo
$seljobid?>&custid=<?echo $custid?>&jobdescription=<?echo
$seldescrip?>" class="whitelink">Invoice</a></td></tr>
                                        <?}?>
</table>
</td><td width="10%" align="right" valign="top"><input
type="submit" name="newbtn" value=" New "
class="colorbtn"></td></tr>
</table>
</form>
</body>
</html>
```

```
<html>
<head><title>Job Registration</title>
<script src="libraries/functions.js"
type="text/javascript" language="javascript"></script>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<?php
```

```
include("fsmysqlinc.inc");
include("fsqueryfunctions.inc");
$customerid=$_GET[customerid];
$jobid=$_GET[jobid];
//$jobdescript=$_GET[descript];
if ($jobid !=""){
     $descripsql="select job_id,cust_id,job_descrip from
fs_jobrecord where job_id='$jobid'";
     $descripreg = MYSQL_QUERY($descripsql);
     $custid= mysql_result($descripreg,0,"cust_id");
     $jobid= mysql_result($descripreg,0,"job_id");
     $descrip= mysql_result($descripreg,0,"job_descrip");
}
if ($_POST[regbtn]) {
     $jobid=$_POST[jobid];
     $cust_idsql="select job_id from fs_jobrecord where
job_id='$jobid'";
     $cust_idreg = MYSQL_QUERY($cust_idsql);
     if   ($custrow=mysql_fetch_array($cust_idreg)){
          $custregsql="update fs_jobrecord set
job_descrip='" . addslashes($_POST[jobname]) . "' where
job_id='$jobid'";
     }else{
          $custregsql="insert into
fs_jobrecord(cust_id,job_descrip, transaction_date)
values('$_POST[cmbcustomerid]','" .
addslashes($_POST[jobname]) . "',now())";
     }
     echo $custregsql;
          $custreg = MYSQL_QUERY($custregsql);
          $url_redirect = "Location: fs_joblist.php";
          header($url_redirect);
          exit;
}
if ($_POST[deletebtn]) {
          $jobid=$_POST[jobid];
     $chkjobidsql="select * from fs_schedule where
job_id='$jobid'";
     $chkjob = MYSQL_QUERY($chkjobidsql);
     if   ($chkjobrow=mysql_fetch_array($chkjob)){
          echo "<h4 align=center><font color='red'>Delete
failed: Job already in Schedule!</font></h4>";
     }else{
          $delmatunitsql="delete from fs_jobrecord where
job_id='$jobid'";
                    $delmatunit =
MYSQL_QUERY($delmatunitsql);
                    $url_redirect = "Location:
fs_joblist.php?";
                    header($url_redirect);
               exit;
```

```
    }
}
/**/
if ($_POST[cancelbtn]) {
          $url_redirect = "Location: fs_joblist.php?";
          header($url_redirect);
          exit;
}
?>
</head>
<body class="body">
<center>
<table border="1" bordercolor="silver" class="tblstyle">
<th colspan="2" align="center"><font color="green"
size=4>Customer Setup</font></th>
<form method="Post" name="customersetup">
<?php
    if ($jobid ==""){
?>
<tr><td><b>Customer Name:</b></td><td> <select
name="cmbcustomerid">
<?php
$custsql="select  cust_id,
cust_descrip,contact_person,cust_address,join_date from
fs_customer order by  cust_descrip  asc";
$selcust = MYSQL_QUERY($custsql);
                while ($mydescriprow =
mysql_fetch_array($selcust)){
                    $selcustid=$mydescriprow["cust_id"];

    $seldescrip=$mydescriprow["cust_descrip"];
?>
          <option value="<?echo $selcustid?>"><?echo
$seldescrip?>
<?        }?>
</select></td></tr>
<?
    }
?>
    <tr><td><b>Job Description</b> </td><td><input
type="text" name="jobname" size="40" maxlength="45"
value="<?echo $descrip?>"><input type="hidden"
name="custid" value="<?echo $customerid?>"><input
type="hidden" name="jobid" value="<?echo
$jobid?>"></td></tr>
    <?
    if
($effstatus=="Y"){$active="checked";}else{$active="";}
    ?>
    <tr><td><b>Status</b> </td><td><input
type="checkbox" id="status" name="status" <? echo
```

```
$active?> value="Y"> <label
for="status">Active</label></td></tr>
     <tr><td colspan="2" align="center"><input
type="submit" value=" Save " name="regbtn"
class="colorbtn">
     <input type="submit" value=" Delete "
name="deletebtn" class="colorbtn" onclick="return
confirmLink(this, 'Delete this Material?')">
     <input type="submit" value="Cancel" name="cancelbtn"
class="colorbtn"> <input type="reset" value="Reset"
class="colorbtn"></td></tr>
</form>
</table>
</body>
</html>
```

```
<html><head><title>Job Scheduller</title>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<?php
include("fsmysqlinc.inc");
$jobid=$_GET[jobid];
$descript=$_GET[descript];
//$datetime= date("d/m/Y");
//$datetime= date("Y/m/d");
$datetime="2006/11/11";
$currtime= date("h:i");
if ($_POST[cancelbtn]) {
          $url_redirect = "Location:
fs_jobselection.php?";
     header($url_redirect);
          exit;
}
if ($_POST[btnfetch]) {
//$datetime= $_POST[txtdate];
$datetime= $_POST[cmbscheduledate];
}
$jobscdsql="select
a.schedule_id,a.schedule_date,b.job_descrip,c.equip_descr
ip,e.equipunit_descrip, a.
schedule_order,a.work_id,d.work_descrip,a.
schedule_time,a. schedule_start,a. schedule_end from
fs_schedule a,fs_jobrecord b,fs_equipment c,fs_worktype
d,fs_equipmentunit e where a.job_id=b.job_id and
a.equip_id=c.equip_id and a.work_id=d.work_id and
a.equip_id=e.equip_id and a.equipunit_id=e.equipunit_id
and a.schedule_date='$datetime' order by
a.schedule_date,a.schedule_id asc";
          $jobschedule = MYSQL_QUERY($jobscdsql);
     $jobscddatesql="select
distinct(schedule_date)scheduledate from fs_schedule
order by schedule_date asc";
```

```
          $jobscheduledate = MYSQL_QUERY($jobscddatesql);
          //echo $jobscdsql;
?>
</head>
<body class="body">
<h3 align="center">Work Sheet</h3>
<form method="Post" name="jobsetup">
<table border="1" align="center" width="95%"
class="tblstyle" bgcolor="#ffffff" bordercolor="#000000">
<tr><td>Engaged Date: </td>
     <td colspan="2"><select name="cmbscheduledate">
                     <?php
                     //$jobscheduledate =
MYSQL_QUERY($jobscheduledate);
                     while ($scheduledaterow =
mysql_fetch_array($jobscheduledate)){

     //$scheduleid=$scheduledaterow["schedule_id"];

     $scheduledate=$scheduledaterow["scheduledate"];
                          if
($datetime==$scheduledate){$dateselected="Selected";
                          }else{$dateselected="";}
                     ?>
                     <option <?php echo $dateselected?>
value="<?php echo $scheduledate?>"><?php echo
$scheduledate?></option>
          <?php }?></select>
           <input type="submit" name="btnfetch"
value="Fetch" class="colorbtn"></td>
</td></tr>
</table>
<table border="1" align="center" width="95%"
class="tblstyle" bgcolor="#ffffff" bordercolor="#000000">
<tr><td colspan="5">
     <table border="1" bordercolor="#000000"
cellspacing="1" cellpadding="0" width="100%"
class="tblstyle">
     <tr bgcolor="#D0ECE0"><th
bordercolor="#000000"><b>#</b></th><th
bordercolor="#000000"><b>Date</b><th
bordercolor="#000000"><b>Job Description</b></th><th
bordercolor="#000000"><b>Section</b></th><th
bordercolor="#000000"><b>Unit</b></th><th
bordercolor="#000000">Order</th><th
bordercolor="#000000">Method</th><th
bordercolor="#000000">Duration(hrs)</th><th
bordercolor="#000000">Time</th></tr>
     <?php
     $incr=1;
```

```
while ($jobschedulerow =
mysql_fetch_array($jobschedule)){
          $scheduleid=$jobschedulerow["schedule_id"];
          $scheduledate=$jobschedulerow["schedule_date"];
          $jobdescrip=$jobschedulerow["job_descrip"];
          $equipdescrip=$jobschedulerow["equip_descrip"];

     $equipunitdescrip=$jobschedulerow["equipunit_descrip
"];
          $procorderno=$jobschedulerow["schedule_order"];
          //$nature=$jobschedulerow["work_id"];
          $nature=$jobschedulerow["work_descrip"];
          $timeframe=$jobschedulerow["schedule_time"];
          $timestart=$jobschedulerow["schedule_start"];
          $timeend=$jobschedulerow["schedule_end"];
          $timerange="$timestart - $timeend" ;
     //for bgcolor
     if
(($incr/2)==(round($incr/2))){$bckcolor="#D0DCE0";}else{$
bckcolor="#ffffff";}
?>
          <tr bgcolor="<?php echo $bckcolor ?>"><td><?php
echo $incr++?></td><td><?php echo $scheduledate?>
</td><td><?php echo $jobdescrip?> </td><td><?php echo
$equipdescrip?> </td><td><?php echo
$equipunitdescrip?></td><td><?php echo $procorderno
?></td><td><?php echo $nature?></td><td><?php echo
$timeframe?></td><td><?php echo $timerange?></td></tr>
<?php
          }
?>
</table>
</td></tr>
</table>
</td></tr>
</table>
</form>
</body>
</html>
```

```
<html><head><title>Job Scheduller</title>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<SCRIPT LANGUAGE="JavaScript1.1">
<!--
var confirmMsg  = 'Do you really want to';
function confirmLink(theLink, theSqlQuery)
{
    // Confirmation is not required in the configuration
file
    if (confirmMsg == '') {
        return true;
```

```
    }
    var is_confirmed = confirm(confirmMsg + ' :\n' +
theSqlQuery);
    if (is_confirmed) {
        theLink.href += '&is_js_confirmed=1';
    }
    return is_confirmed;
} // end of the 'confirmLink()' function
-->
</SCRIPT>
<?php
include("fsmysqlinc.inc");
$jobid=$_GET[jobid];
$descript=$_GET[descript];
if ($_POST[cancelbtn]){
          $url_redirect="Location:fs_jobselection.php";
          header($url_redirect);
          exit;
}
$equipsql="select equip_id,equip_descrip,equip_no from
fs_equipment where effstatus='Y' order by equip_descrip
asc";
//$selequip = MYSQL_QUERY($equipsql);
$worksql="select work_id,work_descrip,work_time from
fs_worktype order by work_descrip asc";
//$selwork = MYSQL_QUERY($worksql);
include("fsschedulle.inc");
$countequipsql="select count(equip_id) equiptotal from
fs_equipment where effstatus='Y'";
$countselequip = MYSQL_QUERY($countequipsql);
     $jobscdsql="select
a.schedule_id,a.schedule_date,b.job_descrip,c.equip_descr
ip,e.equipunit_descrip, a.
schedule_order,a.work_id,d.work_descrip,a.
schedule_time,a. schedule_start,a. schedule_end from
fs_schedule a,fs_jobrecord b,fs_equipment c,fs_worktype
d,fs_equipmentunit e where a.job_id='$jobid' and
a.job_id=b.job_id and a.equip_id=c.equip_id and
a.work_id=d.work_id and a.equip_id=e.equip_id and
a.equipunit_id=e.equipunit_id order by
a.schedule_date,a.schedule_id asc";
          $jobschedule = MYSQL_QUERY($jobscdsql);
          //echo $jobscdsql;
//$datetime= date("d/m/Y");
//$datetime= date("Y/m/d");
$datetime="2008/01/07";
$currtime= date("h:i");
?>
</head>
<body class="body">
<form method="Post" name="jobsetup">
```

```
<table border="1" align="center" width="85%"
class="tblstyle" bgcolor="#ffffff" bordercolor="#000000">
<tr><td colspan="5">
          <div align="center">Job Description:<font
color="orange" size="4"> <?echo $descript?> </font><input
type="hidden" name="jobid" value="<?echo
$jobid?>">      Effective
Date: <input type="text" size="8" maxlength="10"
name="txtdate" value="<? echo
$datetime?>"></div></td></tr>
<tr><th>Sections to be Engaged</th><th>No of Equip.to be
Engaged</th><th>Operational Sequence</th><th>Method of
Operation</th><th>Estimated Production Time
(Hr)</th></tr>
<?php
while ($countequiprow =
mysql_fetch_array($countselequip)){
          $totalequip=$countequiprow["equiptotal"];
}
$selequip = MYSQL_QUERY($equipsql);
while ($equiprow = mysql_fetch_array($selequip)){
          $equipid=$equiprow["equip_id"];
          $equipdescript=$equiprow["equip_descrip"];
          //$equipno=$equiprow["equip_no"];
          $equipno=countactiveunit($equipid);
       $hidequipid=("hidequip$equipid");
       $cmbconc=("cmbmaxconc$equipid");
       $cmborder=("cmborder$equipid");
       $cmbmethod=("cmbmethod$equipid");
       $txttime=("txttime$equipid");
?>
     <tr><td><?php echo $equipdescript?><input
type="hidden" name="<?php echo $hidequipid?>"
value="<?php echo $equipid?>"></td>
          <td><select name="<?echo $cmbconc?>"><?php for
($i = 1;  $i < $equipno + 1;  $i++){
     ?><option value="<?php echo $i?>"><?php echo
$i?></option><?php }?></select></td>
          <td><select name="<?php echo $cmborder?>"><?php
for ($t = 1;  $t < $totalequip + 1;  $t++){
     ?><option value="<?php echo $t?>"><?php echo
$t?></option><?}?></select><input type="hidden"
name="hidorder" value="<?php echo "$totalequip";?>"></td>
          <td><select name="<?php echo $cmbmethod?>">
                    <?php
                    $selwork = MYSQL_QUERY($worksql);
                    while ($workrow =
mysql_fetch_array($selwork)){
                         $workid=$workrow["work_id"];

     $workdescrip=$workrow["work_descrip"];
```

```
                        $worktime=$workrow["work_time"];
                    ?>
                    <option value="<?php echo
$workid?>"><?php echo $workdescrip?></option>
          <?php )?></select></td>
          <td>Time: <input type="text" size="5"
maxlength="4" name="<?echo $txttime?>"></td>
     </tr>
<?}?>
<tr><td colspan="5" align="center"><input type="submit"
name="btnsave" class="colorbtn" value=" Save "
onclick="return confirmLink(this, 'Schedule this Job')">
<input type="reset" value="Clear" class="colorbtn">
<input type="submit" name="cancelbtn" value="Back to
Main" class="colorbtn"></td></tr>
<tr><td colspan="5">
     <table border="1" bordercolor="#000000"
cellspacing="1" cellpadding="0" width="100%"
class="tblstyle">
     <tr bgcolor="#D0ECE0"><th
bordercolor="#000000"><b>#</b></th><th
bordercolor="#000000"><b>Date</b><th
bordercolor="#000000"><b>Section</b></th><th
bordercolor="#000000"><b>Unit</b></th><th
bordercolor="#000000">Order</th><th
bordercolor="#000000">Method</th><th
bordercolor="#000000">Duration(hrs)</th><th
bordercolor="#000000">Time</th><th
bordercolor="#000000"><input type="submit"
name="btnactivate" value="Activate" onclick="return
confirmLink(this, 'Pend/Unpend Schedule Items')"
class="colorbtn"></th></tr>
     <?php
     $incr=1;
while ($jobschedulerow =
mysql_fetch_array($jobschedule)){
          $scheduleid=$jobschedulerow["schedule_id"];
          $scheduledate=$jobschedulerow["schedule_date"];
          $equipdescrip=$jobschedulerow["equip_descrip"];

     $equipunitdescrip=$jobschedulerow["equipunit_descrip
"];
          $procorderno=$jobschedulerow["schedule_order"];
          //$nature=$jobschedulerow["work_id"];
          $nature=$jobschedulerow["work_descrip"];
          $timeframe=$jobschedulerow["schedule_time"];
          $timestart=$jobschedulerow["schedule_start"];
          $timeend=$jobschedulerow["schedule_end"];
          $timerange="$timestart - $timeend" ;
     //for bgcolor
```

```
    if
(($incr/2)==(round($incr/2))){$bckcolor="#D0DCE0";}else{$
bckcolor="#ffffff";}
?>
          <tr bgcolor="<?php echo $bckcolor ?>"><td><?php
echo $incr++?></td><td><?php echo $scheduledate?>
</td><td><?php echo $equipdescrip?> </td><td><?php echo
$equipunitdescrip?></td><td><?php echo $procorderno
?></td><td><?php echo $nature?></td><td><?php echo
$timeframe?></td><td><?php echo $timerange?></td><td>
          <input type="checkbox" name="" value="Yes">
Pending</td></tr>
<?
     }
?>
</table>
</td></tr>
</table>
</td></tr>
</table>
</form>
</body>
</html>
```

```
<html>
<head><title>Job Selection</title>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<SCRIPT LANGUAGE="JavaScript1.1">
<!--
function submitclick (form) {
if (jobselection.jobcost.value == '')
     {
          alert(' Cost is a required field.');
          jobselection.jobcost.focus();
          return false;
     }
  return true;
}
function schedule(scheduleid,descrip){
//scheduleid=22;
window.open('fs_jobscheduller.php?jobid='+scheduleid+'&de
script='+descrip+'', "Notification");
}
-->
</SCRIPT>
<?php
include("fsmysqlinc.inc");
//$jobsql="select
a.job_id,a.job_descrip,b.cust_descrip,a.transaction_date,
a.start_date,a.start_time,a.completed from fs_jobrecord
```

```
a,fs_customer b where a.cust_id=b.cust_id order by
b.cust_descrip, a.job_descrip asc";
$jobsql="select
a.job_id,a.job_descrip,b.cust_descrip,a.transaction_date,
(select min(c.schedule_date) date from fs_schedule c
where
c.job_id=a.job_id)startdate,a.start_date,a.start_time,a.c
ompleted from fs_jobrecord a,fs_customer b where
a.cust_id=b.cust_id order by b.cust_descrip,
a.job_descrip asc";
$seljob = MYSQL_QUERY($jobsql);
?>
</head>
<body class="body">
<center>
<center><font color="green" size=4>Job Selection
Form</font></center>
<form method="Post" name="jobselection">
<table border="1" bordercolor="#000000" width="80%"
class="tblstyle" align="center">
     <tr bgcolor="#D0ECE0"><th>#
</th><th>Description</th><th>Customer</th><th>Transaction
Date</th><th>Commencement
date</th><th>Status</th><th>action</th></tr>
                                        <?php
                                             $incrno=1;
                                             while
($mydescriprow = mysql_fetch_array($seljob)){

     $seljobid=$mydescriprow["job_id"];
          $seldescrip=$mydescriprow["job_descrip"];

     $custdescrip=$mydescriprow["cust_descrip"];

     $transactiondate=$mydescriprow["transaction_date"];
               $startdate=$mydescriprow["startdate"];

     //$starttime=$mydescriprow["start_time"];

     $status=$mydescriprow["completed"];
                              $clickbtn="btn$seljobid";
                                             ?>
     <tr><td><?php echo $incrno++?></td><td><?php echo
$seldescrip?></td><td><?php echo
$custdescrip?></td><td><?php echo
$transactiondate?></td><td><?php echo
$startdate?></td><td><?php echo $status?></td>
<td>
          <?php if($status=="C"){
          }else{?>
```

```
        <a href="fs_jobsche          php?jobid=<?php echo
    hid ?>&descript=<? ech           scrip
      dule</a>
       <?php }?>
      }></tr>


      ..................          ..............................

       tle>Job Selecl
      ef="fs_format.c                Sheet"
type="text/css">
<SCRIPT LANGUAGE="Javas
<!--
function submitclick (
if (jobselection.jobcost.value == '')
    {
        alert(' Cost is a required field.');
        jobselection.jobcost.focus();
        return false;
    }
  return true;
}
function scheduleCost(scheduleid,descrip){
//scheduleid=22;
window.open('fs_jobcosting.php?jobid='+scheduleid+'&descr
ipt='+descrip+'', "Notification");
}
-->
</SCRIPT>
<?php
include("fsmysqlinc.inc");
$jobsql="select
job_id,job_descrip,contact_person,transaction_date,start_
date,start_time,completed from fs_jobrecord order by
job_descrip asc";
$seljob = MYSQL_QUERY($jobsql);
?>
</head>
<body class="body">
<center>
<center><font color="green" size=4>Job Selection
Form</font></center>
<form method="Post" name="jobselection">
<table border="1" bordercolor="#000000" width="80%"
class="tblstyle" align="center">
    <tr bgcolor="#D0ECE0"><th>#
</th><th>Description</th><th>Contact</th><th>Transaction
```

```
Date</th><th>Commencement
date</th><th>Status</th><th>action</th></tr>
                                        <?php
                                            $incrno=1;
                                            while
($mydescriprow = mysql_fetch_array($seljob)){
     $seljobid=$mydescriprow["job_id"];
               $seldescrip=$mydescriprow["job_descrip"];

     $contactperson=$mydescriprow["contact_person"];

     $transactiondate=$mydescriprow["transaction_date"];

     $startdate=$mydescriprow["start_date"];

     //$starttime=$mydescriprow["start_time"];

     $status=$mydescriprow["completed"];

     $clickbtn="btn$seljobid";
                                            ?>
     <tr><td><?echo $incrno++?></td><td><?echo
$seldescrip?></td><td><?echo
$contactperson?></td><td><?echo
$transactiondate?></td><td><?echo
$startdate?></td><td><?echo $status?></td><td><input
type="button"  class="colorbtn" name="<?echo $clickbtn?>"
value="Cost" onclick="scheduleCost('<? echo $seljobid
?>','<? echo $seldescrip ?>')"></td></tr>
                                    <?)?>
</table>
</form>
</body>
</html>
```

```
<html>
<head><title>Job Status</title>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<script src="libraries/functions.js"
type="text/javascript" language="javascript"></script>
<?php
include("fsmysqlinc.inc");
if ($_POST[btnprocess]) {
//To be continued
$seljobupdsql="select
a.job_id,a.cust_id,a.job_descrip,a.completed from
fs_jobrecord a";
$seljobupd = MYSQL_QUERY($seljobupdsql);
     while ($jobrow = mysql_fetch_array($seljobupd)){
          $jobid=$jobrow["job_id"];
               $radjobval=$_POST[("rad$jobid")];
```

```
                $checkjobupsql="select * from fs_jobrecord
where job_id='$jobid' and completed ='C'";
                    $checkjobup =
MYSQL_QUERY($checkjobupsql);
                    if
     ($checkjobrow=mysql_fetch_array($checkjobup)){
                        //echo "<h4 align=center><font
color='red'>Delete failed: Job already
Done!</font></h4>";
                    }else{
                        $updatejobsql="update
fs_jobrecord set completed='$radjobval' where
job_id='$jobid'";
                                    $deljob =
MYSQL_QUERY($updatejobsql);
                    //echo $updatejobsql;
                    }
     }
}
if ($_POST[btndelete]) {
$seljobsql="select
a.job_id,a.cust_id,a.job_descrip,a.completed from
fs_jobrecord a";
$seljob = MYSQL_QUERY($seljobsql);
     while ($jobrow = mysql_fetch_array($seljob)){
          $jobid=$jobrow["job_id"];
          //$chkdelname="chkname$jobid";
               $chkjobval=$_POST[("chkname$jobid")];
          if ($chkjobval !=""){
               $checkjobsql="select * from fs_jobrecord
where job_id='$jobid' and completed ='C'";
                    $checkjob =
MYSQL_QUERY($checkjobsql);
                    if
     ($checkjobrow=mysql_fetch_array($checkjob)){
                        echo "<h4 align=center><font
color='red'>Delete failed: Job already
Done!</font></h4>";
                    }else{
                        $deljobsql="delete from
fs_jobrecord where job_id='$jobid'";
                            $deljob =
MYSQL_QUERY($deljobsql);
                        $deljobschedsql="delete from
fs_schedule where job_id='$jobid'";
                            $delschedjob =
MYSQL_QUERY($deljobschedsql);
                    }
                    //echo $chkequipmentsql;
          //echo $checkjobsql;
     }
```

```
    }
}
$jobsql="select
a.job_id,a.cust_id,a.job_descrip,b.cust_descrip,a.transac
tion_date,a.start_date,a.start_time,a.completed from
fs_jobrecord a,fs_customer b where a.cust_id=b.cust_id
order by b.cust_descrip, a.job_descrip asc";
$seljob = MYSQL_QUERY($jobsql);
?>
</head>
<body class="body">
<center>
<center><font color="green" size=4>Job
Processing</font></center>
<form method="Post" name="jobselection">
<table border="1" width="80%" class="tblstyle"
align="center">
<tr><td>
<table border="1" bordercolor="#000000" width="100%"
class="tblstyle" align="center">
    <tr bgcolor="#D0ECE0"><th>#
</th><th>Description</th><th>Customer</th><th>Transaction
Date</th><th><input type="submit" name="btnprocess"
value="Process" class="colorbtn" onclick="return
confirmLink(this, 'Commit these
Processes?')"></th><th><input type="submit"
name="btndelete" value="Delete" class="colorbtn"
onclick="return confirmLink(this, 'Delete these
Jobs?')"></th></tr>
                                        <?php
                                            $incrno=1;
                                            while
($mydescriprow = mysql_fetch_array($seljob)){

    $seljobid=$mydescriprow["job_id"];

    $custid=$mydescriprow["cust_id"];
            $seldescrip=$mydescriprow["job_descrip"];

    $custdescrip=$mydescriprow["cust_descrip"];

    $transactiondate=$mydescriprow["transaction_date"];

    //$startdate=$mydescriprow["start_date"];

    //$starttime=$mydescriprow["start_time"];
                $status=$mydescriprow["completed"];
                $selectradname="rad$seljobid";
                $selectrada="rada$seljobid";
                $selectradp="radp$seljobid";
                $selectradc="radc$seljobid";
```

```
                $chkradname="chkname$seljobid";
            if ($status=="A"){
            $activeval="checked";
                        $pendingval="";

      $completedval="";
                    $activedisabled="";
                    $pendingdisabled="";
                }else if ($status=="C"){
                                        $activeval="";
                                        $pendingval="";
                $completedval="checked";
      $activedisabled="disabled";
            $pendingdisabled="disabled";
            }else{
            $pendingval="checked";
            $activeval="";
                                        $completedval="";
                                    $activedisabled="";

      $pendingdisabled="";
                                    }
                                                ?>
      <tr><td><?echo $incrno++?></td><td><?echo
$seldescrip?></td><td><?echo
$custdescrip?></td><td><?echo
$transactiondate?></td><td><input type="Radio"
name="<?php echo $selectradname?>" id="<?php echo
$selectrada?>" value="A" <?php echo $activeval?><?php
echo $activedisabled?>><label for="<?php echo
$selectrada?>">Active</label><input type="Radio"
name="<?php echo $selectradname?>" id="<?php echo
$selectradp?>" value="P" <?php echo $pendingval?> <?php
echo $pendingdisabled?>><label for="<?php echo
$selectradp?>">Pending</label><input type="Radio"
name="<?php echo $selectradname?>" id="<?php echo
$selectradc?>" value="C" <?php echo
$completedval?>><label for="<?php echo
$selectradc?>">Completed</label></td><td><input
type="checkbox" name="<?php echo $chkradname?>" id="<?php
echo $chkradname?>"><label for="<?php echo
$chkradname?>">Delete</label></td></tr>
                                            <?}?>
</table>
</td></tr>
</table>
</form>
</body>
</html>
```

```
<html>
<head><title>Home</title>
```

```
<link href="fs_format.css" rel="styleSheet"
type="text/css">
</head>
<body class="body">
<h3 align="center">Home</h3>
<form method="Post" name="home">
<table border="1" bordercolor="#000000" width="90%"
height="70%" class="tblstyle" align="center">
<tr bgcolor="#D0ECE0"><td valign="bottom" align="center"
width="33%"><b>Setup</b>
     <table border="1" bordercolor="Black" width="100%"
height="96%" class="tblstyle" align="center">
     <tr bgcolor="silver"><td valign="bottom"
align="center" width="50%" height="33%"><a
href="fs_equipmentlist.php"><img src="images/images8.jpg"
width="140" height="108" alt="Equipment
Setup"><br>Equipment</a></td>
          <td valign="bottom" align="center" width="50%"
height="33%"><a href="fs_materiallist.php"><img
src="images/images3.jpg" width="140" height="108"
alt="Material Setup"><br>Material</a></td></tr>
     <tr><td valign="bottom" align="center" width="50%"
height="33%"><a href="fs_customersetup.php"><img
src="images/images.jpg" width="140" height="108"
alt="Customer Setup"><br>Customer--</a></td>
          <td valign="bottom" align="center" width="50%"
height="33%"><a href="fs_manpower.php"><img
src="images/images15.jpg" width="140" height="108"
alt="Man-Power Setup"><br>Man-Power*</a></td></tr>
     <tr><td valign="bottom" align="center" width="50%"
height="33%"><a href="fs_joblist.php"><img
src="images/images20.jpg" width="140" height="108"
alt="Job Registration"><br>Job Registration</a></td>
          <td valign="bottom" align="center" width="50%"
height="33%"><a href="fs_companyprofile.php"><img
src="images/images2.jpg" width="140" height="108"
alt="Company Profile"><br>Company Profile</a></td></tr>
     </table>
</td>
<td valign="bottom" align="center"
width="33%"><b>Schedule</b>
     <table border="1" bordercolor="Black" width="100%"
height="96%" class="tblstyle" align="center">
     <tr bgcolor="silver"><td valign="bottom"
align="center" width="50%" height="33%"><a
href="fs_jobselection.php"><img src="images/images14.jpg"
width="140" height="108" alt="Equipment / Time
Schedule"><br>Equipment / Time</a></td>
          <td valign="bottom" align="center" width="50%"
height="33%"><a href="fs_joblistInvoice.php"><img
```

```
src="images/images6.jpg" width="140" height="108"
alt="Customer Invoice"><br>Invoice</a></td></tr>
     <tr><td valign="bottom" align="center" width="50%"
height="33%"><a href="fs_jobcostingselection.php"><img
src="images/images1.jpg" width="140" height="108"
alt="Material Costing"><br>Material Costing</a></td>
          <td valign="bottom" align="center" width="50%"
height="33%"><a href="fs_jobstatus.php"><img
src="images/images17.jpg" width="140" height="108"
alt="Job Status"><br>Job Status</a></td></tr>
     <tr><td valign="bottom" align="center" width="50%"
height="33%"><a href="fs_overhead.php"><img
src="images/images16.jpg" width="140" height="108"
alt="Overhead"><br>Overhead*</a></td>
          <td valign="bottom" align="center" width="50%"
height="33%"><a href="fs_manpower.php"><img
src="images/images10.jpg" width="140" height="108"
alt="Man-Power"><br>Man-Power*</a></td></tr>
     </table>
</td>
<td valign="bottom" align="center"
width="33%"><b>Report*</b>
     <table border="1" bordercolor="Black" width="100%"
height="96%" class="tblstyle" align="center">
     <tr bgcolor="silver"><td valign="bottom"
align="center" width="50%" height="33%"><a
href="fs_jobschedule.php"><img src="images/images7.jpg"
width="140" height="108" alt="Job Schedule"><br>Job
Schedule</a></td>
          <td valign="bottom" align="center" width="50%"
height="33%"><a href="fs_stockupdate.php"><img
src="images/images5.jpg" width="140" height="108"
alt="Material Stock Update"><br>Stock</a></td></tr>
     <tr><td valign="bottom" align="center" width="50%"
height="33%"><a href="fs_customerlist.php"><img
src="images/images11.jpg" width="140" height="108"
alt="Customers"><br>Customers</a></td>
          <td valign="bottom" align="center" width="50%"
height="33%"><a href="fs_manpower.php"><img
src="images/images12.jpg" width="140" height="108"
alt="Man-Power Setup"><br>Man-Power*</a></td></tr>
     <tr><td valign="bottom" align="center" width="50%"
height="33%"><a href="fs_overhead.php"><img
src="images/images13.jpg" width="140" height="108"
alt="Pending Work"><br>Pending Work*</a></td>
          <td valign="bottom" align="center" width="50%"
height="33%"><a href="fs_manpower.php"><img
src="images/images18.jpg" width="140" height="108"
alt="Work-In-Progress"><br>Work-In-
Progress*</a></td></tr>
     </table>
```

```
</td>
</tr>
</table></form>
</body></html>
```

```
<html><head><title>Materials List</title>
<SCRIPT LANGUAGE="JavaScript1.1">
<!--
var confirmMsg  = 'Do you really want to';
function confirmLink(theLink, theSqlQuery)
{
    // Confirmation is not required in the configuration
file
    if (confirmMsg == '') {
        return true;
    }
    var is_confirmed = confirm(confirmMsg + ' :\n' +
theSqlQuery);
    if (is_confirmed) {
        theLink.href += '&is_js_confirmed=1';
    }
    return is_confirmed;
} // end of the 'confirmLink()' function
-->
</SCRIPT>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<?php
include("fsmysqlinc.inc");
include("fsqueryfunctions.inc");
if ($_POST[newbtn]) {
          $url_redirect = "Location:
fs_materialsetup.php?";
          header($url_redirect);
          exit;
}
$matsql="select
a.mat_id,a.mat_descrip,max(b.stock_id)stockid,sum(b.stock
_quant)stockquant from fs_material a,fs_materialstock b
where a.mat_id=b.mat_id group by b.mat_id order by
a.mat_descrip";
$matlist = MYSQL_QUERY($matsql);
     //echo $matsql;
?>
</head>
<body class="body">
<h3 align="center">Material List</h3>
<form method="Post" name="materiallist">
<table border="1" width="80%" class="tblstyle"
align="center">
<tr><td>
```

```
     <table border="1" width="100%" class="tblstyle"
align="center">
     <tr
bgcolor="#D0ECE0"><th><b>#</b></th><th><b>Material</b></t
h><th align="Center"><b>Stock</b></th><th
align="Center">Total Purchase Cost/Unit(N)</th><th
align="Center">Usage
Price/Unit(N)</th><th></th><th></th></tr>
     <?php
     $incr=1;
while ($matlistrow = mysql_fetch_array($matlist)){
          $matid=$matlistrow["mat_id"];
          $stockid=$matlistrow["stockid"];
          $matdescrip=$matlistrow["mat_descrip"];
          $matno=$matlistrow["stockquant"];
//cost
$matcostsql="select stock_price,stock_cost from
fs_materialstock where mat_id='$matid' and
stock_id='$stockid'";
$matcostsel = MYSQL_QUERY($matcostsql);
     while ($matcostrow =
mysql_fetch_array($matcostsel)){
          $matprice=$matcostrow["stock_price"];
          $matcost=$matcostrow["stock_cost"];
     }
          $chkname="chk$matid";
     //for bgcolor
     if
(($incr/2)==(round($incr/2))){$bckcolor="#D0DCE0";}else{$
bckcolor="#ffffff";}
     if
($effstatus=="Y"){$active="checked";}else{$active="";}
?>
          <tr bgcolor="<?php echo $bckcolor ?>"><td><?php
echo $incr++?></td><td><?php echo $matdescrip?> </td><td
align="right"><?php echo $matno?> </td><td
align="right"><?php echo $matcost?></td><td
align="right"><?php echo $matprice?></td><td>
          <a href="fs_materialsetup.php?materialid=<?php
echo $matid?>" class="whitelink">Edit</a></td><td>
          <a href="fs_materialstock.php?materialid=<?php
echo $matid?>&matdescription=<?php echo $matdescrip?>"
class="whitelink">Inventory</a></td></tr>
<?php
          }
?>
</table>
</td><td width="10%" align="right" valign="top"><input
type="submit" name="newbtn" value=" New "
class="colorbtn"></td></tr>
</table>
```

```
</form>
</body>
</html>
```

```
<html>
<head><title>Material Registration</title>
<script src="libraries/functions.js"
type="text/javascript" language="javascript"></script>
<SCRIPT LANGUAGE="JavaScript1.1">
<!--
function submitclick (form) {
if (matsetup.matdescrip.value == '')
     {
          alert(' Description is a required field.');
          matsetup.matdescrip.focus();
          return false;
     }
     return confirmLink(this, 'Save this Material?')
  //return true;
}
-->
</SCRIPT>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<?php
include("fsmysqlinc.inc");
include("fsqueryfunctions.inc");
$materialid=$_GET[materialid];
if ($materialid !=""){
     $descripsql="select
mat_id,mat_descrip,mat_no,mat_cost,effstatus from
fs_material where mat_id='$materialid'";
     $descripreg = MYSQL_QUERY($descripsql);
     $eqid= mysql_result($descripreg,0,"mat_id");
     $descrip= mysql_result($descripreg,0,"mat_descrip");
     $eqno= mysql_result($descripreg,0,"mat_no");
     $eqcost= mysql_result($descripreg,0,"mat_cost");
     $effstatus= mysql_result($descripreg,0,"effstatus");
}
if ($_POST[regbtn]) {
     $mat_idsql="select mat_id from fs_material where
mat_id='$materialid'";
     $mat_idreg = MYSQL_QUERY($mat_idsql);
     if   ($matow=mysql_fetch_array($mat_idreg)){
          $matregsql="update fs_material set
mat_descrip='" . addslashes($_POST[matdescrip]) .
"',mat_no='" . addslashes($_POST[matno]) . "',mat_cost='"
. addslashes($_POST[matcost]) .
"',effstatus='$_POST[status]' where
mat_id='$materialid'";
          $matreg = MYSQL_QUERY($matregsql);
$maxmatid = $materialid;
```

```
//echo "Material already exist!";
    }else{
        $matregsql="insert into
fs_material(mat_descrip,mat_no,mat_cost,effstatus,creatio
n_date) values('" . addslashes($_POST[matdescrip]) .
"','" . addslashes($_POST[matno]) . "','" .
addslashes($_POST[matcost]) .
"','$_POST[status]',now())";
        $matreg = MYSQL_QUERY($matregsql);
//echo "Material Registered!";
//To select the new mat id
$maxmat_idsql="select max(mat_id)maxmatid from
fs_material";
    $maxmatsel = MYSQL_QUERY($maxmat_idsql);
    $maxmatid = mysql_result($maxmatsel,0,"maxmatid");
//End here
    }
        $url_redirect = "Location:
fs_materialstock.php?materialid=$maxmatid&matdescription=
$_POST[matdescrip]";
        header($url_redirect);
        exit;

}
if ($_POST[deletebtn]) {
    $chkmaterialsql="select * from fs_schedule where
mat_id='$materialid'";
    $chkmaterial = MYSQL_QUERY($chkmaterialsql);
    if
    ($chkmaterialrow=mysql_fetch_array($chkmaterial)){
        echo "<h4 align=center><font color='red'>Delete
failed: Material already in use!</font></h4>";
    }else{
        $delmatunitsql="delete from fs_materialunit
where mat_id='$materialid'";
                $delmatunit =
MYSQL_QUERY($delmatunitsql);
        $deletematsql="delete from fs_material where
mat_id='$materialid'";
                $deletemat =
MYSQL_QUERY($deletematsql);
            $url_redirect = "Location:
fs_materiallist.php?";
                header($url_redirect);
                exit;
    }
}
/**/
if ($_POST[cancelbtn]) {
        $url_redirect = "Location:
fs_materiallist.php?";
```

```
            header($url_redirect);
            exit;
}
?>
</head>
<body class="body">
<center>
<table border="1" bordercolor="silver" class="tblstyle">
<th colspan="2" align="center"><font color="green"
size=4>Material Setup</font></th>
<form method="Post" name="matsetup">
     <tr><td><b>Description</b> </td><td><input type=text
name="matdescrip" size="40" maxlength="45" value="<?echo
$descrip?>"><input type="hidden" name="matid"
value="<?echo $materialid?>"></td></tr>
     <?
     if
($effstatus=="Y"){$active="checked";}else{$active="";}
     ?>
     <tr><td><b>Status</b> </td><td><input
type="checkbox" id="status" name="status" <? echo
$active?> value="Y"> <label
for="status">Active</label></td></tr>
     <tr><td colspan="2" align="center"><input
type="submit" value=" Save " name="regbtn"
class="colorbtn" onclick="return submitclick()">
     <input type="submit" value=" Delete "
name="deletebtn" class="colorbtn" onclick="return
confirmLink(this, 'Delete this Material?')">
     <input type="submit" value="Cancel" name="cancelbtn"
class="colorbtn"> <input type="reset" value="Reset"
class="colorbtn"></td></tr>
</form>
</table>
</body>
</html>
```

```
<html>
<head><title>Stock Update</title>
<script src="libraries/functions.js"
type="text/javascript" language="javascript"></script>
<SCRIPT LANGUAGE="JavaScript1.1">
<!--
function submitclick (form) {
if (matsetup.matdescrip.value == '')
     {
          alert(' Description is a required field.');
          matsetup.matdescrip.focus();
          return false;
     }
if (matsetup.matno.value == '')
     {
```

```
            alert('Material No is a required field.');
            matsetup.matno.focus();
            return false;
      }
if (matsetup.matcost.value == '')
      {
            alert(' Cost is a required field.');
            matsetup.matcost.focus();
            return false;
      }
      return confirmLink(this, 'Save this Material?')
  //return true;
}
-->
</SCRIPT>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<?php
include("fsmysqlinc.inc");
include("fsqueryfunctions.inc");
$materialid=$_GET[materialid];
$matdescription=$_GET[matdescription];
if ($materialid !=""){
      $descripsql="select
mat_id,mat_descrip,mat_no,mat_cost,effstatus from
fs_material where mat_id='$materialid'";
      $descripreg = MYSQL_QUERY($descripsql);
      $eqid= mysql_result($descripreg,0,"mat_id");
      $descrip= mysql_result($descripreg,0,"mat_descrip");
      $eqno= mysql_result($descripreg,0,"mat_no");
      $eqcost= mysql_result($descripreg,0,"mat_cost");
      $effstatus= mysql_result($descripreg,0,"effstatus");
}
if ($_POST[regbtn]) {
            $matregsql="insert into
fs_materialstock(mat_id, stock_date, stock_quant,
stock_cost, stock_price,creation_date)
values('$materialid','$_POST[matorderdate]','$_POST[stock
quant]','$_POST[matcost]','$_POST[matprice]',now())";
            //echo "Material Registered!";
            $matreg = MYSQL_QUERY($matregsql);
}
if ($_POST[cancelbtn]) {
            $url_redirect = "Location:
fs_materiallist.php?";
            header($url_redirect);
            exit;
}
?>
</head>
<body class="body">
```

```
<center>
<table border="1" bordercolor="silver" class="tblstyle">
<th colspan="4" align="center"><font color="green"
size=4>Material Stock New Update</font></th>
<form method="Post" name="matsetup">
     <tr><td><b>Description</b> </td><td colspan="3"
align="center"><b><?echo $matdescription?></b><input
type="hidden" name="matid" value="<?echo
$materialid?>"></td></tr>
     <tr><td><b>Order Date</b></td><td><input type="text"
name="matorderdate" size="8" maxlength="10">
yyyy/mm/dd</td>
     <td><b>Transaction Date</b></td><td><?php echo
date("d/m/Y h:i");?></td></tr>
     <tr><td><b>Quantity</b> </td><td colspan=3><input
type=text name="stockquant" size="15"
maxlength="10"></td></tr>
     <tr><td><b>Total Purchase Cost/Unit (N)
</b></td><td><input type="text" name="matcost" size="15"
maxlength="15"></td>
     <td><b>Usage Price/Unit (N) </b></td><td><input
type="text" name="matprice" size="15"
maxlength="15"></td></tr>
     <tr><td colspan="4" align="center"><input
type="submit" value=" Save " name="regbtn"
class="colorbtn" onclick="return submitclick()">
     <input type="submit" value="Cancel" name="cancelbtn"
class="colorbtn"> <input type="reset" value="Reset"
class="colorbtn"></td></tr>
</form>
</table>
</body>
</html>
```

```
<html><head><title>Period List</title>
<SCRIPT LANGUAGE="JavaScript1.1">
<!--
var confirmMsg  = 'Do you really want to';
function confirmLink(theLink, theSqlQuery)
{
    // Confirmation is not required in the configuration
file
    if (confirmMsg == '') {
        return true;
    }
    var is_confirmed = confirm(confirmMsg + ' :\n' +
theSqlQuery);
    if (is_confirmed) {
        theLink.href += '&is_js_confirmed=1';
    }
    return is_confirmed;
} // end of the 'confirmLink()' function
```

```
-->
</SCRIPT>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<?php
include("fsmysqlinc.inc");
include("fsqueryfunctions.inc");
if ($_POST[newbtn]) {
          $url_redirect = "Location: fs_Periodsetup.php";
     header($url_redirect);
          exit;
}
$equipsql="select
a.period_id,a.period_descrip,a.start_date,a.end_date from
fs_period a order by a.period_id";
$equiplist = MYSQL_QUERY($equipsql);
?>
</head>
<body class="body">
<h3 align="center">Period List</h3>
<form method="Post" name="Periodlist">
<table border="1" width="70%" class="tblstyle"
align="center">
<tr><td>
     <table border="1" width="100%" class="tblstyle"
align="center">
     <tr
bgcolor="#D0ECE0"><th><b>#</b></th><th><b>Description</b>
</th><th>Start Date</th><th>End Date</th></tr>
     <?php
     $incr=1;
while ($equiplistrow = mysql_fetch_array($equiplist)){
          $periodid=$equiplistrow["period_id"];
          $periodname=$equiplistrow["period_descrip"];
          $periodStartDate=$equiplistrow["start_date"];
          $periodEndDate=$equiplistrow["end_date"];
     //for bgcolor
     if
(($incr/2)==(round($incr/2))){$bckcolor="#D0DCE0";}else{$
bckcolor="#ffffff";}
     if
($effstatus=="Y"){$active="checked";}else{$active="";}
?>
     <tr bgcolor="<?php echo $bckcolor ?>"><td><?php echo
$incr++?></td><td><?php echo $periodname?> </td><td
align="left"><?php echo $periodStartDate?></td><td
align="left"><?php echo $periodEndDate?></td><td>
          <a href="fs_periodsetup.php?periodid=<?php echo
$periodid?>" class="whitelink">Edit</a></td></tr>
<?php
          }
```

```
?>
</table>
</td><td width="10%" align="right" valign="top"><input
type="submit" name="newbtn" value=" New "
class="colorbtn"></td></tr>
</table>
</form>
</body>
</html>
```

```
<html>
<head><title>Quarter Registration</title>
<link href="dm_btn.css" rel="styleSheet" type="text/css">
<script src="libraries/functions.js"
type="text/javascript" language="javascript"></script>
<SCRIPT LANGUAGE="JavaScript1.1">
<!--
function submitclick (form) {
if (periodsetup.perioddescrip.value == '')
     {
          alert(' Description is a required field.');
     periodsetup.perioddescrip.focus();
          return false;
     }
if (periodsetup.equipno.value == '')
     {
          alert('period No is a required field.');
          periodsetup.equipno.focus();
          return false;
     }
if (periodsetup.startdate.value == '')
     {
          alert(' Cost is a required field.');
          periodsetup.startdate.focus();
          return false;
     }
     return confirmLink(this, 'Save this period?')
  //return true;
}
-->
</SCRIPT>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<?php
include("fsmysqlinc.inc");
include("fsqueryfunctions.inc");
$periodid=$_GET[periodid];
if ($periodid !=""){
     $descripsql="select
period_id,period_descrip,start_date,end_date,maint_cost,u
tilities_cost,effstatus from fs_period where
period_id='$periodid'";
```

```
      $descripreg = MYSQL_QUERY($descripsql);
      $eqid= mysql_result($descripreg,0,"period_id");
      $descrip=
mysql_result($descripreg,0,"period_descrip");
      $startdate=
mysql_result($descripreg,0,"start_date");
      $enddate= mysql_result($descripreg,0,"end_date");
      $maintcost=
mysql_result($descripreg,0,"maint_cost");
      $utilitcost=
mysql_result($descripreg,0,"utilities_cost");
      $effstatus= mysql_result($descripreg,0,"effstatus");
}
if ($_POST[regbtn]) {
      $periodid=$_POST[periodid];
      $period_idsql="select period_id from fs_period where
period_id='$periodid'";
      $period_idreg = MYSQL_QUERY($period_idsql);
      if    ($equipow=mysql_fetch_array($period_idreg)){
            $equipregsql="update fs_period set
period_descrip='" . addslashes($_POST[perioddescrip]) .
"',start_date='" . addslashes($_POST[startdate]) .
"',maint_cost='$_POST[maintcost]',utilities_cost='$_POST[
utilitcost]',effstatus='$_POST[status]',end_date='$_POST[
enddate]' where period_id='$periodid'";
      //echo "period already exist!";
      }else{
            $equipregsql="insert into
fs_period(period_descrip,start_date,end_date,maint_cost,u
tilities_cost,effstatus,creation_date) values('" .
addslashes($_POST[perioddescrip]) . "','" .
addslashes($_POST[startdate]) .
"','$_POST[enddate]','$_POST[maintcost]','$_POST[utilitco
st]','$_POST[status]',now())";
            //echo "period Registered!";
      }
      $equipreg = MYSQL_QUERY($equipregsql);
            echo $equipregsql;
            $url_redirect = "Location:
fs_periodlist.php?periodid=$periodid";
            header($url_redirect);
            exit;
}
if ($_POST[deletebtn]) {
      $periodid=$_POST[periodid];
      $chkperiodsql="select * from fs_schedule where
period_id='$periodid'";
      $chkperiod = MYSQL_QUERY($chkperiodsql);
      if    ($chkperiodrow=mysql_fetch_array($chkperiod)){
            echo "<h4 align=center><font color='red'>Delete
failed: period already in use!</font></h4>";
```

```
    }else{
        $delequipunitsql="delete from fs_periodunit
where period_id='$periodid'";
                $delequipunit =
MYSQL_QUERY($delequipunitsql);
        $deleteequipsql="delete from fs_period where
period_id='$periodid'";
                $deleteequip =
MYSQL_QUERY($deleteequipsql);
                $url_redirect = "Location:
fs_periodlist.php?";
            header($url_redirect);
                exit;
    }
}
/**/
if ($_POST[cancelbtn]) {
        $url_redirect = "Location: fs_periodlist.php?";
        header($url_redirect);
        exit;
}
?>
</head>
<body class="body">
<center>
<table border="1" bordercolor="silver" class="tblstyle">
<th colspan="4" align="center"><font color="green"
size=4>Period Setup</font></th>
<form method="Post" name="periodsetup">
    <tr><td><b>Description</b> </td><td
colspan="3"><input type=text name="perioddescrip"
size="30" maxlength="25" value="<?echo $descrip?>"><input
type="hidden" name="periodid" value="<?echo
$periodid?>"></td></tr>
    <tr><td><b>Start Date </b></td><td><input
type="text" name="startdate" size="15" maxlength="15"
value="<?echo $startdate?>"></td>
    <td><b>End Date </b></td><td><input type="text"
name="enddate" size="15" maxlength="15" value="<?echo
$enddate?>"></td>
    </tr>
    <tr><td><b>Maintenance Cost </b></td><td><input
type="text" name="maintcost" size="10" maxlength="10"
value="<?echo $maintcost?>"></td>
    <td><b>Utilities Cost </b></td><td><input
type="text" name="utilitcost" size="10" maxlength="10"
value="<?echo $utilitcost?>"></td>
    </tr>
    <?
    if
($effstatus=="Y"){$active="checked";}else{$active="";}
```

```
      ?>
      <tr><td colspan="4" align="center"><input
type="checkbox" id="status" name="status" <? echo
$active?> value="Y"> <label
for="status">Active</label></td></tr>
      <tr><td colspan="4" align="center"><input
type="submit" value=" Save " name="regbtn"
class="colorbtn" onclick="return submitclick()">
      <input type="submit" value=" Delete "
name="deletebtn" class="colorbtn" onclick="return
confirmLink(this, 'Delete this period?')">
      <input type="submit" value="Cancel" name="cancelbtn"
class="colorbtn"> <input type="reset" value="Reset"
class="colorbtn"></td></tr>
</form>
</table>
</body>
</html>
```

```
<html>
<head><title>Planning Horizon</title>
<script src="libraries/functions.js"
type="text/javascript" language="javascript"></script>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<?php
include("fsmysqlinc.inc");
include("fsqueryfunctions.inc");
      $WorkingHoursql="select WorkingHour,WorkingDay,Month
from fs_planninghorizon";
      $WorkingHourreg = MYSQL_QUERY($WorkingHoursql);
      $WorkingHour=
mysql_result($WorkingHourreg,0,"WorkingHour");
      $WorkingDay=
mysql_result($WorkingHourreg,0,"WorkingDay");
      $Month= mysql_result($WorkingHourreg,0,"Month");
if ($_POST[regbtn]) {
            $custregsql="update fs_planninghorizon set
WorkingHour='" . addslashes($_POST[WorkingHour]) .
"',WorkingDay='" . addslashes($_POST[WorkingDay]) .
"',Month='$_POST[Month]'";
      echo $custregsql;
            $custreg = MYSQL_QUERY($custregsql);
            $url_redirect = "Location:
fs_planninghorizon.php";
            header($url_redirect);
            exit;
}
if ($_POST[cancelbtn]) {
            $url_redirect = "Location:
fs_planninghorizon.php?";
            header($url_redirect);
```

```
        exit;
}
?>
</head>
<body class="body">
<center>
<table border="1" bordercolor="silver" class="tblstyle">
<th colspan="4" align="center"><font color="green"
size=4>Planning Horizon</font></th>
<form method="Post" name="customersetup">
    <tr><td><b>Working Hour Per Day</b> </td><td
colspan="3"><input type="text" name="WorkingHour"
size="10" maxlength="15" value="<?echo $WorkingHour?>">
    <input type="hidden" name="custid" value="<?echo
$customerid?>"></td></tr>
    <tr><td><b>Working Day Per Week</b> </td><td
colspan="3"><input type="text" name="WorkingDay"
size="10" maxlength="10" value="<?echo
$WorkingDay?>"></td></tr>
    <tr><td><b>Number of Month(s) to plan
for:</b></td><td colspan="3"><input type="text"
name="Month" size="10" maxlength="10" value="<?echo
$Month?>"></td></tr>
    <tr><td colspan="4" align="center"><input
type="submit" value=" Save " name="regbtn"
class="colorbtn" onclick="return submitclick()">
    <input type="submit" value="Cancel" name="cancelbtn"
class="colorbtn"> <input type="reset" value="Reset"
class="colorbtn"></td></tr>
</form>
</table>
</body>
</html>
```

```
<html><head><title>Equipment List</title>
<SCRIPT LANGUAGE="JavaScript1.1">
<!--
var confirmMsg  = 'Do you really want to';
function confirmLink(theLink, theSqlQuery)
{
    // Confirmation is not required in the configuration
file
    if (confirmMsg == '') {
        return true;
    }

    var is_confirmed = confirm(confirmMsg + ' :\n' +
theSqlQuery);
    if (is_confirmed) {
        theLink.href += '&is_js_confirmed=1';
    }
    return is_confirmed;
```

```
} // end of the 'confirmLink()' function
-->
</SCRIPT>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<?php
include("fsmysqlinc.inc");
include("fsqueryfunctions.inc");
if ($_POST[newbtn]) {
     $url_redirect = "Location: fs_equipmentsetup.php";
          header($url_redirect);
          exit;
}
$equipsql="select
a.equip_id,b.period_id,b.period_descrip,a.equip_descrip,b
.forcast_hour,b.actual_hour,b.smoothing_Const from
fs_equipment a,fs_quarterequipment b where
a.equip_id=b.equip_id and b.period_id=c.period_id";
$equiplist = MYSQL_QUERY($equipsql);
?>
</head>
<body class="body">
<h3 align="center">Equipment List</h3>
<form method="Post" name="equipmentlist">
<table border="1" width="80%" class="tblstyle"
align="center">
<tr><td>
     <table border="1" width="100%" class="tblstyle"
align="center">
     <tr
bgcolor="#D0ECE0"><th><b>#</b></th><th><b>Equipment</b></
th><th><b>Active Units</b></th><th
align="right">Cost/hr</th><th></th><th></th></tr>
     <?php
     $incr=1;
while ($equiplistrow = mysql_fetch_array($equiplist)){

     $period_descrip=$equiplistrow["period_descrip"];
          $equipdescrip=$equiplistrow["equip_descrip"];
          //$equipno=$equiplistrow["forcast_hour"];
          $equipno=countactiveunit($period_descrip);
          $actual_hour=$equiplistrow["actual_hour"];

     $smoothingConst=$equiplistrow["smoothing_Const"];
          $effstatus=$equiplistrow["effstatus"];
          $chkname="chk$period_descrip";
     //for bgcolor
     if
(($incr/2)==(round($incr/2))){$bckcolor="#D0DCE0";}else{$
bckcolor="#ffffff";}
```

```
    if
($effstatus=="Y"){$active="checked";}else{$active="";}
?>
          <tr bgcolor="<?php echo $bckcolor ?>"><td><?php
echo $incr++?></td><td><?php echo $equipdescrip?>
</td><td><?php echo $equipno?> </td><td
align="right"><?php echo $actual_hour?></td><td>
          <a
href="fs_equipmentsetup.php?equipmentid=<?php echo
$period_descrip?>" class="whitelink">Edit</a></td><td>
          <a
href="fs_equipmentunitsetup.php?equipmentid=<?php echo
$period_descrip?>" class="whitelink">Add
Unit</a></td></tr>
<?php
     }
?>
</table>
</td><td width="10%" align="right" valign="top"><input
type="submit" name="newbtn" value=" New "
class="colorbtn"></td></tr>
</table>
</form>
</body>
</html>
```

```
<html>
<head><title>Quarter Info</title>
<script src="libraries/functions.js"
type="text/javascript" language="javascript"></script>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<?php
include("fsmysqlinc.inc");
include("fsqueryfunctions.inc");
$fieldtype=$_GET[ParamType];
if ($_POST[regbtn]) {
     $SectionName=$_POST[SectionName];
     $returnequipid=$SectionName;
     $SectionNamesql="select SectionName from
fs_quartermanpower where FieldType='$fieldtype' and
SectionName='$SectionName'";
     $SectionNamereg = MYSQL_QUERY($SectionNamesql);
     if   ($equiprow=mysql_fetch_array($SectionNamereg)){
          $salmanpowerupdsql="update fs_quartermanpower
set
Sal_Period1='$_POST[SalPeriod1name]',Sal_Period2='$_POST[
SalPeriod2name]',Sal_Period3='$_POST[SalPeriod3name]',Sal
_Period4='$_POST[SalPeriod4name]' where
FieldType='$fieldtype' and SectionName='$SectionName'";
          $salmanpowerupd =
MYSQL_QUERY($salmanpowerupdsql);
```

```
     }else{
          $salmanpowerupdsql="INSERT INTO
fs_quartermanpower (FieldType, SectionName, Sal_Period1,
Sal_Period2, Sal_Period3, Sal_Period4) VALUES
('$fieldtype','$SectionName','$_POST[SalPeriod1name]','$_
POST[SalPeriod2name]','$_POST[SalPeriod3name]','$_POST[Sa
lPeriod4name]')";
          $salmanpowerupd =
MYSQL_QUERY($salmanpowerupdsql);
/**/
     }
     //echo $salmanpowerupdsql;
//echo $returnequipid;
}
$equipmentsql="select equip_id,equip_descrip,effstatus
from fs_equipment where effstatus='Y'";
$selequipment = MYSQL_QUERY($equipmentsql);
if ($_POST[fetchbtn]) {
     $SectionName=$_POST[SectionName];
$returnequipid=$SectionName;
     $descripsql="select
Sal_Period1,Sal_Period2,Sal_Period3,Sal_Period4 from
fs_quartermanpower where FieldType='$fieldtype' and
SectionName='$SectionName'";
     //echo $fieldtype;
     $descripreg = MYSQL_QUERY($descripsql);
     $SalPeriod1=
mysql_result($descripreg,0,"Sal_Period1");
     $SalPeriod2=
mysql_result($descripreg,0,"Sal_Period2");
     $SalPeriod3=
mysql_result($descripreg,0,"Sal_Period3");
     $SalPeriod4=
mysql_result($descripreg,0,"Sal_Period4");
$MovingAverage= ($SalPeriod2+$SalPeriod3+$SalPeriod4)/3;
$MovingAverage= number_format($MovingAverage,2);
}
?>
</head>
<body class="body"><center>
<table border="1" bordercolor="silver" class="tblstyle">
<th colspan="2" align="center"><font color="green"
size=4>Last 3 Periods Maintenance Cost for <?php echo
$fieldtype?></font></th>
<form method="Post" name="quartersalary">
<tr><td><b>Section</b></td><td><select
name="SectionName">
<?php
//$selectsection = MYSQL_QUERY($selequipment);
//while ($equiprow = mysql_fetch_array($selectsection)){
```

```
                while ($mydescriprow =
mysql_fetch_array($selequipment)){
                $equipid=$mydescriprow["equip_id"];

     $equipdescrip=$mydescriprow["equip_descrip"];
                if ($equipid==$returnequipid){
?>
                <option value="<?php echo
$equipid?>"selected><?php echo $equipdescrip?>
<?php           }else{
?>
                <option value="<?php echo
$equipid?>"><?php echo $equipdescrip?>
<?php           }
          }
?>
</select><input type="submit" value="Fetch"
name="fetchbtn" class="colorbtn"></td></tr>
     <!--<tr><td><b>Period 1</b> </td><td><input
type="text" name="SalPeriod1name" size="10"
maxlength="10" value="<?echo $SalPeriod1?>"></td></tr>
-->
     <tr><td><b>Period 1</b> </td><td><input type="text"
name="SalPeriod2name" size="10" maxlength="10"
value="<?echo $SalPeriod2?>"></td></tr>
     <tr><td><b>Period 2</b> </td><td><input type="text"
name="SalPeriod3name" size="10" maxlength="10"
value="<?echo $SalPeriod3?>"></td></tr>
     <tr><td><b>Period 3</b> </td><td><input type="text"
name="SalPeriod4name" size="10" maxlength="10"
value="<?echo $SalPeriod4?>"></td></tr>
     <tr><td colspan=2><hr></td></tr>
     <tr><td><b>Moving Average</b> </td><td><?php echo
$MovingAverage?></td></tr>
     <tr><td colspan="2" align="center"><input
type="submit" value=" Save " name="regbtn"
class="colorbtn" onclick="return submitclick()">
</tr>
</form>
</table>
</body>
</html>
```

```
<html>
<head><title>Quarter Info</title>
<script src="libraries/functions.js"
type="text/javascript" language="javascript"></script>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<?php
include("fsmysqlinc.inc");
include("fsqueryfunctions.inc");
```

```
$fieldtype=$_GET[ParamType];
if ($_POST[regbtn]) {
     $SectionName=$_POST[SectionName];
     $returnequipid=$SectionName;
     $SectionNamesql="select SectionName from
fs_quartermanpower where FieldType='$fieldtype' and
SectionName='$SectionName'";
     $SectionNamereg = MYSQL_QUERY($SectionNamesql);
     if   ($equiprow=mysql_fetch_array($SectionNamereg)){
          $salmanpowerupdsql="update fs_quartermanpower
set
Sal_Period1='$_POST[SalPeriod1name]',Sal_Period2='$_POST[
SalPeriod2name]',Sal_Period3='$_POST[SalPeriod3name]',Sal
_Period4='$_POST[SalPeriod4name]' where
FieldType='$fieldtype' and SectionName='$SectionName'";
     $salmanpowerupd = MYSQL_QUERY($salmanpowerupdsql);
     }else{
     $salmanpowerupdsql="INSERT INTO fs_quartermanpower
(FieldType, SectionName, Sal_Period1, Sal_Period2,
Sal_Period3, Sal_Period4) VALUES
('$fieldtype','$SectionName','$_POST[SalPeriod1name]','$_
POST[SalPeriod2name]','$_POST[SalPeriod3name]','$_POST[Sa
lPeriod4name]')";
          $salmanpowerupd =
MYSQL_QUERY($salmanpowerupdsql);
/**/
     }
     //echo $salmanpowerupdsql;
//echo $returnequipid;
}
$equipmentsql="select equip_id,equip_descrip,effstatus
from fs_equipment where effstatus='Y'";
$selequipment = MYSQL_QUERY($equipmentsql);
if ($_POST[fetchbtn]) {
     $SectionName=$_POST[SectionName];
$returnequipid=$SectionName;
     $descripsql="select
Sal_Period1,Sal_Period2,Sal_Period3,Sal_Period4 from
fs_quartermanpower where FieldType='$fieldtype' and
SectionName='$SectionName'";
     //echo $fieldtype;
     $descripreg = MYSQL_QUERY($descripsql);
     $SalPeriod1=
mysql_result($descripreg,0,"Sal_Period1");
     $SalPeriod2=
mysql_result($descripreg,0,"Sal_Period2");
     $SalPeriod3=
mysql_result($descripreg,0,"Sal_Period3");
     $SalPeriod4=
mysql_result($descripreg,0,"Sal_Period4");
$MovingAverage= ($SalPeriod2+$SalPeriod3+$SalPeriod4)/3;
```

```
$MovingAverage= number_format($MovingAverage,2);
}
?>
</head>
<body class="body">
<center>
<table border="1" bordercolor="silver" class="tblstyle">
<th colspan="2" align="center"><font color="green"
size=4>Last 3 Periods Maintenance Cost for <?php echo
$fieldtype?></font></th>
<form method="Post" name="quartersalary">
<tr><td><b>Section</b></td><td><select
name="SectionName">
<?php
//$selectsection = MYSQL_QUERY($selequipment);
//while ($equiprow = mysql_fetch_array($selectsection)){
                while ($mydescriprow =
mysql_fetch_array($selequipment)){
                $equipid=$mydescriprow["equip_id"];

     $equipdescrip=$mydescriprow["equip_descrip"];
                if ($equipid==$returnequipid){
?>
                     <option value="<?php echo
$equipid?>"selected><?php echo $equipdescrip?>
<?php           }else{
?>
                <option value="<?php echo
$equipid?>"><?php echo $equipdescrip?>
<?php           }
          }
?>
</select><input type="submit" value="Fetch"
name="fetchbtn" class="colorbtn"></td></tr>
     <!--<tr><td><b>Period 1</b> </td><td><input
type="text" name="SalPeriod1name" size="10"
maxlength="10" value="<?echo $SalPeriod1?>"></td></tr>
-->
     <tr><td><b>Period 1</b> </td><td><input type="text"
name="SalPeriod2name" size="10" maxlength="10"
value="<?echo $SalPeriod2?>"></td></tr>
     <tr><td><b>Period 2</b> </td><td><input type="text"
name="SalPeriod3name" size="10" maxlength="10"
value="<?echo $SalPeriod3?>"></td></tr>
     <tr><td><b>Period 3</b> </td><td><input type="text"
name="SalPeriod4name" size="10" maxlength="10"
value="<?echo $SalPeriod4?>"></td></tr>
     <tr><td colspan=2><hr></td></tr>
     <tr><td><b>Moving Average</b> </td><td><?php echo
$MovingAverage?></td></tr>
```

```
    <tr><td colspan="2" align="center"><input
type="submit" value=" Save " name="regbtn"
class="colorbtn" onclick="return submitclick()">
</tr>
</form>
</table>
</body>
</html>
```

```
<html><head><title>Admin Staff List</title>
<SCRIPT LANGUAGE="JavaScript1.1">
<!--
var confirmMsg  = 'Do you really want to';
function confirmLink(theLink, theSqlQuery)
{
    // Confirmation is not required in the configuration
file
    if (confirmMsg == '') {
        return true;
    }
    var is_confirmed = confirm(confirmMsg + ' :\n' +
theSqlQuery);
    if (is_confirmed) {
        theLink.href += '&is_js_confirmed=1';
    }
    return is_confirmed;
 // end of the 'confirmLink()' function
-->
</SCRIPT>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<?php
include("fsmysqlinc.inc");
include("fsqueryfunctions.inc");
if ($_POST[newbtn]) {
     $url_redirect = "Location: fs_staffadminsetup.php";
     header($url_redirect);
          exit;
}
$equipsql="select
a.staff_id,a.staff_name,a.staff_salary,a.effstatus from
fs_StaffAdmin a order by a.staff_id";
$equiplist = MYSQL_QUERY($equipsql);
?>
</head>
<body class="body">
<h3 align="center">Admin Staff List</h3>
<form method="Post" name="StaffAdminlist">
<table border="1" width="70%" class="tblstyle"
align="center">
<tr><td>
```

```
    <table border="1" width="100%" class="tblstyle"
align="center">
    <tr bgcolor="#D0ECE0"><th><b>#</b></th><th><b>Staff
Id</b></th><th><b>Staff Name</b></th></tr>
    <?php
    $incr=1;
while ($equiplistrow = mysql_fetch_array($equiplist)){
          $staffid=$equiplistrow["staff_id"];
          $staffname=$equiplistrow["staff_name"];
          $staffsalary=$equiplistrow["staff_salary"];
          $equipid=$equiplistrow["equip_descrip"];
          $effstatus=$equiplistrow["effstatus"];
          $chkname="chk$staffid";
    //for bgcolor
    if
(($incr/2)==(round($incr/2))){$bckcolor="#D0DCE0";}else{$
bckcolor="#ffffff";}
    if
($effstatus=="Y"){$active="checked";}else{$active="";}
?>
    <tr bgcolor="<?php echo $bckcolor ?>"><td><?php echo
$incr++?></td><td><?php echo $staffid?> </td><td><?php
echo $staffname?> </td><td>
          <a href="fs_staffadminsetup.php?staffid=<?php
echo $staffid?>" class="whitelink">Edit</a></td></tr>
<?php
          }
?>
</table>
</td><td width="10%" align="right" valign="top"><input
type="submit" name="newbtn" value=" New "
class="colorbtn"></td></tr>
</table>
</form>
</body>
</html>
```

```
<html>
<head><title>Admin Staff Registration</title>
<script src="libraries/functions.js"
type="text/javascript" language="javascript"></script>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<?php
include("fsmysqlinc.inc");
include("fsqueryfunctions.inc");
//$customerid=$_GET[customerid];
$staffid=$_GET[staffid];
//$jobdescript=$_GET[descript];
if ($staffid !=""){
```

```
     $descripsql="select
staff_id,staff_name,staff_salary,effstatus from
fs_StaffAdmin where staff_id='$staffid'";
     $descripreg = MYSQL_QUERY($descripsql);
     $staffid= mysql_result($descripreg,0,"staff_id");
     $descrip= mysql_result($descripreg,0,"staff_name");
     $staffsalary=
mysql_result($descripreg,0,"staff_salary");
     $effstatus= mysql_result($descripreg,0,"effstatus");
}
if ($_POST[regbtn]) {
     $staffid=$_POST[staffid];
     $staff_idsql="select staff_id from fs_StaffAdmin
where staff_id='$staffid'";
     $staff_idreg = MYSQL_QUERY($staff_idsql);
     if   ($custrow=mysql_fetch_array($staff_idreg)){
          $staffregsql="update fs_StaffAdmin set
staff_name='" . addslashes($_POST[staffname]) .
"',staff_salary='$_POST[staffsalary]',effstatus='$_POST[s
tatus]' where staff_id='$staffid'";
     }else{
          $staffregsql="insert into
fs_StaffAdmin(staff_id,staff_name,staff_salary,effstatus)
values('$staffid','" . addslashes($_POST[staffname]) .
"','$_POST[staffsalary]','$_POST[status]')";
     }
     echo $staffregsql;
          $staffreg = MYSQL_QUERY($staffregsql);
          $url_redirect = "Location:
fs_StaffAdminlist.php";
          header($url_redirect);
          exit;
}
if ($_POST[deletebtn]) {
          $staffid=$_POST[staffid];
     $chkstaffidsql="select * from fs_schedule where
staff_id='$staffid'";
     $chkjob = MYSQL_QUERY($chkstaffidsql);
     if   ($chkjobrow=mysql_fetch_array($chkjob)){
          echo "<h4 align=center><font color='red'>Delete
failed: Staff already in Schedule!</font></h4>";
     }else{
     $delmatunitsql="delete from fs_StaffAdmin where
staff_id='$staffid'";
                    $delmatunit =
MYSQL_QUERY($delmatunitsql);
                    $url_redirect = "Location:
fs_StaffAdminlist.php?";
                    header($url_redirect);
                    exit;
     }
```

```
}
if ($_POST[cancelbtn]) {
          $url_redirect = "Location:
fs_StaffAdminlist.php?";
          header($url_redirect);
          exit;
}
?>
</head>
<body class="body">
<center>
<table border="1" bordercolor="silver" class="tblstyle">
<th colspan="2" align="center"><font color="green"
size=4> Admin Staff Setup</font></th>
<form method="Post" name="staffsetup">
<?php
     //if ($staffid ==""){
?>
<?php
if ($staffid !=""){$rdonly="readonly";}else{
$rdonly="";}?>
     <tr><td><b>Staff ID</b> </td><td><input type="text"
name="staffid" <?php echo $rdonly?> size="20"
maxlength="25" value="<?php echo $staffid?>"></td></tr>
     <tr><td><b>Staff Name</b> </td><td><input
type="text" name="staffname" size="40" maxlength="35"
value="<?echo $descrip?>"></td></tr>
     <?php
     if
($effstatus=="Y"){$active="checked";}else{$active="";}
     ?>
     <tr><td><b>Salary</b></td><td><input type="text"
name="staffsalary" size="20" maxlength="10" value="<?echo
$staffsalary?>"></td></tr>
     <tr><td></td><td><input type="checkbox" id="status"
name="status" <?php echo $active?> value="Y"> <label
for="status">Active</label></td></tr>
     <tr><td colspan="2" align="center"><input
type="submit" value=" Save " name="regbtn"
class="colorbtn">
<input type="submit" value=" Delete " name="deletebtn"
class="colorbtn" onclick="return confirmLink(this,
'Remove this Staff?')">
     <input type="submit" value="Cancel" name="cancelbtn"
class="colorbtn"> <input type="reset" value="Reset"
class="colorbtn"></td></tr>
</form>
</table>
</body>
</html>
```

```
<html><head><title>Production Staff List</title>
```

```
<SCRIPT LANGUAGE="JavaScript1.1">
<!--
var confirmMsg  = 'Do you really want to';
function confirmLink(theLink, theSqlQuery)
{
    // Confirmation is not required in the configuration
file
    if (confirmMsg == '') {
        return true;
    }
    var is_confirmed = confirm(confirmMsg + ' :\n' +
theSqlQuery);
    if (is_confirmed) {
        theLink.href += '&is_js_confirmed=1';
    }
    return is_confirmed;
} // end of the 'confirmLink()' function
-->
</SCRIPT>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<?php
include("fsmysqlinc.inc");
include("fsqueryfunctions.inc");
if ($_POST[newbtn]) {
          $url_redirect = "Location: fs_staffsetup.php";
     header($url_redirect);
          exit;
}
$equipsql="select
a.staff_id,a.staff_name,a.staff_salary,b.equip_descrip,a
effstatus from fs_staff a,fs_equipment b where
a.equip_id=b.equip_id order by a.staff_id";
$equiplist = MYSQL_QUERY($equipsql);
?>
</head>
<body class="body">
<h3 align="center">Production Staff List</h3>
<form method="Post" name="Stafflist">
<table border="1" width="70%" class="tblstyle"
align="center">
<tr><td>
     <table border="1" width="100%" class="tblstyle"
align="center">
     <tr bgcolor="#D0ECE0"><th><b>#</b></th><th><b>Staff
Id</b></th><th><b>Staff
Name</b></th><th>Section</th></tr>
     <?php
     $incr=1;
while ($equiplistrow = mysql_fetch_array($equiplist)){
          $staffid=$equiplistrow["staff_id"];
```

```
            $staffname=$equiplistrow["staff_name"];
            $staffsalary=$equiplistrow["staff_salary"];
            $equipid=$equiplistrow["equip_descrip"];
            $effstatus=$equiplistrow["effstatus"];
            $chkname="chk$staffid";
      //for bgcolor
      if
(($incr/2)==(round($incr/2))){$bckcolor="#D0DCE0";}else{$
bckcolor="#ffffff";}
      if
($effstatus=="Y"){$active="checked";}else{$active="";}
?>
            <tr bgcolor="<?php echo $bckcolor ?>"><td><?php
echo $incr++?></td><td><?php echo $staffid?>
</td><td><?php echo $staffname?> </td><td
align="left"><?php echo $equipid?></td><td>
            <a href="fs_staffsetup.php?staffid=<?php echo
$staffid?>" class="whitelink">Edit</a></td></tr>
<?php
            }
?>
</table>
</td><td width="10%" align="right" valign="top"><input
type="submit" name="newbtn" value=" New "
class="colorbtn"></td></tr>
</table>
</form>
</body>
</html>
```

```
<html>
<head><title>Staff Registration</title>
<script src="libraries/functions.js"
type="text/javascript" language="javascript"></script>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<?php
include("fsmysqlinc.inc");
include("fsqueryfunctions.inc");
//$customerid=$_GET[customerid];
$staffid=$_GET[staffid];
//$jobdescript=$_GET[descript];
if ($staffid !=""){
      $descripsql="select
staff_id,staff_name,staff_salary,equip_id,effstatus from
fs_staff where staff_id='$staffid'";
      $descripreg = MYSQL_QUERY($descripsql);
      $staffid= mysql_result($descripreg,0,"staff_id");
      $descrip= mysql_result($descripreg,0,"staff_name");
      $staffsalary=
mysql_result($descripreg,0,"staff_salary");
```

```
            $staffname=$equiplistrow["staff_name"];
            $staffsalary=$equiplistrow["staff_salary"];
            $equipid=$equiplistrow["equip_descrip"];
            $effstatus=$equiplistrow["effstatus"];
            $chkname="chk$staffid";
        //for bgcolor
        if
((($incr/2)==(round($incr/2)))){$bckcolor="#D0DCE0";}else{$
bckcolor="#ffffff";}
        if
($effstatus=="Y"){$active="checked";}else{$active="";}
?>
            <tr bgcolor="<?php echo $bckcolor ?>"><td><?php
echo $incr++?></td><td><?php echo $staffid?>
</td><td><?php echo $staffname?> </td><td
align="left"><?php echo $equipid?></td><td>
            <a href="fs_staffsetup.php?staffid=<?php echo
$staffid?>" class="whitelink">Edit</a></td></tr>
<?php
            }
?>
</table>
</td><td width="10%" align="right" valign="top"><input
type="submit" name="newbtn" value=" New "
class="colorbtn"></td></tr>
</table>
</form>
</body>
</html>
```

```
<html>
<head><title>Staff Registration</title>
<script src="libraries/functions.js"
type="text/javascript" language="javascript"></script>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<?php
include("fsmysqlinc.inc");
include("fsqueryfunctions.inc");
//$customerid=$_GET[customerid];
$staffid=$_GET[staffid];
//$jobdescript=$_GET[descript];
if ($staffid !=""){
    $descripsql="select
staff_id,staff_name,staff_salary,equip_id,effstatus from
fs_staff where staff_id='$staffid'";
    $descripreg = MYSQL_QUERY($descripsql);
    $staffid= mysql_result($descripreg,0,"staff_id");
    $descrip= mysql_result($descripreg,0,"staff_name");
    $staffsalary=
mysql_result($descripreg,0,"staff_salary");
```

```
     $returnequipid=
mysql_result($descripreg,0,"equip_id");
     $effstatus= mysql_result($descripreg,0,"effstatus");
}
if ($_POST[regbtn]) {
     $staffid=$_POST[staffid];
     $staff_idsql="select staff_id from fs_staff where
staff_id='$staffid'";
     $staff_idreg = MYSQL_QUERY($staff_idsql);
     if   ($custrow=mysql_fetch_array($staff_idreg)){
          $staffregsql="update fs_staff set staff_name='"
. addslashes($_POST[staffname]) .
"',staff_salary='$_POST[staffsalary]',equip_id='$_POST[cm
bequipment]',effstatus='$_POST[status]' where
staff_id='$staffid'";
     }else{
          $staffregsql="insert into
fs_staff(staff_id,staff_name,staff_salary,equip_id,effsta
tus) values('$staffid','" . addslashes($_POST[staffname])
.
"','$_POST[staffsalary]','$_POST[cmbequipment]','$_POST[s
tatus]')";
     }
     echo $staffregsql;
          $staffreg = MYSQL_QUERY($staffregsql);
          $url_redirect = "Location: fs_stafflist.php";
          header($url_redirect);
          exit;
}
if ($_POST[deletebtn]) {
          $staffid=$_POST[staffid];
     $chkstaffidsql="select * from fs_schedule where
staff_id='$staffid'";
     $chkjob = MYSQL_QUERY($chkstaffidsql);
     if   ($chkjobrow=mysql_fetch_array($chkjob)){
          echo "<h4 align=center><font color='red'>Delete
failed: Job already in Schedule!</font></h4>";
     }else{
          $delmatunitsql="delete from fs_staff where
staff_id='$staffid'";
                    $delmatunit =
MYSQL_QUERY($delmatunitsql);
                    $url_redirect = "Location:
fs_stafflist.php?";
                    header($url_redirect);
                    exit;
     }
}
if ($_POST[cancelbtn]) {
          $url_redirect = "Location: fs_stafflist.php?";
          header($url_redirect);
```

```
        exit;
}
$equipmentsql="select equip_id,equip_descrip,effstatus
from fs_equipment where effstatus='Y'";
$selequipment = MYSQL_QUERY($equipmentsql);
?>
</head>
<body class="body">
<center>
<table border="1" bordercolor="silver" class="tblstyle">
<th colspan="2" align="center"><font color="green"
size=4>Production Staff Setup</font></th>
<form method="Post" name="staffsetup">
<?php
     //if ($staffid ==""){
?>
<tr><td><b>Section</b></td><td> <select
name="cmbequipment">
<?php
//$selectsection = MYSQL_QUERY($selequipment);
//while ($equiprow = mysql_fetch_array($selectsection)){
               while ($mydescriprow =
mysql_fetch_array($selequipment)){
                    $equipid=$mydescriprow["equip_id"];

     $equipdescrip=$mydescriprow["equip_descrip"];
               if ($equipid==$returnequipid){
?>
               <option value="<?php echo
$equipid?>"selected><?php echo $equipdescrip?>
<?php          }else{
?>
                    <option value="<?php echo
$equipid?>"><?php echo $equipdescrip?>
<?php          }
               }
?>
</select></td></tr>
<?php
if ($staffid !=""){$rdonly="readonly";}else{
$rdonly="";}?>
     <tr><td><b>Staff ID</b> </td><td><input type="text"
name="staffid" <?php echo $rdonly?> size="20"
maxlength="25" value="<?php echo $staffid?>"></td></tr>
     <tr><td><b>Staff Name</b> </td><td><input
type="text" name="staffname" size="40" maxlength="35"
value="<?echo $descrip?>"></td></tr>
     <?php
     if
($effstatus=="Y"){$active="checked";}else{$active="";}
     ?>
```

```
     <tr><td><b>Salary per Month(N)</b></td><td><input
type="text" name="staffsalary" size="20" maxlength="10"
value="<?echo $staffsalary?>"></td></tr>
     <tr><td></td><td><input type="checkbox" id="status"
name="status" <?php echo $active?> value="Y"> <label
for="status">Active</label></td></tr>
     <tr><td colspan="2" align="center"><input
type="submit" value=" Save " name="regbtn"
class="colorbtn">
     <input type="submit" value=" Delete "
name="deletebtn" class="colorbtn" onclick="return
confirmLink(this, 'Remove this Staff?')">
<input type="submit" value="Cancel" name="cancelbtn"
class="colorbtn"> <input type="reset" value="Reset"
class="colorbtn"></td></tr>
</form>
</table>
</body>
</html>
```

```
<html><head><title>Stock Level</title>
<link href="fs_format.css" rel="styleSheet"
type="text/css">
<?php
include("fsmysqlinc.inc");
include("fsqueryfunctions.inc");
if ($_POST[btnmain]) {
          $url_redirect = "Location: fs_main.php?";
          header($url_redirect);
          exit;
}
//$matsql="select
a.mat_id,a.mat_descrip,sum(b.stock_quant)stockquant,sum(c
.mat_quant)matused from fs_material a,fs_materialstock
b,fs_materialorder c where a.mat_id=b.mat_id and
a.mat_id=c.mat_id and b.mat_id=c.mat_id group by b.mat_id
order by a.mat_descrip";
$matsql="select a.mat_id,a.mat_descrip from fs_material a
order by a.mat_descrip";
$matlist = MYSQL_QUERY($matsql);
     //echo $matsql;
?>
</head>
<body class="body">
<h3 align="center">Material and Schedule</h3>
<form method="Post" name="materialstock">
<table border="1" width="80%" class="tblstyle"
align="center">
<tr><td>
     <table border="1" width="100%" class="tblstyle"
align="center">
```

```
     <tr
bgcolor="#D0ECE0"><th><b>#</b></th><th><b>Material</b></t
h><th align="right"><b>Stock</b></th><th
align="right">Schedule</th><th
align="right">Difference</th></tr>
     <?php
     $incr=1;
while ($matlistrow = mysql_fetch_array($matlist)){
          $matid=$matlistrow["mat_id"];
          $matdescrip=$matlistrow["mat_descrip"];
//Stock
$matstocksql="select sum(b.stock_quant)stockquant from
fs_materialstock b where b.mat_id='$matid'";
$matstock = MYSQL_QUERY($matstocksql);
     while ($matstockrow = mysql_fetch_array($matstock)){
          $stockquant=$matstockrow["stockquant"];
     if ($stockquant==""){$stockquant="0";}
     }
//Order
$matordersql="select sum(c.mat_quant)quantorder from
fs_materialorder c,fs_jobrecord a where c.mat_id='$matid'
and a.job_id=c.job_id and a.completed='A'";
$matorder = MYSQL_QUERY($matordersql);
     while ($matorderrow = mysql_fetch_array($matorder)){
     $quantorder=$matorderrow["quantorder"];
          if ($quantorder==""){$quantorder="0";}
     }
//Order Used
$matusedsql="select sum(c.mat_quant)matused from
fs_materialorder c,fs_jobrecord a where c.mat_id='$matid'
and a.job_id=c.job_id and a.completed='C'";
$matused = MYSQL_QUERY($matusedsql);
     while ($matusedrow = mysql_fetch_array($matused)){
          $matused=$matusedrow["matused"];
          if ($matused==""){$matused="0";}
     }
//Actual Stock
$actualstockquant=$stockquant - $matused;
$scheddiferrence=$actualstockquant - $quantorder;
     //echo $matcostsql;
          $chkname="chk$matid";
     //for bgcolor
     if
(($incr/2)==(round($incr/2))){$bckcolor="#D0DCE0";}else{$
bckcolor="#ffffff";}
?>
     <tr bgcolor="<?php echo $bckcolor ?>"><td><?echo
$incr++?></td><td><? echo $matdescrip?> </td><td
align="right"><? echo $actualstockquant?> </td><td
align="right"><? echo $quantorder?></td><td
align="right"><? echo $scheddiferrence?></td>
```

```
            </tr>
<?
            }
?>
</table>
</td><td width="10%" align="right" valign="top"><input
type="submit" name="btnmain" value="Back to Main"
class="colorbtn"></td></tr>
</table>
</form>
</body>
</html>
```

```
<?php
include("fsdatefunctions.inc");
////////////////////////////////////
function CompanyParamInfo($ReturnField)
{
        $companynamesql="select
company_name,company_address,company_area,company_cost,company_lifespan
from fs_companyprofile";
        $companynamereg = MYSQL_QUERY($companynamesql);
        $companyname= mysql_result($companynamereg,0,"company_name");
        $companyaddress= mysql_result($companynamereg,0,"company_address");
        $companyarea= mysql_result($companynamereg,0,"company_area");
        $companycost= mysql_result($companynamereg,0,"company_cost");
        $companylifespan= mysql_result($companynamereg,0,"company_lifespan");
        if ($ReturnField=='companyarea'){
                $RetParam= $companyarea;
        }elseif($ReturnField=='companycost'){
                $RetParam= $companycost;
        }elseif($ReturnField=='companylifespan'){
                $RetParam= $companylifespan;
        }
        return $RetParam;
}
//////////////12/1/2008////////////////////////////////
///Function to Calculate Manpower/Equipment//////////////////
function EquipmentRatefunc($SectionName,$fieldtype)
{
        $descripsql="select
a.Sal_Period1,a.Sal_Period2,a.Sal_Period3,a.Sal_Period4,b.budgetedhour,b.equip_are
a,b.efficiency from fs_quartermanpower a,fs_equipment b where
a.FieldType='$fieldtype' and a.SectionName='$SectionName' and
a.SectionName=b.equip_id";
        //echo $fieldtype;
        $descripreg = MYSQL_QUERY($descripsql);
        $SalPeriod1= mysql_result($descripreg,0,"Sal_Period1");
        $SalPeriod2= mysql_result($descripreg,0,"Sal_Period2");
        $SalPeriod3= mysql_result($descripreg,0,"Sal_Period3");
        $SalPeriod4= mysql_result($descripreg,0,"Sal_Period4");
```

```
        $budgetedhour= mysql_result($descripreg,0,"budgetedhour");
        $centerarea= mysql_result($descripreg,0,"equip_area");
        $efficiency= mysql_result($descripreg,0,"efficiency");
        $MovingAverage= ($SalPeriod2+$SalPeriod3+$SalPeriod4)/3;
        $MidPowerRate=$MovingAverage/$budgetedhour;
        $EquipmentCostRet=EquipmentCost($SectionName,$fieldtype);
        $PlanningHorizHourRet=PlanningHorizHour();
        $equiprateMid=($EquipmentCostRet*$PlanningHorizHourRet)/$budgetedhou
r;
        //echo $EquipmentCostRet;
        $ActualEquipCostRate=$MidPowerRate+$equiprateMid;
        return $ActualEquipCostRate;
}
///Function to Calculate Manpower/Equipment//////////////////
function BuildingRatefunc($SectionName,$fieldtype)
{
        $descripsql="select
a.Sal_Period1,a.Sal_Period2,a.Sal_Period3,a.Sal_Period4,b.budgetedhour,b.equip_are
a,b.efficiency from fs_quartermanpower a,fs_equipment b where
a.FieldType='$fieldtype' and a.SectionName='$SectionName' and
a.SectionName=b.equip_id";
        //echo $descripsql;
        $descripreg = MYSQL_QUERY($descripsql);
        $SalPeriod1= mysql_result($descripreg,0,"Sal_Period1");
        $SalPeriod2= mysql_result($descripreg,0,"Sal_Period2");
        $SalPeriod3= mysql_result($descripreg,0,"Sal_Period3");
        $SalPeriod4= mysql_result($descripreg,0,"Sal_Period4");
        $budgetedhour= mysql_result($descripreg,0,"budgetedhour");
        $centerarea= mysql_result($descripreg,0,"equip_area");
        $efficiency= mysql_result($descripreg,0,"efficiency");
$MovingAverage=($SalPeriod2+$SalPeriod3+$SalPeriod4)/3;
$FactoryAreaSpace=CompanyParamInfo('companyarea');
$BuildMaintRate=($MovingAverage*$centerarea)/($FactoryAreaSpace*$budgetedho
ur);
$buildcost=CompanyParamInfo('companycost');
$FactoryLifeSpan=CompanyParamInfo('companylifespan');
$planhorizonhour=PlanningHorizHour();
$BuildingRate=($buildcost*$planhorizonhour*$centerarea)/($FactoryLifeSpan*365.4
*24*$FactoryAreaSpace*$budgetedhour);
//echo $planhorizonhour;
$ActualBuildingCostRate=$BuildingRate + $BuildMaintRate;
return $ActualBuildingCostRate;
}
///Function to Calculate Manpower/Equipment//////////////////
function ManPowerRatefunc($SectionName,$fieldtype)
{
        $descripsql="select b.budgetedhour,b.equip_area,b.efficiency from
fs_equipment b where b.equip_id='$SectionName'";
        $descripreg = MYSQL_QUERY($descripsql);
        $budgetedhour= mysql_result($descripreg,0,"budgetedhour");
```

```
        //$equip_area= mysql_result($descripreg,0,"equip_area");
        $efficiency= mysql_result($descripreg,0,"efficiency");
        $StaffSalarysql="select sum(staff_salary)TotalSalary from fs_staff where
equip_id='$SectionName'";
        $StaffSalarysel = MYSQL_QUERY($StaffSalarysql);
        $horizsql="select (Month)horizonmonth from fs_planninghorizon";
        $horizsql_idreg = MYSQL_QUERY($horizsql);
        $horizonmonth= mysql_result($horizsql_idreg,0,"horizonmonth");
        $TotalSalary= mysql_result($StaffSalarysel,0,"TotalSalary");
$ManpowerCostrate=($TotalSalary * $horizonmonth)/($budgetedhour * $efficiency);
return $ManpowerCostrate;
}
function UtilityRatefunc($SectionName,$fieldtype)
{
        $descripsql="select
a.Sal_Period1,a.Sal_Period2,a.Sal_Period3,a.Sal_Period4,b.budgetedhour,b.equip_are
a,b.efficiency from fs_quartermanpower a,fs_equipment b where
a.FieldType='$fieldtype' and a.SectionName='$SectionName' and
a.SectionName=b.equip_id";
        //echo $fieldtype;
        $descripreg = MYSQL_QUERY($descripsql);
        $SalPeriod1= mysql_result($descripreg,0,"Sal_Period1");
        $SalPeriod2= mysql_result($descripreg,0,"Sal_Period2");
        $SalPeriod3= mysql_result($descripreg,0,"Sal_Period3");
        $SalPeriod4= mysql_result($descripreg,0,"Sal_Period4");
        $budgetedhour= mysql_result($descripreg,0,"budgetedhour");
        $centerarea= mysql_result($descripreg,0,"equip_area");
        $efficiency= mysql_result($descripreg,0,"efficiency");
        $MovingAverage= ($SalPeriod2+$SalPeriod3+$SalPeriod4)/3;
        $FactoryAreaSpace=CompanyParamInfo('companyarea');
        $ActualUtilityRate=($MovingAverage*$centerarea)/($FactoryAreaSpace*$bu
dgetedhour);
        return $ActualUtilityRate;
}
function AdminRatefunc($SectionName,$fieldtype)
{
        $descripsql="select b.budgetedhour,b.equip_area,b.efficiency from
fs_equipment b where b.equip_id='$SectionName'";
        $descripreg = MYSQL_QUERY($descripsql);
        $budgetedhour= mysql_result($descripreg,0,"budgetedhour");
        $equip_area= mysql_result($descripreg,0,"equip_area");
        $efficiency= mysql_result($descripreg,0,"efficiency");
        $StaffSalarysql="select sum(staff_salary)TotalSalary from fs_StaffAdmin";
        $StaffSalarysel = MYSQL_QUERY($StaffSalarysql);
        $horizsql="select (Month)horizonmonth from fs_planninghorizon";
        $horizsql_idreg = MYSQL_QUERY($horizsql);
        $horizonmonth= mysql_result($horizsql_idreg,0,"horizonmonth");
        $FactoryAreaSpace=CompanyParamInfo('companyarea');
        $TotalSalary= mysql_result($StaffSalarysel,0,"TotalSalary");
```

```
$AdminCostrate=($TotalSalary * $horizonmonth*$equip_area)/($budgetedhour *
$FactoryAreaSpace);
return $AdminCostrate;
}
function EquipmentCost($SectionName,$fieldtype)
{
$equipunit_idsql="select
sum((equipUnit_PurCost+equipUnit_InstCost)/(equipUnit_LifeExp*365.4*24))Retur
nRate from fs_equipmentunit where equip_id='$SectionName'";
        $equipunit_idreg = MYSQL_QUERY($equipunit_idsql);
        $ReturnRate= mysql_result($equipunit_idreg,0,"ReturnRate");
return $ReturnRate;
}
function PlanningHorizHour()
{
$horizsql="select (WorkingHour*WorkingDay*Month*4)horizonhour from
fs_planninghorizon";
        $horizsql_idreg = MYSQL_QUERY($horizsql);
        $horizonhour= mysql_result($horizsql_idreg,0,"horizonhour");
return $horizonhour;
}
?>
```

```
<?php
function incrdate($pdate)
{
  $dc_year=0+substr($pdate,0,4);
          $dc_month=0+substr($pdate,5,2);
          $dc_day=0+substr($pdate,8,2);
        $funcdate=daycount($pdate);
                if ($dc_day==$funcdate){
                        $dc_day=1;
                        $dc_month=$dc_month + 1;
                                if ($dc_month > 12)
                                {
                                $dc_month=$dc_month - 12;
                                $dc_year=$dc_year + 1;
                                }

                }else{
                        $dc_day=$dc_day + 1;
                }
        $pdate="$dc_year/$dc_month/$dc_day";
        return $pdate;
}
function mod($a,$b)
  {
  $x1=(int) abs($a/$b);
  $x2=$a/$b;
  return $a-($x1*$b);
  }
```

```
function IsLeapYear($dt)
{
//$y=$dt["year"];
$y=0+substr($dt,0,4);
$bulis=((mod($y,4)==0) && ((mod ($y,100)<>0) || (mod($y,400)==0)));
return $bulis;
}
function daycount($dt)
{
/*
$dc_year=$dt["year"];
$dc_month=$dt["mon"];
$dc_day=$dt["mday"];
*/
$dc_year=0+substr($dt,0,4);
$dc_month=0+substr($dt,5,2);
$dc_day=0+substr($dt,8,2);
switch ($dc_month)
{
case  1:
case  3:
case  5:
case  7:
case  8:
case 10:
case 12:
      return 31;
   break;
case  4:
case  6:
case  9:
case 11:
      return 30;
   break;
case 2:
   if (IsLeapYear($dt)) { return 28; } else { return 29; };
   break;
}
}
```

```
$dc_month = substr($dt,8,2);
switch ($dc_month)
{
case 1:
case 3:
case 5:
case 7:
case 8:
case 10:
case 12:
    return 31;
  break;
case 4:
case 6:
case 9:
case 11:
    return 30;
  break;
case 2:
  if (IsLeapYear($dt)) { return 28; } else { return 29; };
  break;
}
}
?>
```

```
<?php
include("fsdatefunctions.inc");
//This function finds the possible date for the operation to take place
//The date must be equal or greater than effective date
function
possibledate($postdate,$vmethod,$equipid,$equipunitid,$worktimeval,$pconc)
{
        $contin="true";
        $incrdate=0;
        $pdate=$postdate;
        while ($contin=="true"){
        //$pdate=$pdate + $incrdate;
                $chekdatesql="select a.schedule_date,a.schedule_time from
fs_schedule a where a.equip_id='$equipid' and equipunit_id='$equipunitid' and
a.schedule_date='$pdate' and a.work_id='$vmethod'";
                $chekdate = MYSQL_QUERY($chekdatesql);
        if ($resultrow=mysql_fetch_array($chekdate)){
                        //To confirm if the date can still be reused

        $chkconfdat=confdate($pdate,$vmethod,$equipid,$equipunitid,$worktimeval,
$pconc);
                                //echo "Time Rem-$chkconfdat";
                        if ($chkconfdat < 1){ //no time remain
                                $contin="true";//date can not be used
                                $incrdate++;
```

```
                        //splitting date
                        $pdate=incrdate($pdate);
                }else{
                        $contin="false";//can still be used
                        $pdate=$pdate;
                }
        }else{
        $contin="false";//date has not been used
        $pdate=$pdate;
        //return $pdate;
        }
    }
    return $pdate;
}
//This function finds the possible time(hrs) remain on a specified date
function confdate($pdate,$vmethod,$equipid,$equipunitid,$worktimeval,$pconc)
{
        $sumequipusedsql="select sum(schedule_time)equiptimeuse from
fs_schedule where equip_id='$equipid' and equipunit_id='$equipunitid' and
schedule_date='$pdate' and work_id='$vmethod'";
        $sumequipused = MYSQL_QUERY($sumequipusedsql);
                while ($equipusedrow =
mysql_fetch_array($sumequipused)){
                        $equiptimeuse=$equipusedrow["equiptimeuse"];
                }
        $selequipnosql="select  equip_no from fs_equipment where
equip_id='$equipid'";
        $selequipno = MYSQL_QUERY($selequipnosql);
                while ($equipnorow =
mysql_fetch_array($selequipno)){
                        $equipmentno=$equipnorow["equip_no"];
                }
//To be continued---Replacing equipno with Max Concurrency Selected
        //$equiptimeavail=$equipmentno * $worktimeval;
        //$equiptimeavail=$pconc * $worktimeval;
        $equiptimeavail=$worktimeval;
        $remequiptime=$equiptimeavail - $equiptimeuse;
        return $remequiptime;
}
//This function returns the Real value to be inserted
function realvalfunc($chkremaintime,$deductval,$worktimeval)
{
        if ($chkremaintime == 0) {
                if ($deductval <= $worktimeval) {
                        $realval=$deductval;
                        $deductval=0;
                }else{
                        $deductval=$deductval - $worktimeval;
                        $realval=$worktimeval;
                }
```

```
		}else if ($deductval > $chkremaintime) {
			$realval=$chkremaintime;
			$deductval=$deductval - $chkremaintime;
	}else{
			$realval=$deductval;
			$deductval=0;
		}
	return $realval;
}
//This function returns the Remainder value (Deduct) to be inserted
function deductvalfunc($chkremaintime,$deductval,$worktimeval)
{
		if ($chkremaintime == 0) {
			if ($deductval <= $worktimeval) {
				$realval=$deductval;
				$deductval=0;
			}else{
				$deductval=$deductval - $worktimeval;
				$realval=$worktimeval;
			}
		}else if ($deductval > $chkremaintime) {
			$realval=$chkremaintime;
			$deductval=$deductval - $chkremaintime;
		}else{
			$realval=$deductval;
			$deductval=0;
		}
	return $deductval;
}
///Function to Calculate Manpower/Equipment//////////////////
function ManPowerRatefunc($SectionName,$fieldtype)
{
	$descripsql="select
Sal_Period1,Sal_Period2,Sal_Period3,Sal_Period4,budgetedhour,efficiency from
fs_quartermanpower,fs_equipment where FieldType='$fieldtype' and
SectionName='$SectionName' and SectionName=equip_id";
	//echo $fieldtype;
	$descripreg = MYSQL_QUERY($descripsql);
	$SalPeriod1= mysql_result($descripreg,0,"Sal_Period1");
	$SalPeriod2= mysql_result($descripreg,0,"Sal_Period2");
	$SalPeriod3= mysql_result($descripreg,0,"Sal_Period3");
	$SalPeriod4= mysql_result($descripreg,0,"Sal_Period4");
	$budgetedhour= mysql_result($descripreg,0,"budgetedhour");
	$efficiency= mysql_result($descripreg,0,"efficiency");
$MovingAverage= ($SalPeriod2+$SalPeriod3+$SalPeriod4)/3;
$MovingAverage= number_format($MovingAverage,2);
$ManPowerRate=($MovingAverage/($efficiency*$budgetedhour));
return $ManPowerRate;
}
?>
```

```
<?php
//$db= mysql_connect("localhost","root","");
$db= mysql_connect("localhost","root","");
mysql_select_db("floorshop",$db);
?>
//This inserts the schedulles
function
insertschedfunc($posdate,$pjobid,$pequipid,$equipunitid,$vconc,$vorder,$vmethod,$
realval,$starttime,$endtime)
{
//$starttime=$starttime + 0.00;
//$endtime=$endtime + 0.00;
$schedrealinssql="insert into
fs_schedule(schedule_date,job_id,equip_id,equipunit_id, schedule_maxconc,
schedule_order,work_id, schedule_time, schedule_start, schedule_end)
values('$posdate','$pjobid','$pequipid','$equipunitid','$vconc','$vorder','$vmethod','$re
alval','$starttime','$endtime')";
        $insertschedreal=mysql_query($schedrealinssql);
//echo $schedrealinssql;
return "Inserted";
}
//-----------------------------------------------------------------------------
//This retrieves active equipment
function selequipmentfunc()
{
$equipmentsql="select equip_id,equip_descrip,effstatus from fs_equipment where
effstatus='Y'";
$selequipment = MYSQL_QUERY($equipmentsql);
return $selequipment;
}
//-----------------------------------------------------------------------------
//This retrieves active equipment Units
function selequipunitfunc($pequipid)
{
$equipunitsql="select equipunit_id,equip_id,equipunit_descrip,effstatus from
fs_equipmentunit where equip_id='$pequipid' and effstatus='Y'";
$selequipunit = MYSQL_QUERY($equipunitsql);
return $selequipunit;
}
//-----------------------------------------------------------------------------
//This retrieves the active no of equipunit
function countactiveunit($pequipid)
{
$countunitsql="select count(equipunit_id) countno from fs_equipmentunit where
equip_id='$pequipid' and effstatus='Y'";
$countquipunit = MYSQL_QUERY($countunitsql);
//echo $countunitsql;
        //$countno=countactiveunit($pequipid);
        while ($countquipunitrow = mysql_fetch_array($countquipunit)){
                $countno=$countquipunitrow["countno"];
```

```
                //echo "Count No= $countno";
        }
return $countno;
}
//-----------------------------------------------------------------------------------------------
//This retrieves equipment Units
function selallequipunit($pequipid)
{
$equipunitsql="select
equipunit_id,equip_id,equipunit_descrip,equipUnit_PurCost,equipUnit_InstCost,equi
pUnit_LifeExp,effstatus from fs_equipmentunit where equip_id='$pequipid'";
$selequipunit = MYSQL_QUERY($equipunitsql);
return $selequipunit;
}
//-----------------------------------------------------------------------------------------------
//This a particular equipment Units number in use for the Job
function countquipunitfunc($pjobid,$pequipid,$vmethod,$posdate)
{
$countunitsql="select count(equip_id) countno from fs_schedule where
job_id='$pjobid' and equip_id='$pequipid' and  work_id='$vmethod' and
schedule_date='$posdate'";
$countunit = MYSQL_QUERY($countunitsql);
return $countunit;
}
//This checks for the lesser order no.Date has nothing to do
function checkordernodate($postdate,$jobid,$vorder)
{
$lessorder=$vorder - 1;
        $schedordersql="select max(schedule_time)maxtime from fs_schedule,a
where a.job_id='$jobid' and a.schedule_date='$postdate' and
a.schedule_order='$lessorder'";
                //$schedorder = MYSQL_QUERY($schedordersql);
//echo $schedordersql;
return $schedordersql;
}
//This checks for the Date taking order into consideration---For Single
function possorderdate($postdate,$jobid,$vorder)
{
//echo "Order-- $vorder";









        }
$maxtimesql="select max(schedule_time)maxtime from fs_schedule where
job_id='$jobid' and schedule_order='$lessorder' and schedule_date ='$maxdate'";
        $maxtimesel = MYSQL_QUERY($maxtimesql);
```

```
        while ($maxtimeselrow = mysql_fetch_array($maxtimesel)){
                $maxtime=$maxtimeselrow["maxtime"];
        }
$schedordersql="select schedule_date,work_id,job_id,schedule_time from
fs_schedule where job_id='$jobid' and schedule_order='$lessorder' and
schedule_date='$maxdate' and schedule_time='$maxtime'";
//echo $schedordersql;
return $schedordersql;
}
?>
```

```
<?php
//This inserts the procedures
include("fsfunctions.inc");
include("fsqueryfunctions.inc");
if ($_POST[btnsave] and $_POST[jobid]!=""){
        $totalorder=$_POST[hidorder];
        //echo $totalorder;
        //Taking order into consideration
        for ($order = 1;  $order < $totalorder + 1;  $order++){
                $selequip = MYSQL_QUERY($equipsql);
                $insincr=1;
                while ($equiprow = mysql_fetch_array($selequip)){
                        $equipid=$equiprow["equip_id"];
                        $equipdescript=$equiprow["equip_descrip"];
                        $equipno=$equiprow["equip_no"];
                        $hidequipid=("hidequip$equipid");
                        $cmbconc=("cmbmaxconc$equipid");
                        $cmborder=("cmborder$equipid");
                        $cmbmethod=("cmbmethod$equipid");
                        $txttime=("txttime$equipid");
                        $pjobid=$_POST[jobid];
                        $pdate=$_POST[txtdate];
                        $pday=0+substr($pdate,0,2);
                        $pmonth=substr($pdate,3,2);
                        $pyear=0+substr($pdate,6,4);
                        $scheddate="$pyear$pmonth$pday";
                        $pequipid=$_POST[("$hidequipid")];
                        $pconc=$_POST[("$cmbconc")];
                        $porder=$_POST[("$cmborder")];
                        $pmethod=$_POST[("$cmbmethod")];
                        $ptime=$_POST[("$txttime")];
                $vconc=rtrim(ltrim($pconc));
                        $vorder=rtrim(ltrim($porder));
                        $vmethod=rtrim(ltrim($pmethod));
                        $vtime=rtrim(ltrim($ptime));
                        //Check for the order i.e if the orders are thesame
                        if ($order==$porder){
                //Retrieves Worktype value
```

```
                                $workvalsql="select
work_id,work_descrip,work_time,work_time2 from fs_worktype where
work_id='$pmethod'";
                                $selworkval = MYSQL_QUERY($workvalsql);
                                while ($workvalrow =
mysql_fetch_array($selworkval)){
                                        $worktimeval=$workvalrow["work_time"];
                                        $worktime2val=$workvalrow["work_time2"];
                                }
                                if (rtrim(ltrim($vtime)) >0){
                                                //echo $worktimeval;
                                                $realiterate=0;
                                                //The duration units-  FULLTIME
ONLY or OVERTIME ONLY
                                                if (($vmethod=="full")or
($vmethod=="over")){
                                                include("fs_singleprocessing.inc");
                                                }else{
                                                //The duration units-  FULLTIME and
OVERTIME Combined
//To be continued

        include("fs_combinedprocessing.inc");
                                                }
                                        }//if Input time >0
                                //echo $scheduleinssql;
                        }// For order equality IF
                }//Ends While equipmentid
        }//Ends For
}//Ends If
?>
*****************************************************************************
*
```

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LIST OF SYMBOLS/NOMENCLATURE

a_j = The area of space occupied by activity centre j

A = Total floor space of the factory building

B = The cost for constructing the factory building

c_{ij}^{b} = cost rate of building space in activity centre j where job i is under process

c_{ijk}^{v} = cost rate of inventory k consumed in activity centre j by job i

c_{ij}^{m} = cost rate of manpower in activity centre j used for job i

c_{ij}^{e} = cost rate of using the equipments in activity centre j for job i

c_{ij}^{u} = cost rate of using the utilities in activity centre j for job i

C_{jt}^{*m} = Optimal total cost required for manpower in centre j in period t.

C_{jt}^{*e} = Optimal total cost to be spent on all the equipments in centre j in period t

C_{kt}^{*v} = Optimal total cost to be spent on inventory k in period

C_{ij} = cost of producing job i in activity centre j.

CP_i = minimum cost of producing job i

C_{kt}^{*v} = Optimal cost of inventorying material k in period t

c_{ij}^{a} = Cost rate allotted to activity centre j for the services rendered by technical/administrative staff in the company

c_{ij}^{a} = cost rate allotted to activity centre j for the services rendered by technical/administrative staff

D_{ij} = Departure time of job i from activity centre j

$D_{i,j-1}$ = Departure time of job i from an activity centre immediately preceding activity centre j

DD_i = Due date for job i (i.e completion date of job i)

D_{jt}^{a} = Actual demand for activity centre j in period t

D_{jn}^{a} = *actual demand of activity j in period n*

D_{jt}^{f} = Forecast hour of demand expected in activity centre j in period t

D^f_{jt-1} = Forecast hour of demand in activity centre j in period t-1

D^a_{kt-1} = Actual quantity of material k used in period t-1

D^f_{kt-1} = Forecast quantity of material k predicted to be used in period t -1

E_{jt-1} = No of available equipment in activity centre j in period t-1

E^n_{jt} = No of equipment in activity centre j to be acquired in period t

E_{jt} = Error in forecast for activity centre j in period t

H_t = Total activity hours available in period t

H_{jt} = Usage hours of equipment in activity centre j in period t

H^h = Expected life span of the factory building in hours

I_{nt} = Installation cost of equipment n

$\{I_i\}_{i=1}^{n}$ = finite set I of n jobs to be processed

J = the last activity centre visited by job i

$\{J_j\}_{j=1}^{J}$ = finite set J of activity centres

K^c_{nt} = Initial cost of purchasing equipment n

K^b_{jt} = Cost of borrowing equipment needed in activity centre j in period t/hr

K^c_{jt} = Cost of contracting out the activity to be performed by equipment i in period t/hr

K^o_{jt} = Cost of overtime engagement of equipment in activity centre j in period t/hr

K^p_{jt} = Cost of purchasing and maintaining new equipment in activity centre j in period t

K_{jt-1} = Cost of purchasing and maintaining the existing equipment in activity centre j in period t-1

L^r_{ijk} = length /area/volume of inventory k used by job i in activity centre j

M^e_{jt} = No of the newly employed staff in centre j in period t

M_{jt-1} = No of the existing staff in centre j in period t-1

MTC_t^b = Building maintenance cost for period t

MTC_{jt}^e = Equipment maintenance cost of activity centre j in period t

N = total number of job in period t

P_{kt-1} = Unit price of material k at period t-1

P_{kt}^h = Holding cost of material k at period t

P_{kt}^s = Set up cost of material k at period t

P_{kt} = Unit price of material k at period t

Q_t = Total amount spent on manpower involved in Technical/Administrative services in period t. by the company

q_j = Waiting time in activity centre j

q_i = queuing or waiting time in the system for job i

R_{kt} = Re order point for quantity k in period t

r_i = the arrival time of job i

S_{jt} = Total salary and wages paid to the manpower in activity centre j in period t

t_t^b = building time in period t

t_{nj}^e = processing time of job n queuing on activity centre j

t_{ij}^e = processing time of job i on machine at activity centre j

t_{ij}^b = building time spent by job i in activity centre j

t_t^u = time of using the utilities in period t

t_{ij}^u = time of using the utilities in activity centre j by job i

t_{ij}^b = time spent by job i in activity centre j

t_{ij}^e = time spent by job i on equipment in activity centre j

t_{ij}^m = time spent by manpower on job i in activity centre j

t_j^e = total processing time on machine for job i

T_{max} = duration in which all operations for all jobs are completed (makespan).

U_t = Total amount spent on utilities in period t by the company

W_{jt} = Wages and salaries paid to each of the existing staff in activity centre j in period t

W_{jt}^{e} = Wages and salaries paid to each of the newly employed staff in activity centre j in period t

W_{jt}^{p} = Wages and salaries paid to the part time staff engaged in activity centre j in period t

W_{jt}^{t} = Cost incurred for temporarily transferred manpower to activity centre j in period t

Y_n = Expected life span of equipment n (in hours)

Π_{jt}^{b} = Factor to determine the fraction of equipment of centre j in period t to be borrowed

Π_{jt}^{c} = Factor to determine the fraction of equipment-hour of centre j in period t to be contracted out

Π_{jt}^{o} = Factor to determine the fraction of equipment-hour of centre j in period t to be executed using overtime engagement

Π_{jt}^{p} = Factor to determine the fraction of new equipment to be purchased in activity centre j in period t

Ω_{jt}^{p} = Factor to determine the fraction of manpower-hour to be engaged on part time basis in activity centre j in period t

Ω_{jt}^{t} = Factor to determine the fraction of manpower-hour to be transferred to activity centre j in period t

Ω_{jt}^{r} = Factor to determine the fraction of new manpower to be recruited in activity centre j in period t

Ωq_{nj} = Mean waiting time of job n queuing on activity centre j

Ωt_{jt}^{m} = Average manpower time in activity centre j at period t

Ωt_{jt}^{e} = Average manpower time on equipment in activity centre j at period t

Ωq_j = mean waiting time in activity centre j

δ_j^c = Machine maintenance factor of equipment in centre j in period t

α^*_{it} is the best value of α that gives the least value of MAD

α_{jt} =smoothing constant for activity centre j to be used in period t.

β_t^b = Building maintenance factor for period t

β_t^b = Building maintenance factor for period t

Ψ_j^m = Manpower efficiency factor at activity centre j in period t

ϖ^w = Waiting time factor, is subject to the opinion of the operator

Λ_j^m = Manpower time factor at activity centre j for particular period t

Λ_t^u = Utility time factor in period t

Λ^n = Due date negotiation factor

τ_{ij} =Processing time

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

When a product is to be manufactured, its production must be carefully planned in order that the manufacturing departments (units) are loaded efficiently and within their capacities. While the product is being manufactured, the production must be controlled to ensure that the programme output is constantly maintained (Chase and Aquilano, 1985, Adams and Ebert, 1993). This concept brings about what is known as Production Planning and Control (PPC), which Adejuyigbe (2002) refers to as a "Siamese twins" of management. It is a coordinated flow of work leading to complete manufacture of the required articles both in quality and in quantity before the arrival of the date promised for delivery.

In some firms, planning and control of production processes are combined together in one department often called Production Control Department, (P.C.D), which is concerned with the planning, production, purchase, storing, materials management, personnel management, inspection and maintenance (Denyer, 1974, Adams and Ebert, 1993 and Adejuyigbe, 2002).

The objective of production planning and control to is to satisfy customer's delivery dates at minimum overall cost by planning the sequence of production activities (Harding, 1975; Denyer, 1974; and George, 1990) and five major objectives of production planning and control highlighted are to:

(i) meet delivery date;

(ii) ensure smooth continuous production;

(iii) use manpower and equipment to the best advantage;

(iv) see that raw materials, Work –in-Progress (W.I.P) and finished goods are kept to optimum levels; and

(v) prevent bottlenecks in production and avoid delays.

A comprehensive scope of work of Production Planning and Control Department was presented by Adams and Ebert (1993) as follows:

(i) To know the nature of work to be done by liaising with sales department

(ii) To allocate and supervise the movement of materials and stock by liaising with purchasing officer.

(iii) To decide where the work is to be done.

(iv) To decide who should do the work by allocating the personnel.

(v) To decide how the work should be done (i.e. production scheduling)

(vi) To fix times for performance by setting up standard time perhaps with the aid of work study officers

(vii) To institute controls to ensure that predetermined programmes are followed to the letter (quality assurance/control)

(viii) To ensure continuous inspection over the quality of jobs produced and

(ix) To institute cost control programme for the whole activities.

For this department to achieve its objectives and efficiently cover the scope of its work, it needs sufficient and accurate information on the following:

(i) The product(s) to be made

(ii) The delivery date

(iii) The quantity required and

(iv) The materials required for the production

The department must also know the situation on the floor of the shop. Such situations are:

(i) Availability of machine and the needed facilities (Tools and Equipment).

(ii) Availability of machine operators (Manpower)

(iii) The capacities for each machine, their efficiency, delay factors and also the maintenance schedule of the machines (Scheduling)

(iv) Stock level; the actual and reserved figures for all items in stock and on- order (Inventory Control)

(v) Standard times of machine and labour, incentives and pay schemes (work study)

(vi) Methods of jig and tool design, process specification and layout charts and

(vii) The present order position, both new and in-progress. (Denyer, 1974 and Harding, 1975).

However, the production planning and control system is affected by the method of production, which also affects the layout of machines. Denyer (1974) is of the opinion that production planning and control is much easier when there is a continuous flow production than a production system where there are different products being made for different jobs, all with different delivery dates and all requiring the use of different machines and machine tools. In a manufacturing context, this system is referred to as jobshop.

The difficulty in planning and controlling the production activities in jobshops is as a result of various peculiarities that are associated with it. Lou and Kager (1989) see a jobshop as a system that deals with manufacturing variety of products in demand

using machines in a general network configuration. Each of these products follows a different plan that specifies the sequence of machines it must visit and the operations performed by them. In literature, jobshop peculiarities, also known as jobshop problems have been considered "notorious" and difficult to solve due to its characteristics (Lawler et.al, 1982, Jain, 1998 and Smith, Peters and Srinivasana, 1999). Some of these characteristics or peculiarities were discussed in section 1.2

1.2 PECULIARITIES OF JOBSHOP

This section discusses some of the peculiarities of jobshop, most especially in the developing countries that have posed challenges to past and present researchers. These peculiarities have resulted in a wide variety of approaches and models either to simplify its scope or to solve them.

Adam and Ebert (1993) considered jobshop as a situation where some work centers may be idle and at the same time, some will be severely over loaded or experience a large build-up of orders a waiting processing. The situation may also necessitate resetting or adjusting the equipment when one order is completed before the next can be processed. In this situation, planning and control becomes haphazard in order to suit the changes in machine configuration and demand request.

Idris and Aderoba (2000) observed that setting up a new jobshop in developing countries has been hindered by inadequate capital to execute the project in one fell swoop. The commercial banks, which would have been of assistance, are usually unwilling to give credit to jobshops because their products are usually undefined and the cash flow is not readily predictable. This situation has forced the interested investors in jobshops to start with little available capital to acquire few equipment with hope of expansion through the returns generated from the installed facilities/machinery.

Commencing a jobshop under this situation of not having sufficient tools and equipment makes it difficult to have a purposeful production planning and control because production in jobshops which is customised in nature, necessitate varieties of tools and equipment to meet diverse specifications of jobs. It also affects the management of working capital as pointed out by Idris (2002).

Akinnuli and Aderoba (2000) bring to limelight some extraneous factors in jobshops, particularly in developing countries that may affect flow time prediction. These factors according to the researchers include shortage and erratic power supply, inability to secure needed raw materials, inadequate finance for working capital, problems of labour and the problems arising from socio-economic and political situations of the these countries. These aforementioned factors are far more critical to flow time determination and job scheduling which are integral part of production planning and control.

Peculiarities of jobshops also include lack of patronage at the gestation period and uncertain demand during growth. These result to under-utilisation or over-utilisation of labour and possibility to lay off staff during under utilisation period. This brings about the problem of job in-securities, which consequently discourage skilled and competent staff from seeking employment in jobshops. Availability of skilled manpower to handle diverse jobs in jobshops is a sine qua non for manpower planning which is one of the salient management decisions for effective production planning and control.

Aderoba (1997a) made a comprehensive revelation of jobshop peculiarities in his work titled "A generalised cost-estimation model for jobshops". Among these peculiarities is the impossibility of jobshops to make use of data from previous production as each new job exhibits its own special characteristic and requirements.

This peculiarity posts serious obstacles to efficient production planning and control, which depends on the astute combination of intelligence about what has actually happened to forecast, plan and set control strategies for future activities. He also notes that one man business method of operating jobshop in the developing countries as a result of limited capital to have full complement of experienced engineers makes the single proprietor's decisions in cost estimation and due date prediction based on hunches which may at the end of the day make or mar the company.

He further revealed that jobshops most especially in developing countries lack systematic arrangement for cost estimation coupled with non-availability of modern computing facilities and standard time data. This usually makes prospective customers in jobshops aimed at awarding job at a non-profitable price using a very hard price bargaining strategies, which may make a manager with a weak will succumb and consequently affects the objective of production planning and control, which is profitability.

Akinyemi *et. al.* (2002) made it known that customers' satisfaction through a combination of service quality and timeliness of jobs to meet the promised delivery-dates makes the firms thrive, a key objective of production planning and control. However, their finding revealed that jobshops in developing countries are characterised with lack of appropriate job scheduling which result to backlog of jobs. Adesoba *et. al.* (2003) also revealed salient peculiarities of jobshops in relation to material planning, which include vague knowledge of materials needed that are multiple in natures because of stochastic and different request pattern of demand in jobshops. Limited storage facility and that of capital to purchase enough stock of materials, were also identified as peculiarities of jobshops. In addition, Akintunlaji,

(2003) lists some materials planning problems that were associated with jobshops, mostly in developing countries. These problems or peculiarities include:

(i) inability to stock materials because of variability of orders, unpredictability of demand and holding cost.

(ii) difficulty to determine the most economical quantities of materials to order for at a given time.

(iii) limited capacity in terms of manpower, machines and suppliers

(iv) limited operational capital to procure and stock needed materials

These peculiarities pointed out by Aderoba *et al.* (2003) and Akintunlaji (2003) with regard the material planning are limiting factors for a smooth production planning and control because of the fact that the size and nature of materials to plan for are hardly known because of unpredictability of demand in jobshop.

With all these aforementioned peculiarities and problems, management decisions to have effective production planning and control in jobshop become a herculean task. This study aimed in solving these problems.

1.3 RESEARCH OBJECTIVES

The overall objective of this study is to provide an integrated approach to production planning and control in jobshops. Specifically, the study will meet the under listed objectives, to surmount the problems facing production planning and control in jobshops. These specific objectives are to:

i. formulate mathematical models for the strategic decisions identified to be affecting production planning and control in jobshops;

ii. integrate the models developed in (i) for holistic optimisation;

iii. develop a computer software for effective implementation of the models; and

iv. test the effectiveness of the models using existing jobshops.

1.4 RESEARCH JUSTIFICATION

Establishment and survival of small scale industries have been identified as a pivot for economic and technology growth of any nation, most especially developing countries. (NSE, 1996; Aderoba, 1998; Adejuyigbe, 1999; and Idris, 2005).

Jobshop, a typical small-scale industry, has been facing problem of extinction because of unguided management policy on some salient strategic decisions. This problem has not only resulted to total collapsed of most of the existing ones or reduced them to moribund production system but discourages many interested investors from establishing them. Jain (1998) submitted that a great deal of research effort has been focused on solving the jobshop problem over decades, resulting in a wide variety of approaches. Nevertheless, he proposed, "that there is the need to focus on hybrid methods to solve the jobshop problem as a single technique cannot solve this stubborn problem".

This study hereby provided hybrid mathematical model through developments; modifications and integration of models on various strategic decisions in jobshops. The resulting model will aid the decision makers in jobshops in having a smooth and successful production planning and control thereby promotes the survival of small-scale industries and consequently aids the economic growth of developing nations.

1.5 CONTRIBUTIONS TO KNOWLEDGE

The outcomes of this research will contribute to the existing knowledge in the field of Production Management, Industrial Engineering and in particular Jobshop Scheduling by:

i. providing a global integration model for solving the problems of jobshops such as job scheduling , due-date prediction, manpower planning, demand management and so on;

ii. generating databases for further research work in solving the problems of jobshop; and

iii. providing an enhanced Computer Software, JOBSIS_2007, based on the developed model which will be useful for quick and accurate decision-making in jobshops.

CHAPTER TWO

LITERATURE REVIEW

2.1 REVIEW OF STRATEGIC DECISIONS IN JOBSHOPS

Based on extensive review of past literature in the field of Industrial and Management Engineering, the under listed decisions were identified to be salient among the strategic decisions that contribute to effective Production Planning and Control in jobshops. These salient strategic decisions are; Demand Management, Manpower Planning, Tools and Equipment Planning, Material Requirement Planning, Due-Date Determination, Cost Estimation, Jobshop Scheduling and Shop Floor Control / Record Management. (Harding, 1975; Adam and Ebert 1993; Kareem and Aderoba, 2003).

A great deal of research has been focused on solving the problems emanating from each of these aforementioned salient decisions resulting in a wide variety of approaches and models. These approaches and models are hereby presented as reviewed from the available past and present literature.

2.2 DEMAND MANAGEMENT

Demand management according to Vollmann, *et.al.* (1997) is a process that includes forecasting which takes place before, during and after the production planning. There are various methods of forecasting which can be broadly classified into; 'Qualitative Techniques, Time Series Analysis, Casual Relationships and Simulation. From the work of Whybark (1993), Makridakis *et. al.* (1982) and Aderoba (2000) on the best forecasting method that could be used in jobshop, considering its peculiarities, exponential smoothing technique was singled out. Gardner (1985) presented a comprehensive study of exponential smoothing where its historical development was traced to the time of Second World War. Gardner (1985)

critically commented on the merits of various models and discredited others based on his own work as well as the work of other researchers. In his conclusion, exponential smoothing technique was also rated as one of the best forecasting methods.

In using the exponential smoothing technique, only three pieces of data are needed. These are; the most recent forecast, the actual demand that occurred for that forecast period and a smoothing constant (α). This smoothing constant (ranges between 0 and 1) determines the level of smoothing and the speed of reaction to differences between forecasts and actual occurrences. The value for this constant is arbitrary and is determined both by the nature of the product and the feelings of the managers as to what constitute a good response rate (Chase and Aquilano, 1985). These features fit the situation in jobshop where there is scanty record from the previous jobs as well as the need for manager to use his initiative to determine the nature of each job which hardly similar to others.

Not only that exponential smoothing technique is simple in formulation and application, it was also rated as the best that gives accurate and optimal results for jobshops (Kareem, 2004). This technique is easy for computerisation, especially when many items require forecast, this feature has made it forms an integral part of virtually all available forecast programs (Chase and Aquilano, 1985).

2.3 MANPOWER PLANNING

It could be deduced from past records that the objective of manpower planning had gone beyond arranging for the necessary number of suitable people, to be allocated to various jobs usually in hierarchical structure or just getting the right number of right people in the right jobs in the right place at the right time. But it has extended to a process that predict for both demand and supply of manpower and

looking at policies to reconcile any difference between the two which is often refer to as closing the manpower gap.

Historically, origin of models of manpower systems could be traced to Seal (1945). However, simple models were reported by Edwards (1983) to have been used by manpower planners long before then. Such models are Royal Marines (1779) cited in Jones (1964) and Greenwood (1918) but details of these models have not usually found their way into academic journals.

Recent efforts on manpower planning include Mehlmann, (1980), Leeson (1980), Zanakis and Maret (1981)Vassiliou (1981), Poornachandra (1990), Aderoba and Lawal (1997) , Aderoba (2000), Bazargan *et.al.* (2003), Fapetu and Kareem (2003) and Igboanugo and Eriobo (2004). Research findings clearly indicate that the development of new models and modification of existing ones are continuing.

Mehlmann (1980) developed an optimal recruitment and transition strategies for manpower systems using dynamic programming recursion with the objective of minimising a quadratic penalty function which reflects the importance of correct manning of each grade under preferred recruitment and transition patterns. The work of Zanakis and Maret (1981) was based on Markovian goal programming model with pre-emptive priorities and provided a more flexible and realistic tool for manpower planning problems. Aderoba and Lawal (1997) developed a heuristic approach to determine crew size based on queuing model. Fapetu and Kareem (2003) developed a workload approach to crew size determination by introducing factor to account for the uncertainty in the performance of maintenance crew. Igboanugo and Eriobo (2004) also adopted a transition probability matrix approach to stochastic measurement of manpower stock and flow to forecast for manpower supply and demand of an oil

prospecting company. However, the model fails to put in place a strategy to reconcile any difference between the two (supply and demand) if arises.

Review of manpower planning models by Edwards (1983) showed that most of the existing work looked at the problem of manpower planning from the perspectives of supply and demand only, while few considered manpower costs along with various recruitment policies. Although, Poornachandra (1990) observed that no work had been reported with the objective of minimising manpower costs, but some work like Ramirez-Beltran (1995) and Rao (1990) considered manpower cost but however, assumed knowledge of a labour requirement and unrealistic assumptions about uncertainty of demand.

Poornachandra (1990) made an attempt to identify various costs associated with manpower planning system , based on this he formulated a manpower planning model with the objective of minimising the manpower system costs. The major limitation of the model is the consideration of manpower costs in isolation of various constraints and operating policies under which a manpower system operates. He then suggested for an integrated model which will minimise the manpower costs in the presence of the system constraints and other operating policies.

Grinold (1976) examined the problem of producing a commodity with uncertain future demand, with time lags in the production process and with the commodity itself being a vital input in the production process. Kurosu (1986)'s work which is of relevance to jobshops situation, described the influence of demand uncertainties on waiting time, idle time and rate of loosing customers. He modeled demand as a queuing process and gone as far as prescribing timing and conditions for temporary increasing or decreasing process capacity to absorb fluctuations in demand. This study however did not consider manpower costs. Aderoba (2000) established a

procedure for determining appropriate levels of full time labour and overtime engagement. Unlike many other models for manpower planning, the study did not assume a particular distribution for demand but proceeded to forecast demand on a continuing basis for the production system using both judgmental decision in the initial forecast and exponential smoothing on emerging historical records. The model however failed to consider the effects of other strategic decisions like availability of tools and equipment and promised due dates.

2.4 TOOLS AND EQUIPMENT PLANNING

Tools and equipment planning is commonly referred to as capacity planning in many literature. Its objective is to determine the number of tools/equipment that will adequately sustain the production process. Early work on tools/equipment planning like that of Shubin and Madeheim (1975) derived a formula which established numbers of tools/equipment required for any particular operation by dividing the capacity required for such operation by the available capacity, while Cornelius and Ranjit (1975) developed a model for capacity expansion in convex cost networks with uncertain demand. These two aforementioned models were developed based on the knowledge of the available capacity and the capacity required.

Psoinos (1975) used stochastic approach to give expected number of machines required, while Miller and Davis (1977) presented various deterministic and stochastic approaches to capacity planning. Richard *et. al.* (1989) adopted queuing methods for determining the number of machine/equipment required for production activities, while Aderoba (1997b) and Idris and Aderoba (2000) planned for acquisition of equipment by developing models for sequential investment in machineries. In a jobshop, capacity required is stochastic clouded with various socio-political interferences, thereby a model that will forecast for future capacity,

provide an effective control measure, minimise the equipment costs with the consideration of effects of other strategic decisions is most appropriate, but to the best knowledge of this researcher no work has been reported with the aforementioned features.

2.5 MATERIAL REQUIREMENT PLANNING

The objectives of Material Requirement Planning (MRP) include control of inventory levels, assign operating priorities for items and plan capacity to load the production system effectively (Orlicky, 1975). The importance of material requirement planning cannot be overemphasized, Adejuyigbe (1999) observed that material intake utilisation and re-ordering policy are crucial components for optimal sustenance of any production system.

Literature is very rich in models on material or inventory management. Although most of these models were designed to minimise total cost of production by balancing cost of order, holding cost of inventory and shortage cost. Some of these models are classified under deterministic models or probabilistic models. Among the existing models are ABC inventory models, Economic Order Quantity model (Tersine, 1982 and Taha, 1992), purchase inventory model (Sarma and Prasad, 1992), Deterministic lot-size inventory model (Shah and Shah, 1992), and EOQ model under permissible delay in payment when supply is random (Trivedi and Shah, 1993).

Adejuyigbe (1999) opined that while most of these models are trying to generate confidence in the stock of meeting any anticipated demand by providing for no shortage. They failed to find application in jobshops because the models do not provide for situations like dynamic nature of material cost; vagaries production requirements, uncertainties in job demand and dates for execution as well as availability of materials in the resource market. In order to address these lapses,

Adejuyigbe (1999) provided a quantitative model for solving the problems peculiar to jobshop inventory management by employing a dynamic programming model using EOQ approach.

Considering the peculiarities of jobshops, material requirement model that will be significant must consider uncertainty of demand and supply; constraints on space and fund; multiple raw materials; and allows continue review as well as dynamic analysis to cater for uncertainty situations. The uncertainty in jobshop falls into three categories; demand uncertainty, supply uncertainty and process uncertainty. In most uncertainty models, attention had only been focused on demand, although in some few models such as Taha, (1992), Gupta and Brennan (1995) and Ho *et. al.* (1995) considerations were given to space limitation, supply uncertainty and process uncertainty respectively. Most of these models employed probability distributions such as normal and exponential distributions. However, Aderoba *et. al.* (2003) model, one of the uncertainty models, provided for a more realistic approach to the problem of inventory management by incorporated standard forecasting techniques into EOQ model.

The work also facilitates the usage of actual demand data as they emerge during the planning horizon and allows periodic review process. As comprehensive as this model was, it failed to consider the importance of scheduled-due date. The issue of scheduled-due date was considered by Akintunlaji (2003) model. The model managed the material requirements by providing weekly reports of orders that must be released to work centres in order to meet the scheduled-due dates of jobs, however the model, not only failed to optimise its objective but overlook stochastic nature of jobshop environment which necessitate a standard forecasting technique.

Considering the nature of jobshop that has to accommodate variety of products, material requirement decisions become task of trade-off between cost of holding multiple materials in stock as inventory and the penalty cost in not meeting the due date, due to shortage of material (Chase and Aquilano, 1985). This situation called for an integrated model that will control inventory levels, assign operating priorities, plan capacity to: load the production system adequately and meet the scheduled-due date of jobs and finally accounts for the jobshops operating characteristics.

2.6 DUE-DATE DETERMINATION

The ability of jobshop to attract new jobs depends on various factors, which include technical, financial and production elements. Akinyemi *et. al.* (2002) made it known that low prices are no longer the sole means of attracting customers, neither will services quality alone, no matter how high, but a combination of service quality and timelines of job attract new jobs. Weber *et. al.* (1991) and Choi and Hartley (1995) also highlighted the importance of meeting the due date and they all concluded that the firm's conformance to their promised due dates on prior job is a significant reputation which attract new customers.

In earlier works on jobshop scheduling, due date performance was usually measured by mean tardiness (Carroll, 1965 & Chang, 1985). On this measure of performance, Kutanoglu and Sabuncuoglu (1999) opined that the natural quantification of this qualitative goal (i.e. due date) involves the tardiness measure which is the positive lateness a job incurs if it completed after its due date. Other measures of performance for due dates are percentage of job tardy (Baker, 1984, Akinyemi *et. al.* 2002), variance of tardiness (Weeks and Fryer, 1976) and weighted tardiness cost (Vepsakinen and Morton, 1987). These criteria emphasised the

consequences of jobs completing late but ignore the consequences of job completing early. However, with recent interest in the Just-In-Time (JIT) approach, both earliness and tardiness penalties have been considered in some scheduling models (Baker and Scudder, 1990).

Most models developed by past researchers to predict due date for jobshops focused on two mutually, exclusive situations. The first situation is where the external customer set the due dates alone. The second situation is an internal one, where the firm sets the due dates exclusively without customer input. These two situations according to Chung and Cheng (1999) are respectively, regarded as situations in which due dates are given as problem parameters and in other case, as decision variables whose values are determined as part of the problem solution. These two situations actually exist in a real life context, but the first situation has been identified as one of the major factors that contribute to the failure of meeting the delivery date. (Wein and Chevalier, 1992).

There are have been numerous studies on the due date determination beginning with the method to estimate flowtime-prediction by Conway *et. al.* (1967) to the survey of work on scheduling, which involves due date assignment decisions, carried out by Cheng and Gupta (1989). Vig and Dooley (1991) considered various heuristics for due date assignment. These heuristics include Total Work Content (TWK), Number of Operation (NOP) and the Number of Jobs in the Queue (JIQ) to assign due dates, their findings show that both job characteristics and job status information are useful in setting due date based on expected flow time. Another comprehensive survey of work up to 1997 was carried out by Chung and Cheng (1999) in the area of analytical solution of the optimal due date assignment and scheduling. The work showed that, majority of the early work in this

regards focused on the static machine problem, in which the production system is assumed to be operating in a static and deterministic environment and that the system carries no workload at each scheduling epoch. Thus, the scheduling and due date assignment decisions are made for a set of simultaneously available jobs without considering the prevalent system workload status. Also in the work of Kutanoglu and Sabuncuoglu (1999), it was observed that the majority of the existing studies have been done in a uniform (or balance) environment (i.e. all machines are equally utilised). Unal *et. al.* (1997) developed a model which addressed the due date assignment issue in re-scheduling decision. The work considered the problem of re-scheduling a single machine in view of newly arrived jobs with part type dependent setup times and aimed to integrate those new jobs into an existing schedule to minimise disruption of the current schedule.

Chung and Cheng (1999) suggested an improved model based on this work. Chung and Cheng's model considered a due date determination model in a situation where the scheduler wishes to update the existing schedule when some new jobs have arrived in to the system, the model categorised jobs as either "old" or "new" jobs, where the due dates of the old jobs are treated as given parameters and those of the new jobs are decision variables.

On the issue of parameters or factors to be considered for predicting due date, Miyazaki (1981) estimated the flow time of a job based on total processing time for the job, number of operations for the job and mean queuing time operation. However, Cheng (1988) assigned the flow time of an arriving job to the sum of total processing time and an expected queuing time, which depends on the job's processing time and the number of jobs in those machines on the job's route when it enters the shop. The work of Enns (1993) identified four basic analytical models for flow time

determination. These models are; Static Constant Flow Time Prediction (SCON), Dynamic Constant Flowtime Prediction Model (DCON), Static Processing Plus Waiting Time Prediction Model (SPPW), Dynamic Processing Plus Waiting Time Prediction Model (DPPW). Among these four models, Enn's simulation showed that the DPPW provided the best results in terms of accurately predicting jobshop flow times. However, this model suffered a set back because it treated waiting time on an aggregate basis which implies that each machine has the same expected utilisation rate. This assumption is far from reality as this may provide unrealistically high estimates for jobs with few operations on relatively free machine. A far serious limitation on the four Enn's models is that the data require are excessive and rather confusing which may involve mathematical complexities that may render them inapplicable.

As indicated by the discussion above, completion time of a job in a jobshop can be affected by many different factors related to job characteristics and shop status, which is very difficult to predict accurately. Also, the level of influence of each factor on completion time of a job can depend on other characteristics of the production system such as the dispatching rules, shop utilisation rate and number of work centres. Chang (1994) developed a simple rule for due date determination in which the only variable that needs to be estimated to predict due date is queuing time of the system He.acknowledged the fact that, there are various factors that have significant effects on the queuing time of a job. Based on this, he developed a computer simulation model to represent a hypothetical dynamic jobshop, which was used to study the relative effects of some factors on queuing time of jobs under various production system characteristics, dispatching rules and shop utilisation rates. Chang finally concluded that to have an effective rule for due date determination, jobshop

production managers should develop rules based on the characteristics of their own production system and analyses of the historical production data to identify those factors that have significant effects on completion times of jobs in their own shops.

An empirical model to predict due date for jobshop, which based the determination of waiting time on a recently completed jobs, using job card to record the arrival, departure and processing time of all jobs and later used N-period moving average or exponential smoothing procedure to predict the waiting time for new jobs was developed by Akinnuli and Aderoba (2000). This model not only accommodated job characteristics, shop status and system characteristics but also considered external delays such as electricity disruption, raw materials shortage, equipment failure, labour problem etc. which are considered to be far more critical to due date determination, particularly in developing countries. It also prescribed a range of due dates to reflect the best and worst possible scenarios.

By considering all the aforementioned research work on due date determination, it shows that most models in used capture only one or two of the salient decisions that are in a real life context determines the waiting period of job in a dynamic jobshop. Akinnuli and Aderoba's model that indirectly accommodated more than one decision was based on pure statistical sampling of recently completed job, which was used to predict the waiting time for new jobs. This assumption is naïve at best, because each new job exhibits its own special characteristics and requirement which usually differ from previous jobs.

2.7 COST ESTIMATION

Cost estimation is a reasonable anticipates cost of executing a work, which according to George (1990) should not be optimistic nor pessimistic. Aderoba (1997a)

referred to it as the prediction of the cost of product before its actual manufacture, which if under estimated will result to loss for the company and if over-estimated will result to loss of contracts or customer's goodwill.

In order to have an estimate close to the actual cost as much as possible, Aderoba (1997a) opined that there is a need to employ suitable cost estimation method. This has to be performed by experienced engineers and technical cost specialists who will employ the knowledge and experience of production technology, methods analysis and engineering economics to predict the probable cost of product.

There are different types of approach to cost estimation as contained in the literature, such approaches include: Account Analysis Approach, Conference Approach, Quantitative Analysis of Past Cost Relationship, and Industrial Engineering Approach. Among these approaches, Account Analysis Approach which estimate cost function by classifying cost account in the ledger as variable, fixed or mixed with respect to the identified cost variables has been widely used (Mowen, 1986), however, researcher like Horngren *et al* (1997) opined that supplementing the Account Analysis Approach by the Conference Approach will improve it credibility. In the recent times Industrial Engineering Approach which estimates cost functions by analysing the relationship between inputs and outputs in physical terms had been given credence to either by combining it with other approaches or use it alone (Newbery *et.al.*,1988; Moodie and Bobrowsk,1999; Maggi, 2001 and Aderoba , 1997a).

As much as there are different approaches to cost estimation, also available in the literature are methods of estimation. These methods are; Tradition Cost Accounting (TCA), Direct Cost (DC), Activity- Based Costing (ABC) and Theory of Constrains (TOC). Among these methods ABC has been considered to be relevant

and suitable for product costing not only for manufacturing process but also in other areas such as retailing, profit making and non-profit making governmental institutions (Cooper and Kaplan, 1988a; Cooper and Kaplan, 1988b; Turney, 1989; Brimson, 1991 and Aderoba, 1997a)

In ABC analysis, costs are pooled based on activities involved and is a method in which the cost of a product equals the cost of all the activities required to produce it (Garrision and Noreen, 1994 and Aderoba, 1997a). It was gathered from earlier works that the benefits of this method include accurate product cost (Raffish, 1991; Cooper and Kaplan, 1988a). Usefulness of cost for decision making (Cooper and Kaplan, 1992), fairer apportionment of overhead costs, generation of more accurate information on product cost , provision of appropriate data for day-to-day managerial decisions (Zhuang and Burns, 1992) and provision for job classification as well as ability to incorporate judgmental decisions (Aderoba 1997a).

As useful as this method is, it has a problem of using non-relevant information for making managerial decision (Boyd and Cox, 2002) also Johnson (1992) questioned the validity of ABC for making decision. To address these flaws, Theory of Constrains (TOC) was suggested by Boyd and Cox (2002) but the situation considered for their comparison failed to accommodate multiple constraint situations, that is, it adopts a fixed routing condition. This condition makes it unreasonable to uphold their conclusion for jobshops operations, which are characterised with varying routings in terms of products, manufacturing processes, raw materials and manpower utilisation.

Considering the inability of most of the available cost estimation methods for effective application in jobshops environment, researchers have developed specific models to surmount the complexity of cost estimation in jobshop. Among these

researchers are Aderoba (1997a) and Lawal and Adebayo (2004). The model developed by Lawal and Adebayo was based on the application of Machine Hour Rate (MHR) for cost estimation of products in jobshop. The concept of MHR according to Aderoba (1995) is the total cost of using a machine in an hour. This includes all cost of elements such as the actual machine cost, floor space cost, operator wages, overhead rates, depreciation charges and maintenance charges. In using Lawal and Adebayo's model, the assumption that the capacity utilisation can be predetermined and stable limits its uses in a jobshop environment where utilisation of facilities is stochastic in nature.

Aderoba (1997a)'s model was based on ABC method. It classified the activities in jobshop into machine-based production, labour intensive production, technical service and administrative service. It also considered salient characteristics that usually exhibit by these activities in estimating the periodic rates. In estimating these periodic rates, factors like number of tools and equipment, labour efficiency factor, equipment efficiency factor were included. These inclusions resulted into a better cost estimation when compared with Lawal and Adebayo's model. However, the model considered costing as an independent decision in which the interactive effects of other salient strategic decisions were ignored. In literature, few attentions were paid to these interactive effects as observed by Moodie and Bobrowski (1999). Among the few researchers that have examined these interactive effects include Imtiaz (1990), Moodie and Bobrowski (1999), Fischer and Imtiaz (1992) and Cheng (1990). Moodie and Bobrowski (1999) considered the situation in which the negotiation involves trade-off between price and delivery date. The results from this work showed that to have an optimal decision for effective cost of production, the interactive effects of other strategic decisions could not be ignored.

2.8 JOBSHOP SCHEDULING

A schedule is a timetable for performing activities, utilising or allocating resources and facilities. Its objective in jobshops is to disaggregate the master production schedule into time-phased; weekly, daily, or hourly activities. Jobshop scheduling, one of the most difficult operations scheduling (Pirlot, 1992), has often been investigated but very few studies are concerned with uncertainty constraint. In real life situations, some unexpected events may occur or the processing time may vary, therefore, classical approaches relying on precise data are disrupted.

The most available literature dealing with jobshop scheduling assumes all the time parameters (e.g. processing times) to be known exactly. This assumption can cause difficulties in the application of schedule, most especially in jobshops where durations of manufacturing are often imprecise and this imprecision in data, according to Lawler *et.al.* (1982) is very critical for the scheduling procedures. Considering this situation, Fortemps (1994) developed a framework to solve and optimise jobshop scheduling problems with uncertainties. This approach relies on fuzzy numbers. Fuzzy numbers are quantities arising from the fuzzy-set theory of Zadeh (1965). They are useful to deal with imprecise data or probabilistic representation of values.

Jain and Meeran (1998) presented a comprehensive overview of jobshop scheduling techniques, which span over 40 years (1951 to 1998) the effort has not only led to an improvement in the understanding of jobshop problems but also highlighted techniques and benchmark instances with detailed structure of difficult problems. This historical trend of jobshop scheduling problem showed that the there is diverse opinion about who first proposed the jobshop scheduling in its current form. In literature it was found that Roy and Sussman (1964) were the first to propose the disjunctive graph representation and Balas (1969) was the first to apply an

enumerative approach based on the disjunctive graph. Nevertheless, there were still earlier documents in jobshop scheduling such as Giffler and Thompson (1960) which proposed a priority dispatch rule template. Akers and Friedman (1955)'s Boolean Algebra Approach, Johnson (1954)'s Flow-Shop Algorithm and Salvesen and Anderson (1951) on Industrial Production Scheduling form part of earlier work in production scheduling. The objective in all these works is to complete all the tasks as quickly as possible.

The major objectives of scheduling are make-span minimisation, net present value maximisation, quality maximisation and cost minimisation (Kolisch and Padman, 1997). Chase and Aquilano (1985) also submitted that most of the research in jobshop scheduling focused on priority rules to decide which job to do next. The work further added that jobshop scheduling could not be effective without priority control; capacity planning and shop floor control. This shows that the work has given credence to integration of other strategic decisions for effective scheduling in jobshops.

Various techniques or models were developed to solve the problems of jobshop scheduling which Jain and Meeran (1998) believed that no efficient algorithm could possibly solve. However, attempt was made by using meta-heuristics approach in solving jobshop problems by Lawler *et. al.* (1982), Tamaki and Nishikawa (1992), Dell'Amico and Trubian, (1993) and Branimarte (1993). It can be safely assumed that the work of Johnson (1954) on scheduling initiated an optimal algorithm method for solving the problems of scheduling and the most productive periods in the domains of Management Science and Operation Research was 1950s. During this time many problems were solved by the application of crude but effective heuristics which formed the basis of the development of classical scheduling theory today. During

1960s, emphasis was directed at finding exact solutions by the application of enumerative algorithms which adopted more elaborate and sophisticated mathematical constructs.

Although these strategies are of tremendous theoretical values providing significant research accomplishment but Hooker in his well-celebrated paper titled "*Testing Heuristics: We Have it all Wrong*" concluded that results from these techniques were below expectation (Hooker, 1995). Rinnooy Kan (1976) stated that a natural way to attack scheduling problems is to formulate them as mathematical programming models, however, the results from many of these works are extremely disappointing despite the mathematical complexities that involves. The majority of these techniques are unable to achieve feasible solutions to many problems and are therefore of limited practical use. Consequently they are only applied in the calculation of lower bounds. During the 1970s and until the mid 1980s the emphasis was placed on justifying the complexity. Numerous works spanning from Cook (1971) to Lawler *et al.*(1982) clearly highlighted the extreme intractability of jobshop scheduling problems demonstrating that only a very few special instances are solvable in polynomial time.

Local search techniques have made considerable progress in the last 20 years and have quickly reached a certain degree of maturity. Even though extensive computational analysis of these techniques has been performed, but due to the combinatorial nature of jobshop scheduling problems, these methods have extreme difficulty in effectively providing optimal solutions. This then suggests that suitable techniques for jobshop scheduling problems lie in other domains.

As proposed above that scheduling problems could be solved optimally using mathematical programming techniques and one of the most common forms of

mathematical formulation for jobshop scheduling problems was the mixed integer linear programming by Manne (1960) . French (1982) expressed the view that an integer programming formulation of scheduling problems is computationally infeasible. Nemhauser and Wolsey (1988) and Blazewicz *et. al.* (1996) also confirmed the view and further indicated that mathematical programming models have not yet achieved the breakthrough for scheduling problems and that these techniques are only able to solve highly simplified "toy" instances, within a reasonable amount of times. The results further indicated that these techniques suffered from excessive computational effort while the resulting solutions are usually of poor quality, with a large deviation from optimum, even when combined with other techniques and applied in the calculation of the lower bound, (like work of Fisher *et. al.* 1983, Applegate and Cook 1991), they have not performed well.

It is then evident that mathematical approaches are inadequate for jobshop scheduling problems. Consequently, the focus of enumerative approaches for the jobshop was shifted to branch and bound techniques (Brucker *et. al.*, 1994). Although branch and bound techniques were able to produce good solutions but the test bed of problems used in this analysis is just at the limit of the problems, which could be solved by these methods. Hence, none of these techniques can guarantee the solution to problem of higher dimensionality or complexity, as the technique usually suffers from memory overflow, even when incorporated with other techniques, results are also very disappointing (Jain and Meeran, 1998).

Despite the fact that there were numerous techniques for jobshop scheduling problems as revealed above, there is much debate concerning their application in the developing nations. Akinyemi *et. al.* (2002) considered the peculiarities of jobshop in the developing nations to schedule job against due dates using a single algebraic

sequencing rule, this work is similar to Balas *et. al.* (1998)'s work on jobshop scheduling with deadlines. Is not surprising that despite the Dagli and Sittisathanchai (1995)'s "*New Approach for jobshop scheduling*", several calls had been made for rigorous experimentation and controlled analysis on the Integrated Approach for jobshop scheduling problems (Chase and Aquilano, 1985; Mickay et. al., 1988; Jain and Meeran, 1998).

2.9 SHOP FLOOR CONTROL AND RECORD MANAGEMENT

Shop Floor Control is a management strategy that entails using adequate and proper records to monitor the progress of jobs and where necessary, expediting orders and/or adjusting system capacity to make sure that master schedule is met. According to American Production and Inventory Control Society (APICS,1984), Shop Floor Control was defined as a system for utilising data from the shop floor as well as data processing files to maintain and communicate status information on shop orders and work centres. The major functions of shop floor control as highlighted in APICS (1984) are:

i. assigning priority of each shop order.

ii. maintaining work-in-progress quantity information.

iii. conveying shop order status information to the office.

iv. providing actual output data for capacity control purposes.

v. providing quantity by location by shop order for WIP inventory and accounting purposes.

vi. providing measurement of efficiency, utilisation and productivity of manpower and machines.

The essence of any control is to compare between a laid down standard of a system with its current or final status, which may necessitate corrective or preventive,

measures. This task requires tools that will give information on the laid down standards as well as current status of such system. These tools can be in the form of records, cards or files. Various tools for optimal feedback controls in dynamic stochastic jobshops can be found in the work of Chase and Aquilano (1985) and Presman *et. al.* (1996).

2.10 EXISTING SOFTWARES FOR JOBSHOP

There are existing proprietary softwares that are available in developed countries including USA for solving jobshop's problems in the areas like inventory control, production control, job scheduling and costing (Shoptech Corp. 2008; AyaNova, 2008; and Exact Holding, 2008; Linkit, 2008; and DBA, 2008)). Many of these softwares are not readily available in developing countries such as Nigeria, besides this, their prices, ranging from $2,500 (about ₦ 300,000) to $5,000 (about ₦ 600,000), are very high to purchase by small-scale shops of the developing countries due to their low incomes. Therefore there is need to develop a local software that will be robust and versatile enough to solve the problems of jobshops in the developing countries at a minimum possible cost.

2.11 DISTINGUISHING FEATURES OF THE CURRENT STUDY

In this work the literature on production planning and control in jobshops is reviewed. This has not only led to an understanding of multidimensional problems of jobshops but also established the fact raised by Jain (1998) that within the domain of constraint optimisation problems, jobshop problems remain a prime challenge that will continue to stimulate research interest because what goes on in jobshops has only been studied in an isolated approach. Because of this, this study supports the opinion of Mickay et. al. (1988) that there is the need to focus on hybrid or integrated models to solve the jobshop problems as a single technique or model has failed to solve the

problems. Chase and Aquilano (1985) also submitted that most of the research in jobshop scheduling focused on priority rules to decide which job to do next. The work further added that jobshop scheduling could not be effective without priority control; capacity planning and shop floor control. This shows that the work has also given credence to integration of various strategic decisions for effective scheduling in jobshops. Also the software provided to solve jobshop problems in literature are deficient in the area of integration and optimisation which the present study has taken care of.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 FORMULATION OF MODELS

In this chapter, mathematical models were formulated for strategic decisions that are pertinent in effective production planning and control in jobshops using various quantitative techniques and modification of some relevant models. The strategic decisions considered include; demand management, cost estimation, manpower planning, tools and equipment planning, material requirement planning, due date determination, job scheduling and shop floor control and record management.

The models developed were integrated using heuristic approaches to provide hybrid models for solving the difficult problems of jobshops. Procedures for the development of computer software for rapid implementation of the hybrid model were also discussed in this chapter.

3.2 DEMAND MANAGEMENT MODEL

Demand Management according to Vollmann, *et. al.* (1997) is a process that includes forecasting which takes place before, during and after the operation planning. There are various methods of forecasting which can be broadly classified into:

(i) Qualitative Techniques

(ii) Time series Analysis

(iii) Casual Relationships and

(iv) Simulation.

(i). **Quantitative Techniques**: These forecasting techniques are subjective and judgmental in nature, which based on estimates and opinions of stakeholders.

These techniques include; Delphi method, Market Survey, Panel Consensus, Historical analogy and grass root input.

(ii). **Time Series Analysis:** This method is based on the idea that data relating to past demand could be used to predict future demand. Examples of this type include simple moving average, weighted moving average, exponential smoothing, regression analysis, Box Jenkins technique, and Shiskin Time Series.

(iii). **Casual Forecasting Technique**: This approach assumes that demand is related to some underlying factor or factors in the environment. Examples of this technique includes; regression analysis, econometric model, leading indicators etc.

(iv). **Simulation models**: These methods allow the forecaster to run through a range of assumptions about the condition of the forecast.

From the work of Wybark (1973), Makridakis *et. al.* (1982) and Aderoba (2000) on the best forecasting method that could be used in jobshop, considering its peculiarities, exponential smoothing technique was singled out.

In using exponential smoothing technique, only three pieces of data are needed. These are; the most recent forecast, the actual demand that occurred for that forecast period and a smoothing constant (α). This smoothing constant (ranges between 0 and 1) determines the level of smoothing and the speed of reaction to differences between forecasts and actual occurrences. The value for this constant is arbitrary and is determined both by the nature of the product and the feelings of the managers as to what constitute a good response rate (Chase and Aquilano, 1985). These features fit the situation in jobshop where there is scanty record for the previous

jobs as well as the need for manager to use his initiative to determine the nature of each job which hardly similar to others.

Not only that exponential smoothing technique is simple in formulation and application, it has also been rated as the best that gives accurate and optimal results for jobshops by Kareem (2004).

3.2.1 Development of Demand Management Model

The forecast for activity i in period t could be written as:

$$D^f_{jt} = D^f_{jt-1} + \alpha_{it} (D^a_{jt-1} - D^f_{jt-1}) \quad \text{.....3.1}$$

Source: Chase and Aquilano (1985)

Where: D^f_{jt} = Forecast hour of demand expected in activity centre j in period t

D^f_{jt-1} = previous forecast hour of demand in activity centre j in period t-l

D^a_{jt-1} = actual hour of demand in activity centre j in period t -l

α_{jt} =smoothing constant for activity centre j to be used in period t.

This equation states that the new forecast is equal to the old forecast plus a portion of the error (Error is the difference between the previous forecast and what actually occurred). If forecast is to be done where no previous forecast (D^f_{jt-1}) exist, a starting forecast can be made by using an average of actual demand of the preceding periods over the first n periods, where n could be:

$$n = \frac{2}{\alpha} - 1 \quad \text{(round n to the nearest integer).....3.2}$$

therefore

$$D^f_{jt-1} = \frac{\sum_{n=1}^{n} D^a_{jn}}{n} \quad \text{.....3.3}$$

where D^a_{jn}= actual demand of activity j in period n

3.2.2 Optimal value for Demand Management Model

The optimal forecast value is the one that has minimum forecast error (E). Forecast error can be written as

$$E_{jt} = \left| D^a_{jt} - D^f_{jt} \right| \text{ ----------, 3.4}$$

Where:

E_{jt} = Error in forecast for activity centre j in period t

D^a_{jt} = Actual demand for activity centre j in period t and

D^f_{jt} = Forecast demand for activity centre j in period t

Forecast errors provide a measure of accuracy and a basis for comparing the performance of different forecast models or using different values for parameters. The most commonly used measures of error are:

i. Average Error (AE)

ii. Mean Absolute Deviation (MAD)

iii. Mean Squared Error (MSE)

Among these, three measures, Mean Absolute Deviation (MAD) has been considered the most valuable because of its simplicity and usefulness in obtaining tracking signals. It also measures the dispersion of some observed values from expected values (Chase and Aquilano, 1985). In view of the above, in choosing the most appropriate value for α, Mean Absolute Deviation, would be used to compare the errors resulted from various values of α and then select the best value of α which gives the least MAD. This value can then be used to get the optimal forecast value. Mathematically, optimal forecast for period t can then be written as

$$^{*}D^{f}_{jt} = D^{f}_{jt-1} + \alpha^{*}_{jt} (D^{a}_{jt-1} - D^{f}_{jt-1}) \text{..... 3.5}$$

Where:

α^*_n = the best value of α that gives the least value of MAD.

MAD can be calculated using equation 3.6

$$\text{MAD} = \frac{\sum_{t=1}^{n} |E_n|}{n} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.6$$

3.3 COST ESTIMATION MODEL

One of the major objectives of production planning and control in jobshops is to determine a profitable and satisfactory cost of production. This has to be properly done before the acceptance of any job most especially in jobshop where its economic environment is characterised by hard price bargaining between the prospective customer and the shop manager, in which a shop manager with a weak bargaining strength can succumb to a non-profitable price offer in the absence of a realistic cost estimation model.

Formulation of a realistic model to predict cost of production in a jobshop must as a matter of necessity account for its intrinsic characteristics by allowing for usage of judgmental decision and job prediction based on the current shop status and past performance records.

Mathematically, using Activity Based Costing (ABC) system, the minimum cost of production could be expressed as shown in equation 3.7

$$\text{Min } CP_i = \sum_{j=1}^{J} C_{ij} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.7$$

Where:

CP_i = minimum cost of producing job i

C_{ij} = cost of producing job i in activity centre j.

Using ABC system, this model considered job i to pass through one or more activity centres before its completion. These activity centres are denoted by $j^1, j^2 \ldots J$,

where J is the last activity centre which the job has to pass through in a pre-determined schedule that will give an optimal due date.

Cost of producing job i in each activity centre j (C_{ij}) will of necessity be made up of different cost elements, such as; cost of using equipments, factory utility and floor space, engaging manpower and inventory cost, The summation of these costs is expressed in equation 3.8

$$C_{ij} = c_{ij}^{e} t_{ij}^{e} + c_{ij}^{m} t_{ij}^{m} + c_{ij}^{h} t_{ij}^{h} + c_{ij}^{u} t_{ij}^{u} + c_{ij}^{a} t_{ij}^{b} + c_{ijk}^{r} L_{ijk} \quad \text{..... 3.8}$$

Where:

c_{ij}^{e} = cost rate of using the equipments in activity centre j for job i

c_{ij}^{m} = cost rate of manpower in activity centre j used for job i

c_{ij}^{h} = cost rate of building space in activity centre j where job i is under process

c_{ij}^{u} = cost rate of using the utilities in activity centre j for job i

c_{ij}^{a} = cost rate allotted to activity centre j for the services rendered by technical/administrative staff

c_{ijk}^{r} = cost rate of inventory k consumed in activity centre j by job i

t_{ij}^{e} = time spent by job i on equipment in activity centre j

t_{ij}^{m} = time spent by manpower on job i in activity centre j

t_{ij}^{h} = time spent by job i in activity centre j

t_{ij}^{u} = time of using the utilities in activity centre j by job i

L^{l}_{ijk} = length /area/volume of inventory k used by job i in activity centre j

The variables to determine the cost of producing job i in activity centre j as shown in equation 3.8, could be categorised into; cost rates ($c^{e}_{ij}, c^{m}_{ij}, c^{h}_{ij}, c^{s}_{ij}, c^{a}_{ij}$ and c^{v}_{ijk}), processing times ($t^{e}_{ij}, t^{m}_{ij}, t^{h}_{ij}$ and t^{n}_{ij}) and inventory quantity L^{l}_{ijk}. The estimation of cost rates are discussed in section 3.3.1, while the estimation of processing times and inventory quantity are discussed in sections of Due date determination and Material Requirement Planning Model respectively.

3.3.1 Estimation of Cost Elements

i. **Equipment cost rate** (c^{e}_{ij}): This rate gives the amount for using an equipment in an hour, is estimation is as shown in equation 3.9

$$c^{e}_{ij} = \frac{C^{*e}_{jt}}{D^{f}_{jt}} \quad \ldots\ldots\ldots\ldots\ldots\ldots 3.9$$

where:

C^{*e}_{jt} = Optimal total cost to be spent on all the equipments in centre j in period t is determined using ***Tools and Equipment Planning Model*** developed in section 3.5.

D^{f}_{jt} = Forecast hour of demand expected in activity centre j in period t (as pre-determined in ***Demand Management Model*** in section 3.2)

ii. **Manpower cost rate** (c^{m}_{ij}): This is an hour rate of engaging manpower in activity centre j, is estimated from the total optimal cost of manpower for centre j. This is shown in equation 3.10

$$c_{ij}^{m} = \frac{C_{jt}^{*m}}{\Psi_{jt}^{m} D_{jt}^{f}} \quad \ldots\ldots\ldots\ldots\ldots\ldots 3.10$$

Where:

C_{jt}^{*m} = Optimal total cost required for manpower in centre j in period t. This is determined using ***Manpower Planning Model*** developed in section 3.4

Ψ_{jt}^{m} = Manpower efficiency factor at activity centre j in period t (its determination is discussed in section 3.9.2(i))

D_{jt}^{f} = Forecast hour of demand expected in activity centre j in period t (as pre-determined in ***Demand Management Model*** in section 3.2)

iii. **Cost rate for factory floor space (c_{ij}^{b}):** This amount is allotted for using the factory floor space where centre j is located. This could be estimated as shown in equation 3.11

$$c_{ij}^{b} = \frac{\beta_{t}^{b} a_{j} B H_{t}}{A H^{b} D_{jt}^{f}} \quad \ldots\ldots\ldots\ldots\ldots\ldots 3.11$$

and

Where,

a_j = Floor space area occupied by activity centre j

A = Total floor space of the factory building

B = The cost for constructing the factory building

H_t = Total activity hours available in period t

H^b = Expected life span of the factory building in hours

D_{jt}^{f} = Forecast hour of demand expected in activity centre j in period t (as pre-determined in ***Demand Management Model*** in section 3.2)

β_t^b = Building maintenance factor for period t (see section 3.9.2 (ii))

iv. **Utility cost rate** (c_{ij}^{u}): Cost of electricity, water, compressed air etc could be regarded as utility costs while levies by governments (excluding company taxes), insurance, bank charges and cost of stationeries can be regarded as general cost. The utility and general rates can be apportioned to the various activity centres using proportionate areas being only measurable cost determinant of the floor space occupied by the factory facilities. This rate gives the amount for using an equipment in an hour, is estimation is as shown in Equation 3.12

$$c_{ij}^{u} = \frac{a_j U_t}{A D_{jt}^{f}} \quad \ldots\ldots\ldots\ldots\ldots\ldots 3.12$$

where:

a_j = Floor space area occupied by activity centre j

A = Total floor space of the building

U_t = Total amount spent on utilities in period t by the company

D_{jt}^{f} = Forecast hour of demand expected in activity centre j in period t (as pre-determined in ***Demand Management Model*** in section 3.2)

Since U_t could not be known as at the time of planning, an estimated value might be used based on the previous amount spent on utilities. This estimation could be done using moving average of the past amount.

v. **Technical /administrative services cost (c_{ij}^{a}):** - This cost caters for the services like design and drafting, technical supervision and inspection, repairs and maintenance, purchasing, security services, transportation services, marketing, clerical unit and other administrative units. The cost for these services could be apportioned to the various activity centres using proportionate areas which was taken to be only measurable cost determinant. It is expressed as shown in equation 3.13

$$c_{ij}^{a} = \frac{a_j Q_t}{AD_{ij}^{J}} \quad \text{..... 3.13}$$

Where:

c_{ij}^{a} = Cost rate allotted to activity centre j for the services rendered by technical/administrative staff in the company

a_j = Floor space area occupied by activity centre j

A = Total floor space of the building

Q_t = Total amount spent on manpower involved in Technical/Administrative services in period t. by the company

D_{jt}^{f} = Forecast hour of demand expected in activity centre j in period t (as pre-determined in ***Demand Management Model*** in section 3.2)

vi. **Inventory cost rate** (c_{ijk}^{r}): This rate gives the amount for using a unit of inventory k by job i at centre j. This is expressed in equation 3.14

$$c_{ijk}^{r} = \frac{C_{kt}^{*r}}{D_{kt}^{f}} \quad \ldots\ldots\ldots\ldots\ldots\ldots 3.14$$

C_{kt}^{*r} = Optimal total cost to be spent on inventory k in period (This value is determined in section 3.6, Material Requirement Planning Model)

D_{kt}^{f} = Forecast hour of demand expected in activity centre j in period t (as pre-determined in ***Demand Management Model*** in section 3.2)

3.4 MANPOWER PLANNING MODEL

Consequence of inappropriate manpower planning and its control on any organisation is very significant in terms of cost because manpower represents a large component of total operation costs of any firm (Abernathy *et.al*, 1973). The purpose of this section is to develop a manpower planning model that will incorporate control strategies to determine an appropriate level of regular and part time manpower need for a jobshop. It will also put in place an efficient device to control the excess and shortage of labour-hours when available in any of the activity centre in jobshop.

The model developed in this study is a modification of Aderoba (2000)'s model on manpower planning for new jobshops. The model was developed based on the following salient decisions:

Decision I: How many permanent workers to maintain at any period t.

Decision II: How many overtime workers to be engaged at any period t

Decision III: How to effectively utilise idle time associated with excess full time.

Decision III according to Aderoba (2000) is a technological decision that may be made to fill up idle time be either introducing buffer production during idle time or by laying off full time workers which the model prohibited. However, the model failed to make any provision for the usage of idle time which is associated with excess full time labour whereas, idle-time in jobshop, most especially in developing countries, is significant because their job is characterised with peculiarity of having some centres with excess work hour while others may have shortage work hour (Adam and Ebert, 1993)

The present model, thereby considered the usage of idle time by transferring the excess labour-hour from a centre where it occurs to a centre with shortage labour-hour, considering the technological inter-relationship among these centres. The model also allowed for integration of Demand Management Model to forecast for a realistic demand for each activity centre and also incorporates job and manpower scheduling into the model.

Based on these modifications, the study has presented a model with 3-level formulation of strategy to the problem of manpower planning and control in jobshops. These strategies are:

i. Determination of optimum permanent workers to maintain at any period t.

ii. Internal transfer of labour-hour from centre(s) with excess labour-hour to the centre(s) with shortage labour- hour considering the technological inter-relationship.

iii. Engagement of part time labour where necessary.

3.4.1 Determination of Optimal Manpower Cost

The objective of manpower planning is to minimise the total manpower cost of meeting all orders within the specified period. Manpower cost has been identified to represent a large component of total working capital in jobshops (Idris, 2002). Based on this, effective planning and control of manpower that will reduce overall production cost is necessary in achieving the objectives of production planning and control.

3.4.2 Objective Function

The objective function is to minimise the total cost of manpower in centre j in period t. This is expressed mathematically as:

$$\text{Min } C^{*w}_{jt} =$$

$$W_{jt} M_{j,t-1} + \Omega^{v}_{jt}\left(W^{v}_{jt} M^{v}_{jt}\right) + \Omega^{l}_{jt}\left(W^{l}_{jt}(D^{l}_{jt} - D^{l}_{j,t-1})\right) + \Omega^{p}_{jt}\left(W^{p}_{jt}(D^{l}_{jt} - D^{l}_{j,t-1})\right) \quad \text{.....3.15}$$

Where:

W_{jt} = Wages and salaries paid to each of the existing staff in activity centre j in period t

W^{v}_{jt} = Wages and salaries paid to each of the newly employed staff in activity centre j in period t

W^{l}_{jt} = Cost incurred for temporarily transferred manpower to activity centre j in period t

W^{p}_{jt} = Wages and salaries paid to the part time staff engaged in activity centre j in period t

M_{jt-1} = No of the existing staff in centre j in period t-1 that would be catered for in period t

M_{jt}^{+} = No of the newly employed staff in centre j in period t

D_{jt}^{f} = Forecast hour of demand expected in activity centre j in period t (as pre-determined in ***Demand Management Model*** in section 3.2)

D_{jt-1}^{f} = Forecast hour of demand in activity centre j in period t-1

Ω_{jt}^{r} = Factor to determine the fraction of new manpower to be recruited in activity centre j in period t

$\Omega_{jt}^{r'}$ = Factor to determine the fraction of manpower-hour to be transferred to activity centre j in period t

Ω_{jt}^{p} = Factor to determine the fraction of manpower-hour to be engaged on part time basis in activity centre j in period t

S_{jt} = Total salary and wages paid to the manpower in activity centre j in period t

H_{jt} = Total working hour of manpower in activity centre j in period t

3.4.3 Constraints and Relaxations

For the implementation of the model, the following constraints and relaxations are to be observed:

1. If $D_{jt}^{f} \geq D_{jt-1}^{f}$ then

$$\Omega_{jt}^{r} + \Omega_{jt}^{r'} + \Omega_{jt}^{p} = 1 \qquad \text{.....3.16}$$

Otherwise

$$\Omega_{jt}^{r} = \Omega_{jt}^{r'} = \Omega_{jt}^{p} = 0 \qquad \text{.....3.17}$$

2. Optimum value of C^{*n}_{μ} can be determined by varying the values of Ω^{v}_{μ}, Ω^{t}_{μ} and Ω^{p}_{μ}

3. Number of manpower (M_{μ}) to be engaged in activity centre j in period t is determined using equation 3.18

$$M_{\mu} \geq \frac{D^{t}_{\mu-1} + \theta_{\mu}(D^{t}_{\mu} - D^{t}_{\mu-1})}{H_{\mu}} \qquad \ldots\ldots\ldots\ldots\ldots 3.18$$

M_{μ} must be rounded up to the nearest integer no

Where

$$\theta_{\mu} = 1, \text{ if } D^{t}_{\mu} \geq D^{t}_{\mu-1} \qquad \ldots\ldots\ldots\ldots\ldots 3.19$$

$$= 0, \text{ if otherwise}$$

4. The existing manpower should not be retrenched during the planning horizon i.e.

$$M_{\mu-1} \leq M_{\mu} - I_{\mu} \text{ for all j, t} \qquad \ldots\ldots\ldots\ldots\ldots 3.20$$

Where

5. I_{μ} is the voluntary attrition by workers. That is, the growth of workers should be monotonically increasing during the planning period.

6. $$W_{\mu} = \frac{S_{\mu}}{M_{\mu}} \qquad \ldots\ldots\ldots\ldots\ldots 3.21$$

7. Part-time labour can only be engaged if there is no excess labour hour that can be transferred from another centers, i.e. $\Omega^{p}_{\mu} = 1$ if $\Omega^{t}_{\mu} = 0$ ……3.22

3.5 TOOLS AND EQUIPMENT PLANNING MODEL

Availability of tools/equipment in term of type and quantity is an essential input to achieve the objectives of production planning and control of any firm.

Tool/equipment planning starts with the determination of capacity required and the knowledge of available capacity for each operation that makes up the production system. Earlier works on tools/equipment planning like that of Shubin and Madeheim (1975) has derived a formula which established numbers of tools/equipment required for any particular operation by dividing the capacity required for such operation by the available capacity.

In a jobshop, capacity required is stochastic, thereby a model that will be suitable in this situation must of necessity include a strategy that will forecast for a realistic capacity requirement and at the same time provides an effective control measure that will cater for the excess / insufficient capacity as a result of un-deterministic nature of demands in jobshops.

3.5.1 Determination of Optimal Tools / Equipment Requirement

The objective of tool/equipment planning is to minimise the total cost expended on the purchase and maintenance of tools/equipment that are needed for the smooth running of a production system within a specified period.

To achieve this objective, the model proposed in this study has the following features:

i. a realistic and optimum strategy to determine the required capacity-hour for each operation in period t.

ii. a measure that will control the imbalance that might arise between the forecast and the existing capacity.

The first feature would be achieved by integrating the Demand Management Model of Equation 3.5 into the model while the second feature, which is of control in nature, would be achieved through the combination of two or more of the following

conditions to cater for the shortage between the existing capacity and the required capacity:

i. using the equipment above the normal period i.e. an overtime usage.

ii. hire equipment

iii. contract out part of the job or

iv. purchase the needed equipment to carter for the shortage in capacity required.

3.5.2 Objective Function

The objective function is to minimise the total cost of tools and equipment needed to meet the expected orders within a specified period .This can be expressed mathematically as:

Min C^{*}_{jt}:

$$K_{jt-1}E_{jt-1} + \Pi^{p}_{jt}K^{p}_{jt}E^{p}_{jt} + \Pi^{c}_{jt}K^{c}_{jt}\left(D^{f}_{jt} - D^{f}_{jt-1}\right) + \Pi^{o}_{jt}K^{o}_{jt}\left(D^{f}_{jt} - D^{f}_{jt-1}\right) + \Pi^{b}_{jt}K^{b}_{jt}\left(D^{f}_{jt} - D^{f}_{jt-1}\right) \quad \text{..... 3.23}$$

Where:

E_{jt-1} = No of available equipment in activity centre j in period t-1

E^{p}_{jt} = No of equipment in activity centre j to be acquired in period t

K_{jt-1} = Cost of purchasing and maintaining the existing equipment in activity centre j in period t-1

K^{p}_{jt} = Cost of purchasing and maintaining new equipment in activity centre j in period t

K^{c}_{jt} = Cost of contracting out the activity to be performed by equipment *i* in period t/hr

K_{jt}^{o} = Cost of overtime engagement of equipment in activity centre j in period t/hr

K_{jt}^{b} = Cost of borrowing equipment needed in activity centre j in period t/hr

K_{nj}^{i} = Initial cost of purchasing equipment n

D_{jt}^{f} = Forecast hour of demand expected in activity centre j in period t (as pre-determined in ***Demand Management Model*** in section 3.2)

D_{jt-1}^{f} = Forecast hour of demand in activity centre j in period t-1

Π_{jt}^{n} = Factor to determine the fraction of new equipment to be purchased in activity centre j in period t

Π_{jt}^{c} = Factor to determine the fraction of equipment-hour of centre j in period t to be contracted out

Π_{jt}^{o} = Factor to determine the fraction of equipment-hour of centre j in period t to be executed using overtime engagement

Π_{jt}^{b} = Factor to determine the fraction of equipment of centre j in period t to be borrowed

H_{jt} = Usage hours of equipment in activity centre j in period t

I_{nj} = Installation cost of equipment n

Y_{n} = Expected life span of equipment n (in hours)

δ_{jt}^{v} = Machine maintenance factor

3.5.3 Constraints and Relaxations

For the implementation of this model, the following constraints and relaxations are to be observed

1 If $D_{\mu}^{f} \geq D_{\mu-1}^{f}$ Then

$$\Pi_{\mu}^{p} + \Pi_{\mu}^{r} + \Pi_{\mu}^{o} + \Pi_{\mu}^{h} = 1 \qquad \text{.....3.24}$$

Otherwise

$$\Pi_{\mu}^{p} = \Pi_{\mu}^{r} = \Pi_{\mu}^{o} = \Pi_{\mu}^{h} = 0 \qquad \text{.....3.25}$$

2 Optimum value of C_{μ}^{*r} can be determined by varying the values of $\Pi_{\mu}^{p}, \Pi_{\mu}^{r}, \Pi_{\mu}^{o}$ *and* Π_{μ}^{h}

3 Number of equipment (E_{μ}) to be made available in activity centre j in period t is determine using Equation 3.26

$$E_{\mu} \geq \frac{D_{\mu-1}^{f} + \lambda_{\mu}(D_{\mu}^{f} - D_{\mu-1}^{f})}{H_{\mu}} \qquad \text{.....3.26}$$

E_{μ} must be rounded up to the nearest integer no

Where:

$$\lambda_{\mu} = 1, \text{ if } D_{\mu}^{f} \geq D_{\mu-1}^{f} \qquad \text{.....3.27}$$

$$= 0, \text{ if otherwise} \qquad \text{.....3.28}$$

4 $$K_{\mu-1} = \delta_{\mu}^{r} \sum_{n=1}^{E_{\mu}} \left[\frac{K_{n}^{1} + I_{n}}{Y_{n} E_{\mu-1}} \right] \quad \text{and} \qquad \text{.....3.29}$$

5 $$K_{\mu}^{p} = \delta_{\mu}^{r} \sum_{n=1}^{E_{\mu}^{p}} \left[\frac{K_{n}^{1} + I_{n}}{Y_{n} E_{\mu}^{p}} \right] \qquad \text{.....3.30}$$

δ_{μ}^{r} = Machine maintenance factor (its determination is discussed in section 3.9.2(iii))

3.6 MATERIAL REQUIREMENT PLANNING MODEL

Material Requirement Planning is one of the strategic decisions that need to be made by the production manager in order to have a successful production system. Material Requirement refers to the determination of the type of material or inventory needed and the specific point (R) at which an order would be placed for such material and also the economic size of that material (Q) to be ordered. According to Chase and Aquilano (1985) MRP provides the organisational structure and the operating polices for maintaining and controlling goods to be stocked. It also responsible for ordering and receipt of goods, timing the order placement and keeping track of what has been ordered, how much, (when) and from whom.

In making any decision that will affect the size of material required the following costs must be considered:

i. Holding (or carrying) costs

ii. Set up (or production) costs

iii. Ordering costs and

iv. Shortage costs.

The correct quantity to order and when to order involves a search for the minimum total cost (TC) resulting from the combined effects of holding costs, set up costs and shortage costs. This, according to Chase and Aquilano (1985) is traditionally viewed as one of the essences of Material Requirement Planning (or inventory planning) which could be determined by using mathematical models.

There are two general types of inventory model. These are

(i) **Fixed order quantity models:** Fixed order quantity is event triggered that is, an order initiated when the inventory reached a specified reorder level

(ii) **Fixed- period quantity**: Fixed-period model is limited to placing orders at the end of a predetermined time period

This later model is more applicable where demand for inventory is known and consumed at uniform rate. Considering the stochastic nature of demand in jobshop, researchers like Orlicky (1975) and Aderoba *et. al.* (2003) have recommended EOQ for material/inventory requirement planning.

The basic EOQ model for material/inventory management is derived from the sum of costs that involve in acquiring the material. This is referred to as Total Cost (TC).

$$TC = DC + \left[\frac{D}{Q}\right] S + \left[\frac{Q}{2}\right] H \qquad \text{.....3.31}$$

Where,

TC = Total Cost

D = Demand of material

C = Cost per unit

Q = Quantity to be ordered

S = Set up cost or cost of placing order

H= Holding (or carrying) costs

The optimum or Economic Order Quantity derived from equation 3.22 using derivative principle is

$$Q^* = \sqrt{\frac{2DS}{H}} \qquad \text{.....3.32}$$

And Reorder point is calculated using

$$R = dL \qquad \text{.....3.33}$$

Where:

R = Reorder point

d = average daily demand

L =Lead time in days (i.e. time between placing an order and receiving the items)

3.6.1 Development of Material Requirement Planning Model

Due to jobshop peculiarities, among which Aderoba *et. al* (2003) highlighted as stochastic demand for material , limited capital to purchase the needed material and limited storage facility etc, Equation 3.32 and 3.33 need to be modified in order to have an optimal result as applicable to jobshops. This was achieved using Aderoba et al (2003)'s model as basis.

3.6.2 Objective Function

The objective is to minimise the total cost of inventory at any planning period t. This is expressed as

Min $C_{kt}^{*r} =$

$$\mu_{kt}^{c}\left\{(D_{kt-1}^{f}-D_{kt-1}^{a})P_{kt-1}+(D_{kt-1}^{f}-D_{kt-1}^{a}-D_{kt}^{f})P_{kt}+\left\{2(D_{kt-1}^{f}-D_{kt-1}^{a})-D_{kt}^{f}\right\}P_{kt}^{h}\right)$$
$$+\mu_{kt}^{cr}\left\{(D_{kt-1}^{f}-D_{kt-1}^{a})P_{kt-1}+(D_{kt-1}^{f}-D_{kt-1}^{a})P_{kt}^{h}\right)$$
$$+\mu_{kt}^{nr}(P_{kt}+P_{kt}^{s}+0.5P_{kt}^{h})D_{kt}^{f} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad 3.34$$

Where:

C_{kt}^{*r} = Optimal cost of inventorying material k in period t

P_{kt-1} = Unit price of material k at period t-1

P_{kt} = Unit price of material k at period t

P_{kt}^{h} = Holding cost of material k at period t

P_{kt}^{s} = Set up cost of material k at period t

D_{kt-1}^{f} = Forecast quantity of material k predicted to be used in period t -1

D^a_{kt-1} = Actual quantity of material k used in period t-1

D^f_{kt} = Forecast quantity of material k expected in period t (as pre-determined using ***Demand Management Model*** in section 3.2)

R_{kt} = Re order point for quantity k in period t

3.6.3 Constraints and Relaxations

For the implementation of this model, the following constraints and relaxations are to be observed

1 If $D^f_{kt-1} - D^a_{kt-1} > 0$ and $D^f_{kt} > (D^f_{kt-1} - D^a_{kt-1})$ then

$$\mu^r_{kt} = 1 \text{ and } \mu^{re}_{kt} = \mu^{re}_{kt} = 0 \text{ and} \quad \text{.....3.35}$$

If $D^f_{kt-1} - D^a_{kt-1} > 0$ and $D^f_{kt} < (D^f_{kt-1} - D^a_{kt-1})$ then

$$\mu^{re}_{kt} = 1 \text{ and } \mu^r_{kt} = \mu^{re}_{kt} = 0 \text{ but} \quad \text{.....3.36}$$

If $D^f_{kt-1} - D^a_{kt-1} \leq 0$ then

$$\mu^{re}_{kt} = 1 \text{and } \mu^r_{kt} = \mu^{re}_{kt} = 0 \quad \text{.....3.37}$$

2 If $D^f_{kt-1} - D^a_{kt-1} > 0$ and $D^f_{kt} > (D^f_{kt-1} - D^a_{kt-1})$ then

$$R_{kt} = D^f_{kt} - (D^f_{kt-1} - D^a_{kt-1}) \quad \text{.....3.38}$$

If $D^f_{kt-1} - D^a_{kt-1} > 0$ and $D^f_{kt} < (D^f_{kt-1} - D^a_{kt-1})$ then

$$R_{kt} = 0 \quad \text{.....3.39}$$

3 Order should be done at the beginning of the period

4 For effective implementation of the above model regular record should be kept using Stock Record Card designed in 3.9.1 (iii).

3.7 DUE DATE DETERMINATION MODEL

Due Date determination (DD) or completion time is one of the strategic decisions that can make or mar company's image. Accurate prediction of completion

date in jobshop environment is a difficult task because of its unpredictable job characteristics, which according to Cheng (1994) greatly affects the production planning thereby, makes the estimation of job delivery date a difficult.

In this section attempt is made to estimate an optimal due date for jobshops and also determine other time durations that are necessary for cost estimation as discussed in section 3.2

3.7.1 Estimation of Optimal Due Date (DD)

The objective of this study is to develop a model that will predict an optimal due date for jobshop with the integration of other strategic decisions that are salient to overall planning and control in jobshop. Basically, Due Date (DD) is expressed mathematically as

$$DD_i = r_i + t_i^r + q_i \qquad \text{.....3.40}$$

Where:

DD_i = Due date for job i (i.e completion date of job i)

r_i = the arrival time of job i

t_i^r = total processing time on machine for job i

q_i = queuing or waiting time in the system for job i

In equation 3.40, the value of r_i (that is, the arrival time of job i) would be known after the arrival of the job, however, the total processing time for job i and its waiting time are to be estimated at the time of its arrival. Estimation of these times could be estimated by employing suitable time standards and or by data internally generated through time and motion studies or by judgmental decision-making. Considering the peculiarities of jobshop this study has adopted judgmental decision for processing time while data internally generated through time and motion studies

was used for the waiting time, however, where there is no such data, judgmental decision would be used. These estimations are discussed in section 3.7.2

3.7.2 Estimation of Total Processing Time

Total Processing Time is an aggregate of an individual time spent for production process in each activity centre which could be of machine-activity or manpower-activity. The estimation of these are hereby discussed

(i) ***Processing time for job on machine at activity centre:*** - This time can be estimated using PERT Time Estimate, which uses three time estimates to account for uncertainties in activity durations. The three estimates are:

i. optimistic time (a)

ii. most likely time (m) and

iii. pessimistic time (b)

It is assumed that durations of project activities follow β-distribution curve therefore the estimate of processing time for job i on machine at activity centre j, is:

$$t_{ij}^{e} = \frac{a + 4m + b}{6} \qquad \text{.....3.41}$$

The estimate of optimistic, most likely and pessimistic times could be from the main operator or the immediate technical supervisor. Their estimates, which are judgmental decision, are based on their knowledge and experience of manufacturing processes.

The total processing time of job i (t_i^e), on machines will then be

$$t_i^e = \sum_{j=1}^{J} t_{ij}^{e} \qquad \text{.....3.42}$$

Where:

t_{ij}' = processing time of job i on machine at activity centre j

J = the last activity centre visited by job i

(ii) ***Processing time for job by manpower at an activity centre***: - The time spent by manpower on the job which is necessary for estimation of manpower cost, is the total time used by direct manpower and auxiliary manpower on the job which includes both the direct time on the machine and other non-manufacturing functions such as documentation, sorting, cleaning, and parking which are connected with the job. This time can be estimated as proportion of t_{ij}' as shown in equation 3.43

$$t_{ij}^{m} = A_{jt}^{m} t_{ij}' \qquad \text{.....3.43}$$

Where:

t_{ij}^{m} = time spent by manpower on job i in activity centre j

A_{jt}^{m} = Manpower time factor of activity centre j for particular period t (its determination is discussed in section 3.9.2 (iv))

t_{ij}' = processing time of job i on machine at activity centre j

3.7.2 Estimation of Waiting Times

There are various factors that researchers have mentioned that can affect the period at which a job has to wait before or/and after being processed on a machine. Among these factors, according to Cheng (1994) are:

i. The total processing time of the job

ii. The number of operations or processes that involves

iii. The number of jobs in the activity-center waiting when the job is released to the centre

iv. The total processing time of all the jobs in activity- center waiting when the job is released to the centre

v. The total number and duration of jobs in the shop when the job arrives.

The estimation of the waiting time and other time durations that constitute costing elements which depend on waiting time are hereby discussed:

(i) ***Estimation of waiting time in activity centre:*** Using Akinnuli and Aderoba (2000)'s model as basis, waiting time in an activity centre (q_j) can be predicted using an expected mean-value of the past waiting times and where there is no past record of waiting time a proportion of job processing time on machine in that centre (t_u^r) can be used (see Equation 3.47)..

Expected mean-value of waiting times is calculated using Equation 3.44 and its variance (σ) can also be determined using Equation 3.45

$$\Omega q_j = \frac{\sum_{k=1}^{n_j} q_{j(k)}}{n_j} \qquad \text{.....3.44}$$

Ωq_j = Mean waiting time in activity centre j

$$\sigma^2 = \frac{\sum_{k=1}^{n_j} \left(q_{j(k)} - \Omega q_j\right)^2}{n_j - 1} \qquad \text{.....3.45}$$

Value of $q_{j(k)}$ in Equation 3.44 is the In-Process Delays which is the time spent by a job in an activity centre when not on a machine this is expressed mathematically as shown in Equation 3.46

$$q_j = D_u - (D_{u-1} + t_u^r) \qquad \text{.....3.46}$$

Where:

q_j = Waiting time in activity centre j

D_{ij} = Departure time of job i from activity centre j

D_{ij-1} = Departure time of job i from an activity centre immediately preceding activity centre j

t_{ij}^{r} = Processing time of job i on machine at activity centre j

Where there is no record of existing waiting time, then a proportion of equipment time could be used, that is :

$$\Omega q_{ij} = \varpi^{r} t_{ij}^{r} \qquad \text{.....3.47}$$

Where:

Ωq_{ij} = Mean waiting time in activity centre j

ϖ^{r} = Waiting time factor, is subject to the opinion of the operator

Departure and processing time for all processing machines in an activity centre, which are necessary for accurate determination of waiting time, could be obtained from Equipment Utilisation Cards and Job Cards {see Appendix I (b) and Appendix I (f) respectively}.

(ii) ***Building usage time***: - This is the total time spent by job in the factory. It can be assumed to be the sum of processing and waiting time of a job in activity centre. This time is very significant in jobshop where many jobs may be kept waiting for a long time because of the job characteristics, shop status, system characteristics as well as external delay factors. Estimation of this time can then be expressed as:

$$t_{ij}^{\wedge} = t_{ij}^{r} + \Omega q_{ij} \qquad \text{.....3.48}$$

Where:

$t_{ij}^{\wedge}$ = *(building) time spent by job i in activity centre j*

t_{ij}^{r} = processing time of job i on machine at activity centre j

Ωq_j = mean waiting time in activity centre j.

(iii) ***Utilities time***: - This is the time spent on the activity centre while production-related utilities such as electricity, water, compressed air etc. are being supplied. This time element may probably be the same for all activity centres in the shop as these utilities are often supplied to all activity centres in the shop at the same time. The time is often less than building time since these utilities are not always available in many jobshops, it could be estimated as proportion of t_{ij}^{b} as shown in Equation 3.49:

$$t_{ij}^{u} = A_{jt}^{u} t_{ij}^{b} \qquad \text{.....3.49}$$

Where:

t_{ij}^{u} = time of using the utilities in activity centre j by job i

A_{jt}^{u} = Utility time factor for activity centre j for particular period t (its determination is discussed in section 3.9.2 (v))

3.7.4 Due Date Setting

Predicting due date as shown in Equation 3.40 assumes that the scheduling and due date assignment decisions are made for a set of simultaneously available jobs without considering the prevalent system workload status. That is, the production system is operating in a static and deterministic environment which carries no workload at each activity centre.

This assumption is certainly questionable in practice. For a typical real-world jobshop scheduling, there are bound to exist some jobs, which have entered the system earlier but are yet to be processed while some newly arrived jobs are added to the schedule, thereby increasing the waiting time of the later job. In this situation, the due date of the later job would be increased by the total processing time and queue

time of all the jobs on its route. This waiting time could be expressed mathematically as

$$\Omega^{*}q = \sum_{n=i-1}^{N} \sum_{j=1}^{J} \left(t_{nj}^{r} + \Omega q_{nj} \right) \qquad \text{.....3.50}$$

If this situation occurs, by substituting equations 3.42, 3.44 and 3.50 in Equation 3.40, the due date will become

$$DD_i = r_i + \sum_{n=(i-1)}^{N} \sum_{j=1}^{J} \left(t_{nj}^{r} + \Omega q_{nj} + t_{ij}^{e} + \Omega q_{ij} \right) \qquad \text{.....3.51}$$

Where:

t_{nj}^{r} = processing time of job n queuing on activity centre j which job i wants to enter

Ωq_{nj} = Mean waiting time of job n queuing on activity centre j which job i wants to enter

Equation 3.51 could be regarded as the *baseline due date* in which the First Come, First Served (FCFS) rule is employed. However, based on customers' demand or for other reasons, other scenarios based on *crash services* where the total processing time and queue time of all the jobs queuing on job i's route could be reduced or ignored in order to start the new job earlier.

For crash services, due date could be represented by

$$DD_i = r_i + \sum_{j=1}^{J} \left(t_{ij}^{r} + \Omega q_{ij} \right) + \Lambda^{w} \sum_{n=i-1}^{N} \sum_{j=1}^{J} \left(t_{nj}^{e} + \Omega q_{nj} \right) \qquad \text{.....3.52}$$

Where:

Λ^{w} = Due date negotiation factor

3.8 JOB SCHEDULING MODEL

A schedule is a timetable for performing activities, utilising resources or allocating facilities. The purpose of schedule in jobshop is to disaggregate the master production schedule into time-phased; weekly, daily or hourly activities. The elements of Jobshop Scheduling to be considered when planning for scheduling of activities in floor shop are hereby discussed:

3.8.1 Elements of Jobshop Scheduling

Classical approach to the jobshop scheduling problem focuses on major six elements to evaluate which priority rules are best at satisfying various performance criteria. These are:

i. Job arrival pattern

ii. Number and variety of machines in the shop

iii Ratio of workers to machines in the shop

iv Flow pattern of jobs through pattern

v Priority rules for allocating jobs to machines.

vi Schedule evaluation criteria.

i. ***Job arrival pattern***: Job can arrive at the scheduler's desk either in a batch or over a time interval according to some statistical distribution. In the former case, such arrival pattern is termed *static*, while the latter is termed *dynamic*. Static arrival does not mean that orders are placed by customers at the same moment but they are subject to being schedule at one time. This situation occurs when a production control clerk makes out a schedule within a specified period and does not dispatch any job until at the end of the period. In the case of dynamic arrival, jobs are dispatched as they arrive and the overall schedule is-updated to reflect their effects on the production facilities.

This type of arrival, dynamic arrival, is used for the development of the Job Scheduling Model in this study.

ii ***Number and variety of machines in the shop.:*** The number of machines in the shop obviously affects the scheduling process. If there is but one machine or if a group of machines can be treated as one, the scheduling problem would be greatly simplified as observed by Chase and Aquilano (1985). On the other hand, as the number and variety of machines increase the more complex the scheduling problem is likely to become. Though this model has adopted the pattern of grouping machines performing similar or same functions together as an *activity centre*, but the nature of a typical jobshop necessitates variety of machines which has resulted to various activity centres being considered in the development of this model.

iii. ***Ratio of workers to machines in the shop:*** If there are more workers than machines or an equal number of workers and machines, the shop is referred to as a machine-limited system. If on the other hand, there are more machines than workers, it is referred to as a labour- limited system. Considering the nature of a typical jobshop, most especially in the developing countries, where there is one to one relationship between the machine and direct labour, this study has adopted machine-limited system in the development of Job Scheduling Model.

iv. ***Flow Patterns of jobs through the shop:*** The pattern of flow through the shop ranges from *flow shop*, wherein all the jobs follow the same path from one machine to the next, to *randomly routed jobshop*, where there is no similar pattern of movement of jobs from one machine to the next. This pattern of flow, *random*, is the type employed for the formulation of the Job Scheduling Model developed in this study. A workflow pattern for a hypothetical jobshop is shown in Fig. 3.1.

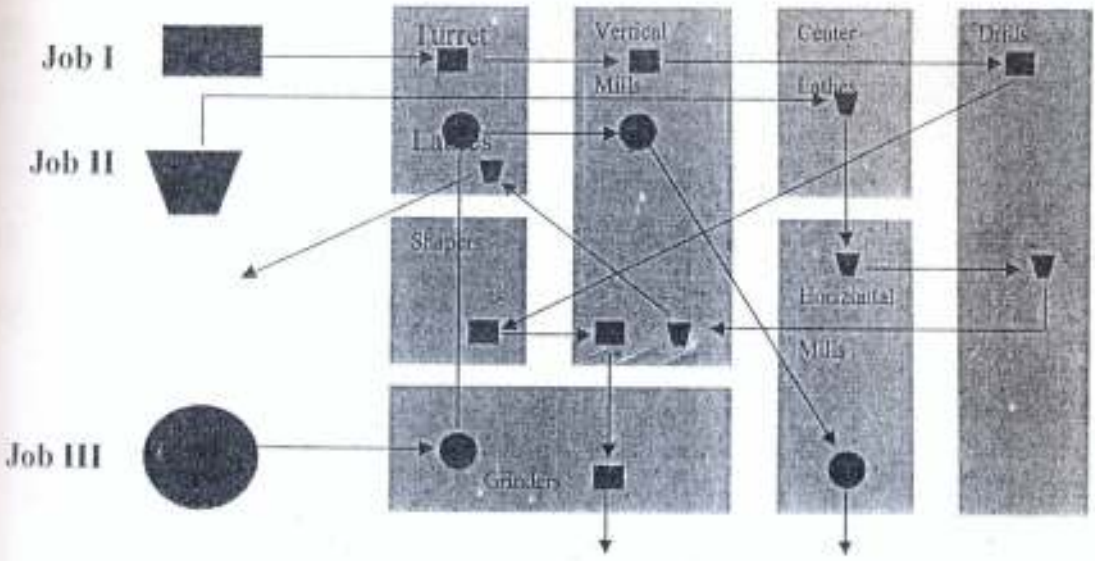

Fig. 3.1 Random flow Pattern for a hypothetical Jobshop

Source: Chase and Aquilano (1985). pp. 583

v. ***Priority rules for allocating jobs to machines:*** A priority rule is a rule for selecting which job to be started first on some machine or activity centre. Priority rules can be very simple, requiring jobs to be sequenced according to one piece of data only, such as processing time, due date, or order of arrival. Other rules may require several pieces of information to derive an index number such as in the least slack rule and the critical ratio rule. Some of these common rules are:

(a) **First Come, First Served (FCFS):** In this rule orders are run in the order of arrival.

(b) **Shortest Processing Time (SPT):** In this rule orders are run in the inverse order to the time required to process them.

(c) **Due date**- earliest due date first; run the jobs with the earliest due date first.

(d) **Slack Time Remaining (STR):** This is calculated as the difference between the time remaining before the due date minus the processing time remaining. Orders with the shortest STR are run first.

(e) **Critical Ratio (CR):** This is calculated as the difference between the due date and the current date divided by the work remaining. Orders with smallest CR are run first.

(f) **Last-Come, First-Served (LCFS):** Last orders are run first in this rule.

(g) **Random Order:** The supervisors or the operators usually select whichever job they feel like running.

(h) **Monetary Charges (MC):** Jobs with higher monetary values are schedule first.

This study opted for First Come First Served rule for allocating jobs to activity centres, however it allows Last-Come, First-Served rule by giving priority to new job on request from the customer which will amount to increase in monetary charges (MC) of such job. Based on this, this study has evolved an *Integrated Scheduling Rule* (ISR) which has combined FCFS with LCFS and MC.

vi ***Schedule objectives:*** There are various objectives that may be in focus when scheduling a job. Among these are:

(a) Meeting due dates of customers or downstream operations

(b) Minimising flow time (the time a job spends in the shop)

(c) Minimising Work-In-Progress (WIP).

(d) Minimising idle time of machine, workers, and so on.

However, this model is to determine the starting times for each operations, but it also takes into consideration the need to minimize the total flow time of all jobs to be scheduled within a specified period.

3.8.2 Development of Jobshop Scheduling Model

This model schedule a finite set I of n jobs $\{I_i\}_{i=1}^{n}$ to be processed on a finite set J of activity centres $\{J_j\}_{j=1}^{j}$. Each job i will be processed on particular activity

centre(s), which has to be scheduled in a predetermined given order, a *precedence constraint*. Each operation of job i has to be processed in activity centre j for an uninterrupted processing time period τ_{ij} and no operation may be pre-empted, i.e. interrupted and then completed at a later time, once started. Each job has its own individual flow pattern through the centres, which is independent of the other jobs. If the completion time of i on j is t_{ij} then the duration in which all operations for all jobs are completed is referred to as the makespan T_{max}.

The objective of this model is to determine the starting times for each job's operation, $\tau_{ij} \geq 0$, in order to minimise the makespan while satisfying the precedence constraint. Mathematically, the objective is

$$T^*_{max} = \min (T_{max}) = \min_{\text{feasible schedules}} (\max (t_{ij} + \tau_{ij}): \forall j_i \in j, i_k \in I) \quad \text{.....3.53}$$

3.9 SHOP FLOOR CONTROL AND RECORD MANAGEMENT

Shop Floor Control is a management strategy that entails using adequate and proper records to monitor the progress of jobs and where necessary, expediting orders and/or adjusting system capacity to make sure that the master schedule is met. According to American Production and Inventory Control Society (APICS,1984), Shop Floor Control is defined as a system for utilising data from the shop floor as well as data processing files to maintain and communicate status information on shop orders and work centres.

The major functions of shop floor control as highlighted in APICS (1984) are:

i. assigning priority of each shop order.

ii. maintaining work-in-progress quantity information.

iii. conveying shop order status information to the office.

iv. providing actual output data for capacity control purposes.

v. providing quantity by location by shop order for work-in-progress inventory and accounting purposes.

vi. providing measurement of efficiency, utilization and productivity of manpower and machines.

In order to monitor and control the activities that go on in jobshop, this study has developed different tools to monitor the floor shop activities and provides an approach to the determination of control-variables. These measures are hereby discussed.

3.9.1 Tools of Shop Floor Control

The essence of any control is to compare between a laid down standard of a system with its current or final status which may necessitate corrective or preventive measures. This task requires tools that provide information on the laid down standards as well as current status of the system. These tools can be in form of records, cards or files.

In jobshops, activities that require control include manpower, tools/equipment, inventory system and the jobs to be produced. Cards referred to as *Floor Shop Cards*, were designed to control and monitor these activities in jobshop. These cards could be completed manually or by "on line" using software developed for this study. The control of these activities and cards developed for their controls are hereby described:

i. . ***Manpower control***: Manpower control in this study is achieved by comparing the results from manpower planning model with the existing status of manpower in the floor shop. It also record the duration of work of manpower in any particular centre. The tool designed for this purpose is *Manpower Utilization Cards (MUC)* that contains information like:

- Designation/Activity centre

- Available manpower (Supervisor, Operator, Ancillary and others)
- Working hours etc.

A specimen of MUC is shown in Appendix I (a).

ii. ***Tools/equipment control***: Control of Tools/Equipment in a jobshop involves comparison between the forecasted capacity of a tool or equipment needed in a particular activity centre with the existing one in the floor shop. The cards to be used for this purpose are *Equipment Utilization Card (EUC)* and *Maintenance Card (MC)*. The cards contain information on the qualitative and quantitative strength of the equipment, its periodic cost of maintenance, date procured, expected useful year, duration at which is being put to use, and others. A specimen of EUC and MC are shown in Appendix I (b) and Appendix I (c) respectively.

iii. ***Inventory control***: A control measure was put in place to monitor the in-flow and out-flow of inventory in the stores. This measure takes into consideration the replacement level or safety stock from Material Requirement Planning Model to set the benchmark for ordering or usage of material in the store. Two Cards called *Stock Record Card (SRC)* and *Material Flow Card (MFC)* were designed to achieve this objective. These cards contain specification of the material, bin balance, ordering record (like date and quantity order, date and quantity received) etc. Specimens of SRC and MFC are shown in Appendix I (d) and Appendix I (e) respectively.

iv. ***Job control***: A card named *Job Card (JBC)* was designed to aid effective control of jobs to be produced. This card contains information like job description, code, quantity and type of material required. It also contains the operation sequence along with the Optimistic, Most Likely and Pessimistic time of production. The card serves as a work order that authorises the floor shop to commence production on the job when it is issued. A specimen of JBC is shown in Appendix I (f)

v. ***Factor utilities control***: Various utilities/facilities need to have proper records of utilisation. Such facilities include factory building, electricity, water, air, stationeries etc. This record will contain the cost of building and its maintenance, actual duration of supplying various utilities and the expected usage year of the building. *Factory Utility Card (FUC)* has been designed as a control tool to achieve this objective. A specimen copy of this card is shown in Appendix I (g)

3.9.2 An Approach to the Determination of Control-Variables

In order to achieve optimal solutions to the various strategic decisions discussed above, there is the need to have an approach that will guide the decision of the management in fixing values for some variables that control the out come of these decisions. These control variables are; Manpower Utilisation Factor (Ψ_{μ}^{m}), Building Maintenance Factor (β^{b}), Machine Maintenance Factor (δ_{μ}^{c}), Manpower Time Factor (A^{m}) and Utilities Time Factor (A^{u})

i. ***Manpower utilisation factor***: Manpower utilisation factor is to account for the unavoidable under-utilisation of manpower as a result of illness, fatigue, break time and so on. The value of manpower utilisation factor (Ψ^{m}) may depend on judgmental decision of the management based on past record of performance of manpower which could be obtained in Manpower Utilisation Card (see Appendix I (a)).

ii. ***Building maintenance factor:*** This factor accounts for the repair and maintenance of shop building for a particular period. It can be estimated by dividing the actual cost of repair and maintenance of factory building by the cost rate of building the factory. This is shown in equation 3.40

$$\beta_t^b = \frac{H^b MTC_t^b}{H_t B} + 1 \qquad \text{.....3.54}$$

Where:

β_t^b = Building maintenance factor for period t

H^b = Expected life span of the factory building in hours

MTC_t^b = Building maintenance cost for period t

H_t = Total hours of activity available in period t

B = The cost for constructing the factory building

Since the value of building maintenance cost cannot be known as at the time of planning for new period, the value could be based on the judgmental decision of the management or prediction using Equation 3.55

$$MTC_t^b = \frac{MTC_{t-1}^b + MTC_{t-2}^b MTC_{t-3}^b ..... + MTC_{t-n}^b}{n} \qquad \text{.....3.55}$$

The past records on the cost of repair and maintenance of factory building could be obtained from Factory Utility Card (see Appendix I (g))

*(iii) **Machine maintenance factor**:* This factor accounts for the repair and maintenance of machine and equipment of a particular activity centre its value could be determined by dividing the actual cost rate of repair and maintenance of equipment by the cost rate of purchasing and installing the equipment. This is shown in Equation 3.56

$$\delta_n^r = \sum_{n=1}^{E_n^r} \left[\frac{Y_n MTC_n^r}{H_t \left(K_n^r + I_n \right)} \right] + 1 \qquad \text{.....3.56}$$

Where:

δ_n^r = Machine maintenance factor of equipment in centre j in period t

E_n^r = No of equipment in activity centre j in period t

Y_n = Expected hours of usage of equipment n

MTC^t_μ = Equipment maintenance cost of activity centre j in period t

H_t = Total hours of activity available in period t

K^t_m = Initial cost of purchasing equipment n

I_n = Installation cost of equipment n

Since maintenance cost of equipment cannot be known as at the time of planning, the value could be based on the judgmental decision of the management or prediction using the past records of maintenance cost; this could be done using Equation 3.57:

$$MTC^t_\mu = \frac{MTC^t_{\mu-1} + MTC^t_{\mu-2} + MTC^t_{\mu-3} \ldots\ldots + MTC^t_{\mu-n}}{n} \qquad \ldots\ldots\ldots\ldots\ldots\ldots 3.57$$

The past records of the cost of repair and maintenance of equipment can be obtained from Equipment Utilisation Cards (see Appendix I (b))

(iv) ***Manpower time factor:*** This factor is used to estimate the time spent by manpower in a particular activity centre which is likely to be more than the actual time spent on machine as a result of documentation, cleaning etc. Its value can be determined by dividing the actual time spent by manpower by the time spent on machine/equipment. That is :

$$A^m_\mu = \frac{\Omega t^m_\mu}{\Omega t^e_\mu} \qquad \ldots\ldots\ldots\ldots\ldots\ldots 3.58$$

Where:

A^m_μ = Manpower time factor at activity centre j for particular period t

Ωt^m_μ = Average manpower time in activity centre j at period t

Ωt^e_μ = Average manpower time on equipment in activity centre j at period t

The average time spent by the manpower in activity centre j and the one spent on the equipment can be determined using Equations 3.59 and 3.60 respectively

$$\Omega t_{jt}^{m} = \frac{\sum_{n=1}^{N} t_{mn}^{m}}{N} \qquad \text{.....3.59}$$

and

$$\Omega t_{jt}^{e} = \frac{\sum_{n=1}^{N} t_{mn}^{e}}{N} \qquad \text{.....3.60}$$

Where:

N = total number of job in period t

The average time spent by manpower in period t can be predicted using the past average manpower time as recorded in Manpower Utilisation Card (see Appendix I (a)). This prediction could be done using Equation 3.61

$$\Omega t_{jt}^{m} = \frac{\Omega t_{jt-1}^{m} + \Omega t_{jt-2}^{m} + \Omega t_{jt-3}^{m} \ldots\ldots + \Omega t_{jt-n}^{m}}{n} \qquad \text{.....3.61}$$

(v) ***Utilities time factor:*** This factor is used to estimate the time spent for using the utilities in a particular activity centre. Its value can be determined by dividing the building time by the actual time of supplying the utilities. That is

$$A_t^u = \frac{t_t^u}{t_t^b} \qquad \text{.....3.62}$$

Where:

A_t^u = Utility time factor in period t

t_t^u = time of using the utilities in period t

t_t^b = building time in period t

The actual time of supply these utilities can be predicted using the past actual time which can be obtained from Record of Supply of Utilities (see Appendix I (g)). To predict this time equation 3.63 could be used

$$t_t^b = \frac{t_{t-1}^b + t_{t-2}^b + t_{t-3}^b \ldots\ldots + t_{t-n}^b}{n} \qquad \ldots\ldots\ldots\ldots\ldots\ldots 3.63$$

3.10 INTEGRATION OF STRATEGIC DECISIONS MODELS IN JOBSHOPS

The models developed for each strategic decision were integrated considering the relationship among them. The forecast hour ($^{*}D^{f}_{jt}$) which was the outcome of the Demand Management Model serves as major input variable in Manpower Planning Model, Material Requirement Planning Model and Tools and Equipment Planning Model to determine the optimum needs of Manpower, Material and Equipment for the planning horizon respectively. These values served as capacity-constraints for Job Scheduling Model. The result of scheduling model produces the cost and due date of jobs using the Cost Estimation Model and Due Date Determination Model respectively. The records of all the processed jobs are kept and control in the various tools designed for the purpose. This interrelationship is shown in Figure 3.2 and based on this relationship, an algorithm was designed for the development of software

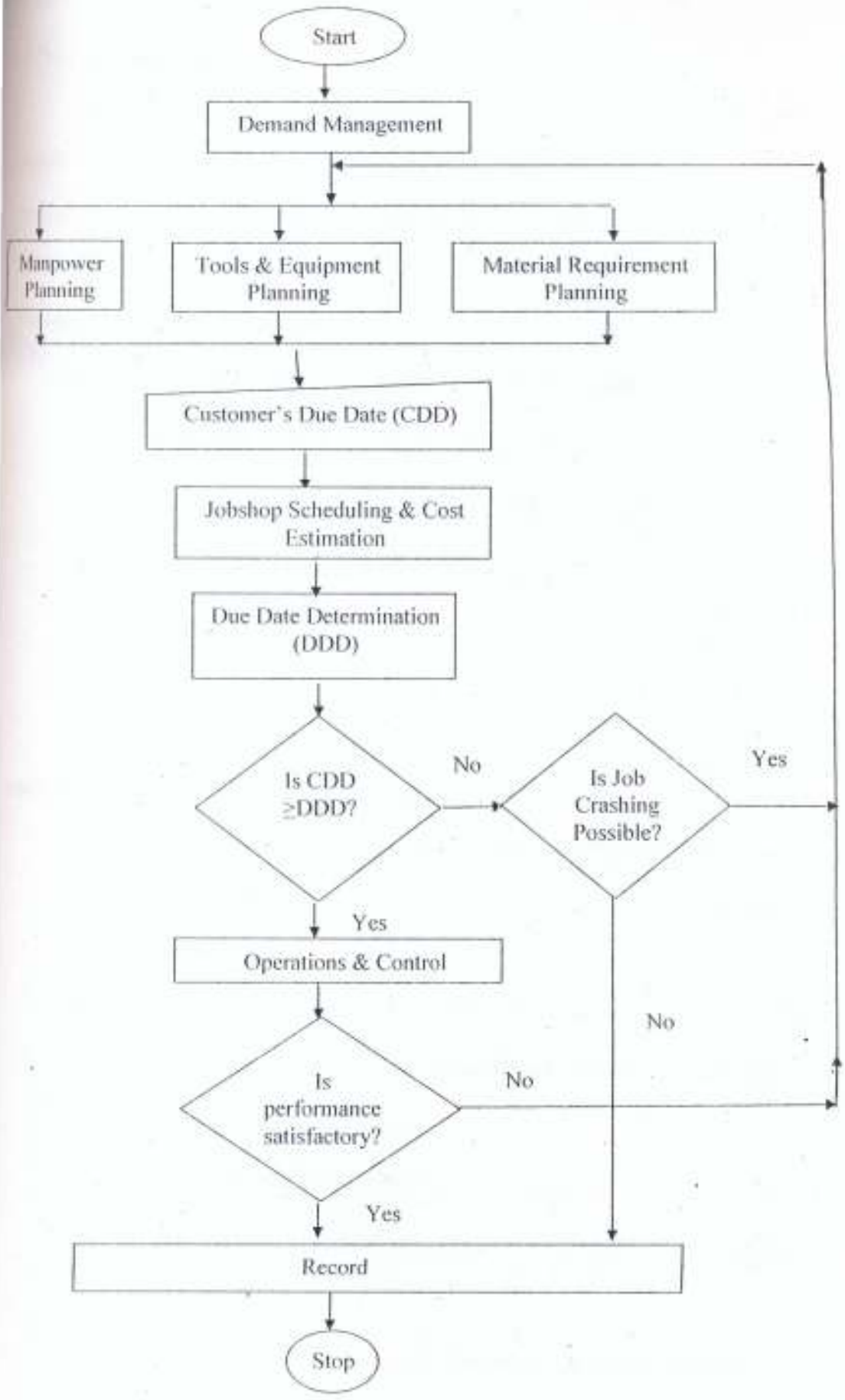

Fig. 3.2: Interrelationship between the Strategic Decisions

3.10.1 Algorithm for Jobshop Integrated Model

The algorithm used for the integration of the models is presented in modules namely, system data input, set-up for planning horizon,, implementation, optimisation, adjustment of shop floor parameters, record and control. These modules are respectively described as follow:

Module I: System data input

10 Input data related to the company - $A, B, H^h, \{J_j\}$ etc

20 Input data related to each activity centre - a_i, c_{ij}^h, c_{ij}^w, c_{ij}^s, c_{ij}^o, c_{ij}^o, c_{ij}^o, I_{ij} K_{ij}^t, Y_{ij}

30 Input data related to material/ inventory requirement- c_{ijk}^r,

40 Input data related to the period- $D_\mu^n, H_\mu, H_\mu, K_\mu^h, K_\mu^c, K_\mu^w, K_\mu^p$, $P_{kt}^h, P_{kt}^r, P_{kt}, W_\mu$

Module II: Set-up for Planning Horizon

50 Input the current floor shop data related to different manpower costs, material costs, tools & equipment costs for "hire", "contract", "purchase" etc

60 Retrieve necessary previous floor shop data like; $D_{kt-1}^n, D_{\mu-1}^f, E_{\mu-1}, M_{\mu-1}$ from **Record and Control** to forecast or optimise for the current period.

70 Forecast demand hour for each activity centre- D_μ^f

80 Determine the number of manpower required for the current period (M_μ)

85 If $M_\mu > M_{\mu-1}$ GOTO 170, ELSE determine cost rate of manpower

90 Determine the number of equipment required for the current period (E_{μ})

95 If $E_{\mu} > E_{\mu-1}$ GOTO 190, ELSE determine cost rate of each equipment

100 Forecast for optimal quantity and type of material needed in the current period (D_{kr}^{f})

110 If $D_{kr}^{f} > D_{kr-1}^{a}$ GOTO 210, ELSE determine the unit cost of each material

Module III: Implementation

120 Set Due Date Negotiation Factor (Λ^{m}) = 1

130 Input job data- $L_{ijk}^{'}$, $r_{i,}$, etc

140 Can the job be done? If no, GOTO 230

150 Schedule the job to determine due date (DD_i) and cost (CP_i)

160 If DD_i and CP_i are acceptable to the customer GOTO 260, ELSE GOTO 230

Module IV: Optimisation

170 Find the least cost of manpower to cater for the shortage in labour hour using any or combinations of available alternatives:

171 Employ new manpower

172 Engage part-time manpower

173 Contract the job out to outsider

174 Engage manpower base on over-time

175 Transfer manpower from idle activity centre(s)

180 Determine total cost rate for manpower, Then GOTO 90

190 Find the least cost of equipment to cater for the shortage in equipment hour using any or combination of available alternatives:

191 Over-time engagement Part-time manpower

192 Hire equipment

193 Contract out part of the job

194 purchase the required equipment(s)

200 Determine the total cost rate for equipment, Then GOTO 100

210 Find the type and the least cost of material to cater for the shortage in material using any or combination of available alternatives:

211 Postpone the order

212 Order on emergency

213 Use alternative material if possible and available

220 Determine total cost rate for each material, Then GOTO 120

Module V: Adjustment of Shop Floor Conditions

230 Adjust Control Factors for Shop Floor Conditions, If Possible GOTO 250 ELSE

240 Adjust job characteristics, If Possible and acceptable to the customer, ELSE GOTO 270

250 Determine new (A^{n}) GOTO 150

Module VI: Record and Control

260 Let Job join the Queue, THEN GOTO 280

270 UPDATE Un accepted Job Record, THEN GOTO 290

280 UPDATE Processed Job Record, THEN GOTO 290

290 **STOP**

3.11 DEVELOPMENT OF COMPUTER SOFTWARE

Application software named Jobshop Integrated Software (JOBSIS_2007) was developed to facilitate quick and effective integration of the strategic decisions that promotes efficient production planning and control in jobshops. Based on the flow chart shown in Appendix II and the Algorithm developed in section 3.10.1, this software was developed using *PHP 5.2.4*, a language that is compatible with all operating systems, supports networking and can be download freely on http://www.wampserver.com. The Software has mysql Database a database with unlimited capacity and readily available on http://www.mysql.com. The code of the Software is shown in Appendix IX. The software was designed with four major modules. These are Setup Module, Order Module, Control Module, and Floor Shop Cards. Details of these modules are now discussed.

3.11.1 Setup Module

Setup module is designed for input all the necessary data to determine the optimum values of the Strategic Decisions. This module consists of ten different windows. The functions of these windows are hereby discussed:

i. **Company profile window:** This window allows the input of data relating to the Jobshop profile such as Company Name, Address, Area, Cost of Building and Expected life span. These data are saved into the in-built-database in the local network named http://localhost/floorshop/fs_companyprofile.php when button "saved" is clicked. The sample of the window is shown in Appendix III (a)

ii. **Planning horizon window:** On this window the management decisions or policy on the Working Hour per Day, Working Days per Week and the Number of Months to plan for could be input and saved into the in-built-database in the local network named

http://localhost/floorshop/fs_planninghorizon.php when button "save" is clicked. The sample of the window is shown in Appendix III (b)

iii. **Activity section window:** On this window, setup could be made for Activity Centre and also necessary data related to the centre could be entered. Such data include Centre Area, Previous Forecast Hour for the centre, Previous Actual Hour for the centre, Smoothing Constant, Manpower Efficiency for the Centre etc. These data will be saved into the in-built-database in the local network named http://localhost/floorshop/fs_ equipmentsetup.php when button "saved" is clicked. The Sample of the window is shown in Appendix III (c). This window leads to Equipment Unit Setup window where data related to equipment in each Activity Centre could be input. These data are Equipment Code No, Purchase Cost, Installation cost and Expected Life Span of the equipment. These data will be saved into the in-built-database in the local network named http://localhost/floorshop/fs_equipmentunitsetup.php when button "saved" is clicked. The sample of the window is shown in Appendix III (d).

iv. **Production staff window:** This window allows the input of data related to the production staff of the company. These data are: Staff Section, Staff ID No, Staff Name, and Monthly Salary. These data will be saved into the in-built-database in the local network named http://localhost/floorshop/fs_staffsetup.php when button "saved" is clicked. The sample of the window is shown in Appendix III (e)

v. **Administrative staff window:** This window is similar to Production Staff Window but differ in the sense that it was specially designed for Administrative staff of the company. This window saves its data into in-built-database in the local network named http://localhost/floorshop/fs_staffadminsetup.php in-built into the software when "saved" button is clicked. The sample of the window is shown in Appendix III (f)

vi. **Building maintenance window:** Building Maintenance Costs for three previous periods could be input on this window and the Moving Average to be used for the planning horizon will be shown on the window. The Moving Average will be stored in the in-built-database in the local network named http://localhost/floorshop/fs_quartermanpower.php when "saved" button is clicked. The sample of the window is shown in Appendix III (g)

vii. **Utilities costs window:** This window allows for the input of three previous Utility Costs and determines the Moving Average to be used for the planning horizon. The Moving Average will be shown on the window and stored in the in-built-database in the local network named http://localhost/floorshop/fs_quartermanpower.php when "saved" button is clicked. The sample of the window is shown in Appendix III (h)

viii. **Equipment maintenance window:** This window is used to input three previous Equipment Maintenance Costs for each Activity Centre, it determines and displays the Moving

Average of the cost and saved it in the in-built-database in the local network named http://localhost/floorshop/fs_quartermanpower.php when "saved" button is clicked. The sample of the window is shown in Appendix III (i)

ix. **Customer registration window:** This window is designed for the input of data for the registration of customers. It allows input like customer's company name, name of the contact person and address. These data will be saved into the in-built-database in the local network named http://localhost/floorshop/fs_customersetup.php when button "saved" is clicked. The sample of the window is shown in Appendix III (j)

x. **Material registration window:** This window permits the setup of the material to be stocked in the planning horizon. The sample of the window is shown in Appendix III (k). When the buttons "save" is click it leads to another window that allow for the input of data related to the material setup. These data are Date of order, Transaction Date, Purchase Cost, and Usage Price. These data would be saved into the in-built-database in the local network named http://localhost/floorshop/fs_materialstock.php when button "saved" is clicked. The sample of the window is shown in Appendix III (l)

3.11.2 Order Module

This Module consists of five windows that facilitate production activities at the time of arrival of jobs. Specific functions of these windows are hereby discussed:

i. **Job registration window:** This window meant for registration of the job when it arrives at the company. It displays the list of the registered

customers where the customer that brought the job could be selected. It saves the job in the in-built-database in the local network named http://127.0.0.1/floorshop/fs_jobregister.php when button "saved" is clicked. The sample of the window is shown in Appendix III (m)

ii. **Material costing window:** On this window the Quantity of material to be used to produce the job would be entered, having displayed the unit price of usage it calculates the Cost of Material and store it in the in-built-database in the local network named http://127.0.0.1/floorshop/fs_jobcosting.php when button "saved" is clicked. The sample of the window is shown in Appendix III (n)

iii. **Job scheduling window:** Information needed for scheduling of job is entered on this window. The information includes the Commencement Date, No of Equipment to be used in each section, the Operational Sequence, Mode of Operation (Full Time or Over Time), and the Estimated Time of Production at each section. It schedules the job as appropriate when button "saved" is clicked and displays the Result of the Schedule. The sample of the window is shown in Appendix III (o)

iv. **Invoice sheet:** This sheet displays the Address of the Company, the Customer Address, the list of the material used and its costs. It also displays the Production Costs base on Equipment Cost, Manpower Cost, Building Cost, Utilities Cost and Administrative Cost of each section. The Estimated Due Date is also displayed. {Samples are shown in Appendix IV (a) to Appendix IV (e)}

v. **Cost rates sheet:** This sheet shows the Cost Rates of Equipment, Manpower, Building, Utilities, and Administrative for each of the

available Sections.[Samples are shown in Appendix V (a) and Appendix V (b)]

3.11.3 Control Module

Control Module provides four major windows that control the Production Processes during the operation on the floor of the shop. These windows are hereby discussed

i. **Job processing window:** This window displays the entire jobs on the floor of the shop on *Active* default, however any of these jobs could be change from *Active* to *Pending*, to allow for priority job if any. Also jobs could be put in *Completed* status *or Delete* if it has not be Scheduled. The sample of this window is shown in Appendix III (p)

ii. **Inventory window:** This window displays the list of the Inventory available on the shop floor, its quantity, total purchase cost per unit Usage price per Unit. The sample of this window is shown in Appendix III (q)

iii. **Work sheet:** This window allows the users to *Fetch* for any of the days in which the shop floor is engaged Through this Fetching it will display the particular jobs on schedule when it will commence and when it will end. Samples of this result are shown in Appendix VI (a) to Appendix VI (f)

vi. **Sectional work sheet:** This window allows the users to *fetch* for any of the section to view its work load. This sheet will contain the description of the job when it will start and when it will end. The samples of this window are shown in Appendix VII (a) to Appendix VII (g)

3.11.4 Floor Shop Cards Module

This module consists of nine windows which permits "on line" completion of different shop floor cards developed for record and control purposes. These cards are described in 3.8.1 and their specimen are shown in appendices 1(a) to 1(i)

3.11.5 Computer Requirements

The developed software requires a minimum computer hardware of 32MB RAM, 1.5GB free Hard Disk space. However, in order to meet up with current development in ICT, a personal computer with minimum of 256MB RAM, 20GB free Hard Disk space is recommended for the software.

3.11.6 Cost of the Software (JOBSIS_2007)

The cost of coding, debugging, test running, compiling and other miscellaneous expenses (transportation, inventory etc) for a unit software is estimated to be ₦ 50,000 and the breakdown of the cost is shown in Table 3.0

Table 3.0: Breakdown of the Cost of Producing a JOBSIS_2007 Software

S/N	Description	Estimated Cost
1	Coding, debugging and test running	₦ 30,000
2	Programme Compilation	₦ 10,000
3	Production of installable programme	₦ 10,000
	Total	**₦ 50,000**

3.12 TESTING OF THE MODEL

The validity of the integrated model was tested using data from a Metal Fabrication Company located in Osogbo, Osun State, Nigeria. The main operation of the company is fabrication and repairs of farm implements, simple industrial machines, and domestic appliances

3.12.1 Company Antecedents

i. **Location:** The Company was located along Osogbo-Ikirun Road, Osogbo, Osun State, Nigeria.

ii. **Staff strength:** 20 Production Staff and 6 Administrative Staff

iii. **Company problems:** The company had the following problems:

   a. backlog of uncompleted jobs

   b. failure to meet most of the promised due dates.

   c. haphazard job costing system

   d. poor records of facilities, products and processes

   e. deficit in annual cash flow

3.12.2 Data Collection and Analysis

Due to lack of proper documentation of facilities, products and processes, a period of six months referred to as planning period (Quarter 1 and Quarter 2) was used to collect data for setting up some initial parameters. Records of jobs undertook during this period based on the intuitive and hunch of the Production Manager in fixing the due dates and estimating the job costs were recorded and presented in chapter five. The instruments used for this purpose were designed by the researcher and referred to as Floor Shop Cards {Appendix I(a) to Appendix I(i)}. During this period, regular visitations to monitor the usage of the Cards were made and with the assistance of the staff of the company to take regular record of activities, using the Cards facilitates the process. The data collected during this period were analysed using simple statistical methods like mean, median, mode, and standard deviation

Another six months, implementation period (Quarter 3 and Quarter 4), was used to validate the model using the developed software (JOBSIS_2007). The

software was used for the planning and control of production-activities of the company. These two periods are hereby discussed.

3.12.3 Planning Period

This period was used to collect data used to forecast for; Demand Hours, Equipment Maintenance Cost, Building Maintenance Cost and Utilities Costs that were used during the implementation period. Average Waiting Time, Manpower Factor and Utility Factor were also determined from the data collected during this period.

3.12.4 Implementation Period

This period was divided into Quarter 3 and Quarter 4, the production activities of the company were undertook using the model developed along with JOBSIS_2007.

i. **Data for quarter 3:** During this period Twenty (20) jobs were processed. Data used for planning the production activities, setting the factory cost rates and scheduling the jobs were presented in Table 3.1 to Table 3.13

Table 3.1: Company Profile Used For Qtr. 3

Name of the Company	Factory space (m^2)	Cost of Building (₦)	Expected Life Span (Year)
XXX	1,200	5,768,000	50

Source: Survey 2007

Table 3.2: Management Policies on Factory Working Conditions and Planning Horizon Used For Qtr. 3

Quarter	Official Working hour/day	Official Working day/week	Planning Horizon (Month)		
			From	To	No of Months
Qtr. 3	8	5	July	Sept.	3

Source: Survey 2007

Table 3.3: Activity Centres Profile Used For Qtr. 3

Activity Centres	Space Area (m^2)	Actual Demand Hour in Qtr. 2	Forecast Demand Hour in Qtr. 2 (Estimation)	Smoothing Constant
Design & Engineering (D&E)	100	112	107	0.99
Turning (TRN)	200	90	92.50	0.98
Milling (MIL)	200	79	80.50	0.95
Welding & Cutting (W&C)	150	109	120.50	0.95
Assembly & Finishing (A&F)	150	115	107.00	0.92
Electrical W/Shop (ELECT)	100	26	27.00	0.90
Wood W/Shop (WOOD)	100	23	21.50	0.96
Others (Admin. Block) (ADM)	200	n.a	n.a	n.a

Source: Survey 2007

Table 3.4: Manpower Utilisation Factor and Timing Factors Used For Qtr. 3

Activity Centres	Manpower Utilisation Factor	Average Waiting Time (Minutes)	Manpower Time Factor (%)	Utility Time Factor (%)
Design & Engineering (D&E)	0.75	45	10	80
Turning (TRN)	0.80	105	25	80
Milling (MIL)	0.80	110	20	80
Welding & Cutting (W&C)	0.85	70	10	80
Assembly & Finishing (A&F)	0.80	115	5	80
Electrical W/Shop (ELECT)	0.80	35	10	80
Wood W/Shop (WOOD)	0.75	40	25	80

Source: Survey 2007

Table 3.5: Material /Inventory Record Used For Qtr. 3

Types of Material	Forecast Quantity in Qtr. 2 (Estimation)	Actual Quantity in Qtr. 2 (Hr)	Smoothing Constant	Forecast Quantity for Qtr. 3
Mild Steel Rod (Low Grade)	57.00	61	0.98	61
Mild Steel Rod (High Grade)	51.00	57	0.94	57
Mild Steel Sheet (Low Grade)	16.00	12	0.95	13
Mild Steel Sheet (High Grade)	69.00	73	0.95	73
Wood	56.50	59	0.90	59
Cable Wire	91.50	83	0.96	82

Source: Survey 2007

Table 3.6: Cost of Purchase, Holding and Set up of Material/Inventory Used For Qtr. 3

Types of Material	Purchase Cost/Unit (Average) (₦)	Holding Cost/Unit (Average) (₦)	Set up Cost/Unit (Average) (₦)	Total Purchase Cost (₦)	Usage Price (₦)
Mild Steel Rod (Low Grade)	320	0.52	0.74	321.26	353.39
Mild Steel Rod (High Grade)	350	0.52	0.74	351.26	386.39
Mild Steel Sheet (Low Grade)	450	1.02	0.85	451.87	497.06
Mild Steel Sheet (High Grade)	471	1.02	0.85	472.87	520.16
Wood	105	1.00	0.95	106.95	117.65
Cable Wire	35	0.35	0.20	35.55	39.11

Source: Survey 2007

Table 3.7: Average Monthly Salary of Manpower/Personnel Used For Qtr. 3

Activity Centres	Monthly Salary (₦)	Monthly Salary (₦)	Monthly Salary (₦)	Monthly Salary (₦)	Monthly Salary (₦)	Monthly Salary (₦)	No of Staff
D&E	6,000	6,000	6,500				3
TRN	10,000	7,500	5,000				3
MIL	10,000	7,500					2
W&C	10,000	7,000					2
A&F	7,000	7,000	7,000	7,000			4
ELECT	6,500	6,000	6,000				3
WOOD	6,000	6,000	6,000				3
ADM	10,000	10,000	8,500	8,500	7,000	6,500	6

Source: Survey 2007

Table 3.8: **Cost of Purchase, Installation, and Expected Usage Year of Available Equipment in Production Section of the Company Used For Qtr. 3**

Activity Centres	Equipment	I	II	III	Total No of Equipment
D&E	Equipment Code	DE 001	DE 002	DE 003	3
	Purchase Cost (₦)	9,500	10,000	8,000.	
	Installation Cost (₦)	2,000	2,000	2,500	
	Expected Usage Year	2	2	2	
TRN	Equipment Code	TRN 001	TRN 002		2
	Purchase Cost (₦)	450,000	650,000		
	Installation Cost (₦)	75,000	120,000		
	Expected Usage Year	10	10		
MIL	Equipment Code	MLL 011			1
	Purchase Cost (₦)	700,000			
	Installation Cost (₦)	100,000			
	Expected Usage Year	10			
W&C	Equipment Code	WDC 001	WDC 002	WDC 003	3 Sets
	Purchase Cost (₦)	30,000	25,000	40,000	
	Installation Cost (₦)	5,000	5,000	5,000	
	Expected Usage Year	4	4	4	
A&F	Equipment Code	ASF 001	ASF 002	ASF 003	3 Sets
	Purchase Cost (₦)	10,000	15,000	12,000	
	Installation Cost (₦)	2,000	1,500	3,000	
	Expected Usage Year	5	5	5	
ELECT	Equipment Code	ELE 001			1 Set
	Purchase Cost (₦)	13,000			
	Installation Cost (₦)	4,000			
	Expected Usage Year	4			
WOOD	Equipment Code	WDW 001			1 Set
	Purchase Cost (₦)	20,000			
	Installation Cost (₦)	5,000			
	Expected Usage Year	5			

Source: Survey 2007

Table 3.9: **Building Maintenance Cost and Utility Costs Used For Qtr. 3**

	**Cost (₦)	Cost for Qtr. 1 (₦)	Cost for Qtr. 2 (₦)
Building Maintenance:	32,000	42,000	37,000
Utilities:	20,000	16,000	18,000

Source: Survey 2007

*(NB: ** These costs were based on the estimate from the past records)*

Table 3.10: Maintenance Cost of Tools & Equipment in Production Sections Used For Qtr. 3

Activity Centres	**Maintenance Cost (₦)	Maintenance Cost for Qtr. 1 (₦)	Maintenance Cost for Qtr. 2 (₦)
D&E	9,000	10,000	10,500
TRN	22,000	18,000	20,000
MIL	19,000	17,000	18,000
W&C	10,000	11,000	11,500
A&F	6,000	6,000	6,500
ELECT	9,500	10,000	11,000
WOOD	12,000	12,500	12,000

Source: Survey 2007

*(NB: ** These costs were based on the estimate from the past records)*

Table 3.11: Management Values and Decisions on Manpower Used For Qtr. 3

Activity Centres	Likely Salary for New Manpower (₦)	Likely hourly cost for Part Time Manpower (₦)	Cost of Transfer a Manpower (₦)
D&E	6,000	200	n.a
TRN	8,000	150	100
MIL	8,000	150	100
W&C	7,500	150	100
A&F	6,500	120	100
ELECT	6,000	120	100
WOOD	5,000	150	100

Source: Survey 2007

Table 3.12: Management Values and Decisions on Tools and Equipment Used For Qtr. 3

Activity Centres	Likely Cost of a unit Equipment (₦)	Likely Cost/hr of Hiring a unit Equipment (₦)	Likely Cost/hr of Contracting out a job (₦)
D&E	10,000	250	150
TRN	600,000	n.a	500
MIL	750,000	n.a	500
W&C	35,000	500	700
A&F	15,000	500	700
ELECT	15,000	400	600
WOOD	25,000	400	600

Source: Survey 2007

Table 3.13: Operational Sequence, Processing Time and Material to be Used for Jobs Processed in Qtr. 3

Job Code	Arrival Date	Operational Sequence With Estimated Processing Time (Hr)					Material /Inventory To be used with Quantity			
		1st Operation	2nd Operation	3rd Operation	4th Operation	5th Operation				
07/001	03/07/2007	DE (4)	WC (14)	AF (5)			MRL (10)	MSH (16)	MSL (4)	
07/002	04/07/2007	DE (4)	TRN (10)	MLL (6)	WC (5)	AF (4)	MRH (3)	MRL (2)		
07/003	09/07/2007	DE (4)	WC (7)	TRN (9)	MLL (6)	AF (4)	MRH (4)	MRL (2)		
07/004	09/07/2007	DE (3)	WC (6)	ELECT (7)	WOOD (6)	AF (5)	MRH (2)	MSH (8)	WOD (12)	CAB (16)
07/005	11/07/2007	DE (3)	TRN (7)	AF (4)			Nil	Nil	Nil	
07/006	25/07/2007	DE (3)	TRN (6)	AF (4)			Nil	Nil		
08/001	08/08/2007	DE (4)	TRN (7)	AF (4)			Nil	Nil		
08/002	08/08/2007	DE (4)	WC (16)	ELECT (10)	WOOD (6)	AF (4)	MRH (6)	MSH (12)	WOD (13)	CAB (16)
08/003	14/08/2007	DE (4)	WC (18)	AF (6)			MRH (7)	MRL (2)	MSH (12)	
08/004	16/08/2007	DE (4)	WC (6)	TRN (7)	MLL (5)	AF (4)	MRH (3)	MRL (1)		
08/005	16/08/2007	DE (4)	WC (18)	AF (5)			MRH (10)	MRL (2)		
08/006	20/08/2007	DE (4)	WC (10)	ELECT (6)	WOOD (6)	AF (4)	MRH (3)	MSH (8)	WOD (10)	CAB (15)
09/001	03/09/2007	DE (3)	WC (20)	WOOD (8)	AF (5)		MRL (8)	MSL (21)		
09/002	10/09/2007	DE (4)	WC (5)	TRN (7)	MLL (6)	AF (4)	MRH (3)	MRL (2)		
09/003	12/09/2007	DE (4)	WC (10)	ELECT (8)	WOOD (6)	AF (4)	MRH (5)	MSH (12)	WOD (13)	CAB (16)
09/004	18/09/2007	DE (3)	TRN (7)	AF (5)			Nil	Nil	Nil	Nil
09/005	18/09/2007	DE (3)	TRN (6)	AF (3)			Nil	Nil	Nil	Nil
09/006	19/09/2007	DE (4)	WC (8)	ELECT (6)	WOOD (5)	AF (4)	MRH (3)	MSH (10)	WOD (15)	CAB (18)
09/007	19/09/2007	DE (4)	TRN (7)	AF (4)			Nil	Nil	Nil	Nil
09/008	26/09/2007	DE (3)	WC (5)	TRN (7)	MLL (7)	AF (4)	MRH (3)	MRL (2)		

Source: Survey 2007

Key:

Codes Related To Operational Sequence		Codes Related To Material/Inventory	
DE	Design and Engineering Process	MSL	Mild Steel Sheet (Low Grade)
TRN	Turning Process	MSH	Mild Steel Sheet (High Grade)
MLL	Milling Operation	MRL	Mild Steel Rod (Low Grade)
WC	Welding and Cutting Process	MRH	Mild Steel Rod (High Grade)
ELECT	Electrical Work	WOD	Wood
WOOD	Wood/Carpentry Work	CAB	Cable Wire
AF	Assembly and Finishing Process	( )	
( )	Processing Times (in Hour) are inserted in the Brackets		Quantity of the material are put in the Brackets

ii **Data for Quarter 4:** During this period Twenty Eight (28) jobs were processed. Data used for planning the production activities, setting the factory cost rates and scheduling the jobs were presented in Table 3.14 to Table 3.26

Table 3.14: Company Profile Used For Qtr. 4

Name of the Company	Factory space (m^2)	Cost of Building (₦)	Expected Life Span (Year)
XXX	1,200	5,768,000	50

Source: Survey 2007

Table 3.15: Management Policies on Factory Working Conditions and Planning Horizon Used For Qtr. 4

Quarter	Official Working hour/day	Official Working day/week	Planning Horizon (Month)		
			From	To	No of Months
Qtr. 4	8	5	October	December	3

Source: Survey 2007

Table 3.16: Activity Centres Profile Used For Qtr. 4

Activity Centres	Space Area (m^2)	Actual Demand Hour in Qtr. 3	Forecast Demand Hour in Qtr. 3	Smoothing Constant
Design & Engineering **(D&E)**	100	73	111.95	0.98
Turning **(TRN)**	200	80	90.05	0.99
Milling **(MIL)**	200	30	79.08	0.99
Welding & Cutting **(W&C)**	150	148	109.58	0.99
Assembly & Finishing **(A&F)**	150	87	114.36	0.99
Electrical W/Shop **(ELECT)**	100	37	26.10	0.98
Wood W/Shop **(WOOD)**	100	37	22.94	0.97
Others (Admin. Block) **(ADM)**	200	n.a	n.a	n.a

Source: Survey 2007

Table 3.17: Manpower Utilisation Factor and Timing Factors Used For Qtr. 4

Activity Centres	Manpower Utilisation Factor	Average Waiting Time (Minutes)	Manpower Time Factor (%)	Utility Time Factor (%)
Design & Engineering **(D&E)**	0.75	40	12	80
Turning **(TRN)**	0.80	115	22	80
Milling **(MIL)**	0.80	100	22	80
Welding & Cutting **(W&C)**	0.85	72	13	80
Assembly & Finishing **(A&F)**	0.80	110	5	80
Electrical W/Shop **(ELECT)**	0.80	25	12	80
Wood W/Shop **(WOOD)**	0.75	42	30	80

Source: Survey 2007

Table 3.18: Material /Inventory Record Used For Qtr. 4

Types of Material	Forecast Quantity in Qtr. 3 (Hr)	Actual Quantity in Qtr. 3 (Hr)	Smoothing Constant	Forcast Quantity for Qtr. 4
Mild Steel Rod (Low Grade)	60.92	50	0.99	51
Mild Steel Rod (High Grade)	56.94	55	0.98	53
Mild Steel Sheet (Low Grade)	12.20	25	0.99	25
Mild Steel Sheet (High Grade)	72.80	78	0.95	78
Wood	58.75	63	0.96	63
Cable Wire	81.38	81	0.97	82

Source: Survey 2007

Table 3.19: Cost of Purchase, Holding and Set up of Material/Inventory Used Qtr. 4

Types of Material	Purchase Cost/Unit (Average) (₦)	Holding Cost/Unit (Average) (₦)	Set up Cost/Unit (Average) (₦)	Total For Purchase (₦)	Usage Price (₦)
Mild Steel Rod (Low Grade)	326	0.65	0.88	327.53	360.28
Mild Steel Rod (High Grade)	360	0.55	0.78	361.33	397.46
Mild Steel Sheet (Low Grade)	455	1.25	0.90	457.15	502.87
Mild Steel Sheet (High Grade)	475	1.10	0.90	477.00	524.70
Wood	115	1.20	0.95	117.15	128.87
Cable Wire	40	0.45	0.23	40.68	44.75

Source: Survey 2007

Table 3.20: Average Monthly Salary of Manpower/Personnel Used For Qtr. 4

Activity Centres	Monthly Salary (₦)	Monthly Salary (₦)	Monthly Salary (₦)	Monthly Salary (₦)	Monthly Salary (₦)	Monthly Salary (₦)	No of Staff
D&F	6,200	6,200	6,700				3
TRN	10,200	7,700	5,200				3
MIL	10,200	7,700					2
W&C	10,200	7,200					2
A&F	7,200	7,200	7,200	7,200			4
ELECT	6,700	6,200	6,200				3
WOOD	6,200	6,200	6,200				3
ADM	10,200	10,200	8,700	8,700	7,200	6,700	6

Source: Survey 2007

Table 3.21: Cost of Purchase, Installation, and Expected Usage Year of Available Equipment in Production Section of the Company Used For Qtr. 4

Activity Centres	Equipment	I	II	III	Total No of Equipment
D&E	Equipment Code	DE 001	DE 002	DE 003	3
	Purchase Cost (₦)	9,500	10,000	8,000.	
	Installation Cost (₦)	2,000	2,000	2,500	
	Expected Usage Year	2	2	2	
TRN	Equipment Code	TRN 001	TRN 002		2
	Purchase Cost (₦)	450,000	650,000		
	Installation Cost (₦)	75,000	120,000		
	Expected Usage Year	10	10		
MIL	Equipment Code	MLL 011			1
	Purchase Cost (₦)	700,000			
	Installation Cost (₦)	100,000			
	Expected Usage Year	10			
W&C	Equipment Code	WDC 001	WDC 002	WDC 003	3 Sets
	Purchase Cost (₦)	30,000	25,000	40,000	
	Installation Cost (₦)	5,000	5,000	5,000	
	Expected Usage Year	4	4	4	
A&F	Equipment Code	ASF 001	ASF 002	ASF 003	3 Sets
	Purchase Cost (₦)	10,000	15,000	12,000	
	Installation Cost (₦)	2,000	1,500	3,000	
	Expected Usage Year	5	5	5	
ELECT	Equipment Code	ELE 001			1 Set
	Purchase Cost (₦)	13,000			
	Installation Cost (₦)	4,000			
	Expected Usage Year	4			
WOOD	Equipment Code	WDW 001			1 Set
	Purchase Cost (₦)	20,000			
	Installation Cost (₦)	5,000			
	Expected Usage Year	5			

Source: Survey 2007

Table 3.22: Building Maintenance Cost and Utility Costs Used For Qtr. 4

	Cost for Qtr. 1 (₦))	Cost for Qtr. 2 (₦)	Cost for Qtr. 3 (₦)
Building Maintenance:	42,000	37,000	36,850
Utilities:	16,000	18,000	18,240

Source: Survey 2007

Table 3.23: Maintenance Cost of Tools & Equipment in Production Sections Used For Qtr. 4

Activity Centres	Maintenance Cost for Qtr. 1 (₦)	Maintenance Cost for Qtr. 2 (₦)	Maintenance Cost for Qtr. 3 (₦)
D&E	10,000	10,500	9,000
TRN	18,000	20,000	19,500
MIL	12,000	18,000	17,500
W&C	11,000	11,500	10,600
A&F	6,000	6,500	6,450
ELECT	10,000	11,000	10,200
WOOD	12,300	12,000	11,250

Source: Survey 2007

Table 3.24: Management Values and Decisions on Manpower Used For Qtr. 4

Activity Centres	Likely Salary for New Manpower (₦)	Likely hourly cost for Part Time Manpower (₦)	Cost of Transfer a Manpower (₦)
D&E	6,000	200	n.a
TRN	8,000	200	100
MIL	8,000	200	100
W&C	7,500	200	100
A&F	6,500	150	100
ELECT	6,000	150	100
WOOD	5,000	150	100

Source: Survey 2007

Table 3.25: Management Values and Decisions with Relation to Tools and Equipment Used For Qtr. 4

Activity Centres	Likely Cost of a unit Equipment (₦)	Likely Cost/hr of Hiring a unit Equipment (₦)	Likely Cost/hr of Contracting out a job (₦)
D&E	10,000	250	150
TRN	600,000	n.a	500
MIL	750,000	n.a	500
W&C	35,000	500	700
A&F	15,000	500	700
ELECT	15,000	400	600
WOOD	25,000	400	600

Source: Survey 2007

Table 3.26: Operational Sequence, Processing Time and Material to be Used for Jobs Processed in Qtr. 4

Job Code	Arrival Date	Operational Sequence With Estimated Processing Time (Hr)					Material /Inventory To be used with Quantity			
		1st Operation	2nd Operation	3rd Operation	4th Operation	5th Operation				
10/001	04/10/2007	DE (4)	WC (5)	TRN (7)	MLL (5)	AF (3)	MRH (5)	MRL (2)		
10/002	04/10/2007	DE (4)	TRN (8)	AF (3)			Nil	Nil		
10/003	09/10/2007	DE (4)	WC (3)	MLL (8)	TRN (7)	AF (3)	MRH (6)	MRL (2)		
10/004	19/10/2007	DE (4)	MLL (6)	AF (3)			MRH (4)			
10/005	10/10/2007	DE (4)	WC (4)	TRN (7)	AF (3)		Nil			
10/006	18/10/2007	DE (4)	WC (5)	MLL (6)	AF (3)		MRH (13)			
10/007	19/10/2007	DE (4)	WC (4)	TRN (7)	AF (3)		Nil			
10/008	24/10/2007	DE (4)	TRN (8)	AF (3)			Nil			
10/009	24/10/2007	DE (6)	WC (8)	AF (4)			MRL (3)	MSH (8)		
10/010	24/10/2007	DE (5)	WC (5)	TRN (7)	MLL (7)	AF (3)	MRH (17)	MRL (10)	WOD (17)	CAB (10)
11/001	05/11/2007	DE (6)	WC (13)	AF (10)			MRL (10)	MSH (12)	MSL (7)	
11/002	06/11/2007	DE (4)	WC (7)	ELECT(10)	AF (3)		MRH (4)	MSH (5)	WOD (6)	CAB (26)
11/003	06/11/2007	DE (5)	WC (22)	AF (14)			MRH (10)	MRL (18)	MSL (2)	
11/004	07/11/2007	DE (4)	TRN (8)	AF (3)			Nil	Nil	Nil	
11/005	12/11/2007	DE (4)	TRN (8)	MLL (9)	WC (4)	AF (3)	MRH (10)	MRL (10)		
11/006	15/11/2007	DE (5)	MLL (10)	TRN (5)	WC (4)	AF (3)	MRH (21)	MSH (10)	WOD (10)	CAB (15)
11/007	20/11/2007	DE (4)	TRN (7)	AF (3)			Nil	Nil	Nil	Nil
11/008	20/11/2007	DE (5)	WC (5)	TRN (10)	AF (5)		MRH (6)	MRL (4)	MSH (8)	WOD (6)
11/009	20/11/2007	DE (4)	TRN (8)	MLL (8)	WC (4)	AF (4)	MRH (6)	MRL (4)		
11/010	22/11/2007	DE (4)	WC (4)	AF (4)			MRL (4)	MSH (8)		
11/011	22/11/2007	DE (4)	WC (11)	AF (7)			Nil	Nil		
11/012	22/11/2007	DE (4)	WC (5)	MLL (11)	AF (5)		MRH (5)			
11/013	22/11/2007	DE (4)	MLL (8)	WC (4)	AF (3)		MRH (4)			
12/001	06/12/2007	DE (4)	WC (7)	ELECT (11)	WOOD (10)	AF (3)	MRH (5)	MSH (7)	WOD (12)	CAB (30)
12/002	10/12/2007	DE (4)	TRN (9)	MLL (9)	WC (6)	AF (4)	MRH (6)	MSH (4)		
12/003	10/12/2007	DE (4)	WC (15)	AF (10)			MRL (7)	MSH (14)		
12/004	10/12/2007	DE (4)	WC (4)	ELECT (13)	WOOD (11)	AF (7)	MRH (10)	MSH (10)	WOD (7)	CAB (27)
12/005	18/12/2007	DE (4)	WC (7)	TRN (9)	MLL (9)	AF (5)	MRH (12)	MRL (10)	WOD (4)	

Source: Survey 2007

Key:

Codes Related To Operational Sequence		Codes Related To Material/Inventory	
DE	Design and Engineering Process	**MSL**	Mild Steel Sheet (Low Grade)
TRN	Turning Process	**MSH**	Mild Steel Sheet (High Grade)
MLL	Milling Operation	**MRL**	Mild Steel Rod (Low Grade)
WC	Welding and Cutting Process	**MRH**	Mild Steel Rod (High Grade)
ELECT	Electrical Work	**WOD**	Wood
WOOD	Wood/Carpentry Work	**CAB**	Cable Wire
AF	Assembly and Finishing Process	**( )**	
( )	Processing Times (in Hour) are inserted in the Brackets		Quantity of the material are put in the Brackets

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 PRE-IMPLEMENTATION AND POST IMPLEMENTATION RESULTS

This section presents the results obtained from pre-implementation and during implementation period of the model. The results from Qtr. 1 and Qtr. 2 were got when the model has not been used and the production planning and control in the company was based on the intuitive of the production manager. While the results from Qtr. 3 and Qtr. 4 emerged when the model along with the software are being used. The results considered were Job Frequency, Variation between the Due Dates and the Completion Dates, Capacity Utilisation as well as Cash flow analysis. These results were statistically analysed using Statistical Package for the Social Sciences (SPSS) and the implications of the results on the Production Planning and Control were also discussed.

4.2 JOB FREQUENCY

There are eighty-eight (88) jobs processed during the whole period (Qtr. 1, 2, 3 and 4). Table 4.1 and 4.2 show the frequency of the job with relation to Job Descriptions and Quarterly distribution respectively. Also Fig. 4.1 shows the pictorial view of the job frequency with relation to the Quarters.

Table 4.1 Frequency with Relation to Job Description

Name of Job

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Water Tank	7	8.0	8.0	8.0
	Cylinder Boring	11	12.5	12.5	20.5
	Machine Parts	25	28.4	28.4	48.9
	Local Oven	13	14.8	14.8	63.6
	Shaft Cutting	14	15.9	15.9	79.5
	Metal doors	3	3.4	3.4	83.0
	Burglary Proof	5	5.7	5.7	88.6
	Metal Window	1	1.1	1.1	89.8
	Metal Door & Window	1	1.1	1.1	90.9
	Cutting of Gear	3	3.4	3.4	94.3
	Cutting of Pulley	3	3.4	3.4	97.7
	Metal Chair	1	1.1	1.1	98.9
	Repair of Chair	1	1.1	1.1	100.0
	Total	88	100.0	100.0	

Table 4.2 Distribution of Jobs on Quarterly Basis

Type of Quarter

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Quarter 1 (Pre-usage of Computer)	21	23.9	23.9	23.9
	Quarter 2 (Preusage of Computer)	19	21.6	21.6	45.5
	Quarter 3 (Post-usage of Computer)	20	22.7	22.7	68.2
	Quarter 4 (Post-usage of Computer)	28	31.8	31.8	100.0
	Total	88	100.0	100.0	