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ROUTES TO PROFITABILITY:

Operating Controls For Small Manufacturers

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ROUTES TO PROFITABILITY: OPERATING CONTROLS FOR SMALL MANUFACTURERS

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INTRODUCTION

Many new manufacturing businesses are able to operate profitably through the first few periods with little in the way of formal systems and controls. However, to sustain a profitable manufacturing business through changing business cycles requires more than intuitive management, even if the operation remains small. And if the operation begins to grow, the lack of formal controls will not allow the manufacturer to make informed decisions necessary to sustain that growth and ensure profitability.

This book is one of a series of four operating controls guides written and prepared by the Manitoba Institute of Management Inc. (MIM). They have been produced through funding from Industry, Science and Technology Canada for the Research and Advocacy Program of the *Canadian Aboriginal Economic Development Strategy*, and are designed to assist Aboriginal people across Canada to make informed decisions to maximize business profitability. The titles in the series are:

Small Retailers
Small Wholesalers
Small Service Business
Small Manufacturers

These guides are available by contacting an Aboriginal Business Development Program Officer in your region about your proposed business project.

Although all aspects of the manufacturing business are important, this book has identified two key areas as *critical operating concerns.* "Bottom End" Operations Control and "Top End" Operations Monitoring are essential to the effective management of any manufacturing firm.

"Bottom End" Operations Control simply means that the manufacturer must know all costs of production and be in a position to control them. These costs include the direct material and direct labour that go into a unit of production, and the appropriate amount of overhead expense assigned to each unit of production. To have control of these costs means the manufacturer can competitively price products. Consequently, the manufacturing operation should report good financial results. "Top End" Operations Monitoring procedures are required to keep the "Bottom End" controls in check.

Accordingly, this guide book is divided into two parts:

PART A "Bottom End" Operations Control

PART B "Top End" Operations Monitoring

Each part first identifies the critical operating concern. The guide then takes you through a sequence of steps and illustrated examples. Once you have a grasp of the concepts you can begin to implement your own system using the forms in the back of this book. Should you have questions about the information in this book, please contact the business development officer who provided it to you.

THIS GUIDE IS DESIGNED TO ASSIST THE READER TO MAKE INFORMED DECISIONS TO MAXIMIZE PROFITABILITY BUT CANNOT GUARANTEE SUCCESS IN BUSINESS.

NOTE THAT THE EXAMPLES USED ARE NOT OF ANY ACTUAL BUSINESSES AND ARE PROVIDED SOLELY FOR THE PURPOSES OF EXPLAINING THE ELEMENTS OF AN OPERATING CONTROLS SYSTEM.

PART A
"BOTTOM END"
OPERATIONS CONTROL

CRITICAL OPERATING CONCERN. The manufacturer requires a method to control and report all costs of production, direct and overhead. Otherwise, there is little basis for pricing products competitively and profitably. In instances where production methods lead to costs of production that are too high to meet competitive prices, the manufacturer cannot take remedial action without effective controls to identify costs of production.

COST CONTROLS FOR DIRECT LABOUR AND MATERIAL

Whether you are a small manufacturer with few products or a larger "growth" manufacturer with several products, the approach is the same. Follow the steps outlined below.

STEP 1 Set up a cost sheet for each product similar to the example in Figure 1. Notice that the sheet is prepared in four sections:

SECTION A	Labour Cost
SECTION B	Material Cost
SECTION C	Overhead
SECTION D	Cost Summary

(For the moment, disregard Sections C and D.)

This procedure is a "shortcircuited" version of the normal procedure in which you would record all inputs at all times. The assumption, of course, is that the interval you pick to fill in the cost sheet represents the total situation. In the illustrated examples which follow, ABC Manufacturing Ltd. produces one product, a #3 switch box. A larger manufacturer with several products would prepare a cost sheet for each product.

STEP 2 Use the cost sheet as a monitoring device. Note that in Figure 2, ABC Manufacturing Ltd. repeats the above procedure in July when another production run begins. Section D, now filled in, keeps track of the costing for each production run. The reasons for this costing might include changed manufacturing methods, new production workers, or lack of confidence in prior estimates.

EXAMPLE: ABC MANUFACTURING LTD.

Figure 1
COST SHEET

Description: #3 Switch Box									
Quantity: 100									
A.	LABOUR COST					C.	OVERHEAD		
DATE	DEPARTMENT	OPERATION	HOURS	RATE	AMOUNT		RATE	AMOUNT	
May 8		Lathe	3	$14.00	$42.00				
May 9		Weld	15	8.00	120.00				
May 9		Glue	10	8.00	80.00				
May 10		Spray	7	10.00	70.00				
TOTAL					$312.00	TOTAL			

B.	MATERIAL COST				D.	COST SUMMARY		
DATE	DESCRIPTION	QUANTITY	PRICE	AMOUNT		ESTIMATE Date: May	ESTIMATE Date: July	VARIANCE
May 8	Type 'A' Steel	100	$3.00	$300.00				
May 9	Switch #10	200	1.00	200.00				
May 9	Screws & Nuts	1,000	.16	160.00				
May 10	Red Paint	3	10.00	30.00				
TOTAL				$690.00	TOTAL			

On May 8, a normal production run of 100 #3 Switch Boxes begins. Simply keep track of the direct labour and direct material costs on the Cost Sheet as the batch of 100 switch boxes is completed. At the end of the production run the Cost Sheet should look like the example above.

EXAMPLE: ABC MANUFACTURING LTD.

Figure 2

COST SHEET

Description:	#3 Switch Box
Quantity:	100

A.	LABOUR COST					C.	OVERHEAD		
DATE	DEPARTMENT	OPERATION	HOURS	RATE	AMOUNT		RATE	AMOUNT	
May 8		Lathe	3	$14.00	$42.00				
May 9		Weld	15	8.00	120.00				
May 9		Glue	10	8.00	80.00				
May 10		Spray	7	10.00	70.00				
TOTAL					$312.00	TOTAL			

B.	MATERIAL COST				D.	COST SUMMARY		
DATE	DESCRIPTION	QUANTITY	PRICE	AMOUNT		ESTIMATE Date: May	ESTIMATE Date: July	VARIANCE
May 8	Type 'A' Steel	100	$3.00	$300.00				
May 9	Switch #10	200	1.00	200.00	Labour	$312.00	$336.96	(24.96)
May 9	Screws & Nuts	1,000	.16	160.00	Material	690.00	745.20	(55.20)
May 10	Red Paint	3	10.00	30.00	Overhead	209.00	225.72	(16.72)
TOTAL				$690.00	TOTAL	$1,211.00	$1,307.88	(96.88)

In July another production run of 100 #3 Switch Boxes begins. Section D of the Cost Sheet has now been completed. Disregard the information on Overhead for the time being.

Direct Labour has increased from $312.00 to $336.96, a total of an 8% increase in direct costs in a two month period. If there are no other changes, this increase will reduce profits by a corresponding amount.

This should alert you that either a price increase is in order, or that a cost reduction program may be necessary.

OVERHEAD COST ASSIGNMENTS

For effective operations control, manufacturers must determine the amount of overhead cost to assign to the finished product. The procedure varies for a small manufacturer with few products and a larger "growth" manufacturer with several products.

The Small Manufacturer (one product)

STEP 1 Identify overhead costs. These are all costs other than direct labour and material. They include, for example, salaries, interest expense, utilities, insurance, taxes, depreciation and supplies.

STEP 2 Identify direct labour costs. The "wage cost" for the same period is a good approximation.

STEP 3 Calculate the "*burden rate*". The burden rate tells you how much overhead cost to assign for every dollar of direct labour cost. Use the following formula:

$$\text{BURDEN RATE} = \frac{\text{Overhead Costs}}{\text{Direct Labour Costs}}$$

STEP 4 Complete Section D of the cost sheet as illustrated in Figure 2. With the addition of overhead costs to direct labour and material costs, all costs have been assigned to a unit of production.

EXAMPLE: ABC MANUFACTURING LTD.

(1) **Overhead Costs** including salaries, interest expense, utilities, insurance, taxes, depreciation, supplies, etc. are $400,000.00 for the previous year.

(2) **Wage Costs** for the same period are $600,000.00. These include the wages of production workers. All other (eg. foremen's wages, bookkeeper's salary, etc.) are included as a cost of overhead.

(3) **Burden Rate:**

$$\text{Burden Rate} = \frac{\text{Overhead Costs}}{\text{Direct Labour Costs}}$$

$$= \frac{\$400{,}000.00}{\$600{,}000.00}$$

$$= \$.67 \text{ per dollar of direct labour}$$

Simply stated, for every dollar of direct labour, $.67 of overhead is assigned to the cost of the product. In Figure 2, 100 units of #3 Switch Boxes required $312.00 of direct labour. The overhead cost, therefore, was $209.04 ($312.00 x $.67) or $2.09 per unit of output.

(4) See Section D of Figure 2.

The Larger "Growth" Manufacturer (several products)

STEP 1 Set up an overhead distribution sheet similar to the example in Figure 3. The objective is to assign all overhead costs to production centres or departments.

STEP 2 Across the top of the form write in the service centres and production centres that exist in your firm. A service centre is an area of cost that does not actually generate production output, such as administration, quality control or purchasing. Note that five columns are allowed on the form, but you can add more if necessary. A production centre represents an actual step in the production sequence, such as machining, welding, plating, painting, or assembly. Again, five columns are allowed, but you can add more to suit your own requirements.

STEP 3 Identify all overhead costs which will include salaries, indirect labour, interest expense, utilities, and so on.

STEP 4 Allocate all overhead costs to service and production centres.

STEP 5 Re-allocate the overhead costs (originally distributed to service centres) to production centres.

STEP 6 Calculate production centre "burden rates" for each production centre using the following formula:

$$\frac{\text{Production Centre Overhead}}{\text{Production Centre Direct Labour Costs}}$$

STEP 7 Complete Sections C and D of the cost sheet as illustrated in Figure 4. With the addition of overhead costs, all costs have been assigned to a unit of production.

EXAMPLE: ABC MANUFACTURING LTD.

Figure 3 Overhead Distribution Sheet

OVERHEAD DESCRIPTION	TOTAL	SERVICE CENTRE					PRODUCTION CENTRE				
		A Admin.	B Bldg.	C Equip. Main.	D	E	Machining	Assembly	Painting		
Salaries	$80,000.00	$60,000.00	$4,000.00	$4,000.00			$4,000.00	$4,000.00	$4,000.00		
Indirect Labour	100,000.00	-	20,000.00	18,000.00			16,000.00	22,000.00	24,000.00		
Interest	20,000.00	-	6,000.00	2,000.00			8,000.00	2,000.00	2,000.00		
Utilities	30,000.00	-	6,000.00	-			10,000.00	8,000.00	6,000.00		
Taxes & Insurance	10,000.00	-	2,000.00	2,000.00			2,000.00	2,000.00	2,000.00		
Building Depreciation	40,000.00	-	40,000.00	-			-	-	-		
Equipment Depreciation	50,000.00	6,000.00	4,000.00	4,000.00			16,000.00	8,000.00	12,000.00		
Supplies	60,000.00	10,000.00	4,000.00	14,000.00			14,000.00	10,000.00	8,000.00		
Miscellaneous	10,000.00	4,000.00	-	-			2,000.00	2,000.00	2,000.00		
DISTRIBUTION TOTAL	400,000.00	80,000.00	86,000.00	44,000.00			72,000.00	58,000.00	60,000.00		
A. Administration		(80,000.00)	10,000.00	10,000.00			40,000.00	16,000.00	4,000.00		
B. Building			(96,000.00)	6,000.00			60,000.00	20,000.00	10,000.00		
C. Equipment Maintenance				(60,000.00)			48,000.00	6,000.00	6,000.00		
D.											
E.											
ALLOCATION TOTAL							220,000.00	100,000.00	80,000.00		
DIRECT LABOUR DOLLARS							200,000.00	300,000.00	100,000.00		
BURDEN RATE							1.10	.33	.80		

Note that all overhead is finally distributed to the three production centres and a burden rate is calculated for each.

(2) Five columns are allowed for service centres and five columns for production centres. In the example, the service centres are "*Administration*", "*Building*", and "*Equipment Maintenance*". Other possibilities are "*Quality Control*", "*Purchasing*", and so on. The production centres are "*Machining*", "*Assembly*", and "*Painting*". Other possibilities are "*Welding*" or "*Plating*".

(3) Overhead costs are identified as follows:

Salaries	$ 80,000.00
Indirect Labour	100,000.00
Interest	20,000.00
Utilities	30,000.00
Taxes and Insurance	10,000.00
Building depreciation	40,000.00
Equipment depreciation	50,000.00
Supplies	60,000.00
Miscellaneous	10,000.00
	$400,000.00

Remember not to include direct labour and direct material, but also remember that no other cost should be omitted.

(4) Allocating each overhead cost to service and production centres requires use of the imagination. Examine how salaries of $80,000.00 are distributed. In this case "salaries" include those of the president and the controller and the $80,000.00 cost is really allocated the way they feel they devote their time.

Administration (including selling)	75%
Building Functions	5%
Supervising Equipment Maintenance	5%
Supervising Machining	5%
Supervising Assembly	5%
Supervising Painting	5%
	100%

Therefore, the salary overhead is distributed accordingly in terms of how the time is spent.

The $100,000.00 indirect labour cost is really allocated the way three production supervisors and a janitor feel they spend their time.

Administration	0%
Cleaning the building (ie. janitor)	20%
Supervising Equipment Maintenance	18%
Supervising Machining	16%
Supervising Assembly	22%
Supervising Painting	24%
	100%

The process goes on until each overhead expense category is distributed, including:

- the distribution of capital financing to the building and various items of equipment used by each centre to allocate interest expense;
- the distribution of floor space to each centre to allocate the tax expense.

(5) Now, all overhead costs allocated to service centres are re-allocated to production centres. You can do this effectively if you have ranked the service centres in terms of relative amount of service provided to other service centres. This ranking should have occurred in (2) above. Simply stated, relatively more "*Administration*" goes into "*Building*" and "*Equipment Maintenance*" than, say, "*Equipment Maintenance*" goes into "*Administration*".

Next, write in the service centre descriptions in the lower lefthand corner of Figure 3 in the same order that they appear across the top of the sheet. For each service centre, re-allocate the amount of overhead initially assigned to the remaining service centres and production centres.

In the example, $80,000.00 of administrative overhead costs have to be re-allocated. Labour hours in each centre were used to reflect the amount of administrative support that was likely required. Notice that $10,000.00 is distributed to each of the remaining service centres first before the production centres are even considered. These amounts then increase the "*Building*" overhead and "*Equipment Maintenance*" overhead that have to be similarly redistributed.

Building overhead is redistributed to the remaining service centre and production centres on the basis of square footage devoted to each. And the process continues until all service centre overhead has been re-allocated to production centres as illustrated in Figure 3.

(6) Finally, production centre burden rates are calculated for each production centre. Before you can do this you will have to allocate the dollars of direct labour (eg. wages of the production workers not including those already counted as overhead) to each production centre. If you keep time sheets this will not be an onerous task.

$$\text{Production Centre Burden Rate} = \frac{\text{Production Centre Overhead}}{\text{Production Centre Direct Labour Dollars}}$$

$$\text{"}\textit{Machining}\text{" Burden Rate} = \frac{\$220{,}000.00}{\$200{,}000.00} = \$1.10 \text{ per dollar of direct labour}$$

$$\text{"}\textit{Assembly}\text{" Burden Rate} = \frac{\$100{,}000.00}{\$300{,}000.00} = \$.33 \text{ per dollar of direct labour}$$

$$\text{"}\textit{Painting}\text{" Burden Rate} = \frac{\$80{,}000.00}{\$100{,}000.00} = \$.80 \text{ per dollar of direct labour}$$

EXAMPLE: ABC MANUFACTURING LTD.

Figure 4 Cost Sheet

Description: #3 Switch Box

Quantity: 100

A.	LABOUR COST					C.	OVERHEAD		
DATE	DEPARTMENT	OPERATION	HOURS	RATE	AMOUNT		RATE	AMOUNT	
May 8	Machinery	Lathe	3	$14.00	$42.00		$1.10	$46.20	
May 9	Assembly	Weld	15	8.00	120.00		.33	39.60	
May 9	Assembly	Glue	10	8.00	80.00		.33	26.40	
May 10	Painting	Spray	7	10.00	70.00		.80	56.00	
TOTAL					$312.00	TOTAL		$168.20	

B.	MATERIAL COST				D.	COST SUMMARY		
DATE	DESCRIPTION	QUANTITY	PRICE	AMOUNT		ESTIMATE Date: May	ESTIMATE Date: July	VARIANCE
May 8	Type 'A' Steel	100	$3.00	$300.00				
May 9	Switch #10	200	1.00	200.00	Labour	$312.00		
May 9	Screws & Nuts	1,000	.16	160.00	Material	690.00		
May 10	Red Paint	3	10.00	30.00	Overhead	168.20		
TOTAL				$690.00	TOTAL	$1,170.20		

Section C has been completed using the individual departmental burden rates. With the addition of overhead costs in Section D, all costs of production have been assigned to a unit of production.

The cost sheet is a useful tool to identify all costs associated with a unit of production. For a smaller manufacturer (with only one product), the procedure is straight-forward, requiring the collection of direct labour and direct material cost as well as determining the amount of overhead that a unit of production should be assigned by using a company-wide "burden rate."

The larger manufacturer with several products will find departmental burden rates useful to allocate overhead costs to a unit of production. The amount of overhead assigned is proportional to the amount of input required from each production department. Units of production requiring proportionately more input from production departments where a high proportion of overhead has been assigned, such as a machining department, will be assigned more overhead than units of production requiring less of that department's input.

This more precise assignment of cost will enable the manufacturer to make more informed and profitable pricing decisions.

PART B
"TOP END"
OPERATIONS MONITORING

CRITICAL OPERATING CONCERN. A manufacturer who has achieved adequate "bottom end" control needs to ensure that this is transformed into a favourable financial result. Sales and production planning must take into account all of the inputs, including direct material, direct labour and overhead. The manufacturer needs these elements integrated into a monitoring format which provides a basis for controlling all costs of production.

QUANTITY OF PRODUCTION

To determine how much to produce, you begin with an estimate of how much can be sold and some idea of how much should be kept in inventory. With these estimates, the preparation of a sales and production plan is simple arithmetic.

STEP 1 Prepare a monthly unit sales forecast for the year as in the following example. Your forecast is based on an analysis of requirements by customers, territories, and salespeople.

EXAMPLE: ABC MANUFACTURING LTD

Monthly sales estimate

UNIT SALES FORECAST
#3 SWITCH BOX

January	250	July	700
February	150	August	750
March	250	September	700
April	400	October	650
May	550	November	550
June	650	December	400

STEP 2 Prepare a Sales and Production Plan as illustrated in Figure 5.

Figure 5 Sales and Production Plan

#3 SWITCH BOX				
MONTH	ESTIMATED SALES	PLANNED FINISHED GOODS INVENTORY END OF MONTH	PLANNED FINISHED GOODS INVENTORY BEGINNING OF MONTH	PRODUCTION REQUIREMENTS
January	250	1,550	1,600	200
February	150	1,500	1,550	100
March	250	1,450	1,500	200
April	400	1,400	1,450	350
May	550	1,350	1,400	500
June	650	1,300	1,350	600
July	700	1,250	1,300	650
August	750	1,200	1,250	700
September	700	1,150	1,200	650
October	650	1,100	1,150	600
November	550	1,050	1,100	500
December	400	1,000	1,050	350
TOTAL	6,000			5,400

The plan assumes that the beginning inventory of 1,600 units is to be reduced to 1,000 units by the end of the year and that this is accomplished by reducing inventory by 50 units a month. This means that production must vary throughout the year according to demand. With such a plan, production employees must be continually hired and laid off. In an actual situation you will have to determine whether it makes more sense to incur labour turnover costs (eg. recruitment and training) as in the above plan or to plan level production and let inventory buildup occur along with higher inventory costs.

QUANTITY OF RAW MATERIAL

To determine the quantity of raw material you should keep on hand you will need to know the quantity of each type required for each type of production unit.

STEP 1 Prepare a Direct Materials Budget similar to the example in Figure 6.

STEP 2 Transcribe to the Direct Materials Budget (as shown in Figure 6) information from the following sources:

"*Raw Material Name,*" "*Material Required per Unit,*" *and* "*Cost per Unit*" from the Cost Sheet for each product. (The Cost Sheet for the #3 Switch Box appears in Figure 4.)

"*Production Units Required*" from the Sales and Production Plan for each product. (See Figure 5 for the #3 Switch Box Sales and Production Plan.)

STEP 3 Plan to keep sufficient inventory on hand at the end of any month to cover production requirements over the period of an "*order lead time*" (the length of time taken to replenish stock once an order is placed with a supplier).

STEP 4 You can now use the completed Direct Materials Budget to monitor purchasing as well as to plan for it.

EXAMPLE: ABC MANUFACTURING LTD

Figure 6 Direct Materials Budget

DIRECT MATERIALS BUDGET ALL PRODUCTS									
				MATERIALS			PURCHASES		
MONTH	RAW MATERIAL NAME	PROD'N UNITS REQ'D	MATERIAL REQ'D PER UNIT	REQ'D FOR PROD'N	PLUS: RAW MATERIAL ENDING INVENTORY	LESS: RAW MATERIAL BEGINNING INVENTORY	TOTAL RAW MATERIAL REQ'D	COST PER UNIT	TOTAL COST
		+	x	=	+	-	=	x	=
Jan.	Type "A" Steel	200	1 sq. ft.	200 sq. ft.	450 sq. ft.	650 sq. ft.	0	$3.00/sq. ft.	-
	Switch #10	200	2	400	900	1,300	0	1.00 ea.	-
	Screws & Nuts	200	10	2,000	4,500	6,500	0	.16 ea.	-
	Red Paint	200	.03 gal.	6 gal.	13.5 gal.	19.5 gal.	0	$10.00/gal.	-
Feb.	Type "A" Steel	100	1 sq. ft.	100 sq. ft.	550 sq. ft.	450 sq. ft.	200 sq. ft.	$3.00/sq. ft.	$600.00
	Switch #10	100	2	200	1,100	900	400	1.00 ea.	$400.00
	Screws & Nuts	100	10	1,000	5,500	4,500	2,000	.16 ea.	$320.00
	Red Paint	100	.03 gal.	3 gal.	16.5 gal.	13.5 gal.	6 gal.	$10.00/gal.	$60.00
Mar.	Type "A" Steel	200	1 sq. ft.	200 sq. ft.	850 sq. ft.	550 sq. ft.	500 sq. ft.	$3.00/sq. ft.	$1,500.00
	Switch #10	200	2	400	1,700	1,100	1,000	1.00 ea.	$1,000.00
	Screws & Nuts	200	10	2,000	8,500	5,500	5,000	.16 ea.	$800.00
	Red Paint	200	.03 gal.	6 gal.	25.5 gal.	16.5 gal.	15 gal.	$10.00/gal.	$150.00
TOTAL	(All Products)								$900,000.00

(2) The information is transcribed as indicated from the Cost Sheet and Sales and Production Plan for each product. Note that in Figure 6 this is done only for the #3 Switch Box for each month. It is assumed that raw materials for other products would follow for each month.

(3) It has been assumed that when an order is placed it will be received in two months. Examine "*Type A Steel*". A physical inventory at year end determined that 650 square feet were available and that after 200 square feet were used for production in January, 450 square feet remained. This is more than sufficient to cover production requirements of 300 square feet for February and March combined. Therefore, raw material inventories of Type A Steel at the end of January are excessive.

Now look at February. Production requirements for Type A Steel for March and April are:

March 200 square feet
April 350 square feet (not shown in Figure 6)

Planned end-of-month Type A Steel inventories for February, therefore, are 550 square feet.

The same logic is applied for each raw material in each month.

(4) $900,000.00 is to be spent on direct materials purchasing for the year. The budget can now be used to implement the purchasing plan.

MANPOWER REQUIREMENTS

The Direct Labour Budget is a projection of manpower requirements in dollars for the implementation of the Sales and Production Plan.

STEP 1 Prepare a Direct Labour Budget similar to the example in Figure 7.

STEP 2 Transcribe to the Direct Labour Budget (as shown in Figure 7) information from the following sources:

"Process," "Required per Unit" and "Labour Rate" from the Cost Sheet for each product. The Cost Sheet for the #3 Switch Box appears in Figure 4.

"Production Units Required" from the Sales and Production Plan for each product. See Figure 7 for the #3 Switch Box Sales and Production Plan.

STEP 3 You can now use the completed Direct Labour Budget to monitor direct labour cost as well as to plan for it.

EXAMPLE: ABC MANUFACTURING LTD

Figure 7 Direct Labour Budget

DIRECT LABOUR BUDGET ALL PRODUCTS						
			DIRECT LABOUR HOURS			
MONTH	PROCESS	PROD'N UNITS REQ'D	REQ'D PER UNIT	TOTAL REQ'D	LABOUR RATE	DIRECT LABOUR COST
		+	x	=	x	=
Jan.	Lathe	200	.03 hr/unit	6 hrs.	$14.00/hr.	$84.00
	Weld	200	.15 hr./unit	30 hrs.	$8.00/hr.	$240.00
	Glue	200	.10 hr./unit	20 hrs.	$8.00/hr.	$160.00
	Spray	200	.07 hr./unit	14 hrs.	$10.00/hr.	$140.00
Feb.	Lathe	100	.03 hr./unit	3 hrs.	$14.00/hr.	$42.00
	Weld	100	.15 hr./unit	15 hrs.	$8.00/hr.	$120.00
	Glue	100	.10 hr./unit	10 hrs.	$8.00/hr.	$80.00
	Spray	100	.07 hr./unit	7 hrs.	$10.00/hr.	$70.00
Mar.	Lathe	200	.03 hr./unit	6 hrs.	$14.00/hr.	$84.00
	Weld	200	.15 hr./unit	30 hrs.	$8.00 /hr.	$240.00
	Glue	200	.10 hr./unit	20 hrs.	$8.00/hr.	$160.00
	Spray	200	.07 hr./unit	14 hrs.	$10.00/hr.	$140.00
TOTAL	(All Products)			60,000 hrs.		$600,000.00

(2) The information is transcribed as indicated from the Cost Sheet and the Sales and Production Plan for each product. Note that in Figure 7 this is done only for the #3 Switch Box for each month. It is assumed that raw materials for other products would follow.

(3) $600,000.00 is to be spent on direct labour for the year.

FACTORY OVERHEAD AND OPERATING EXPENSES

Manufacturing overhead is the final category, since you have already covered direct material and direct labour costs.

STEP 1 Prepare a Manufacturing Expense Budget similar to the example in Figure 8 so that you can treat the manufacturing overhead in the following categories:

FACTORY OVERHEAD Factory Employee Benefits Repair and Maintenance Factory Supplies Expense Utilities	**Variable Costs**
Factory Supervisory Salaries Property and Business Taxes Insurance Expense Depreciation	**Fixed Costs**
OPERATING EXPENSE Advertising Delivery Office Supplies	**Variable Costs**
Owner's Drawing Administrative Salaries Office Employee Benefits Dues and Licences Interest Legal and Audit Telephone Other	**Fixed Costs**

NOTE: If you are using *The One Book Accounting System: A Guide for Small Manufacturers*, you should assemble expense information in this format.

STEP 2 Determine the budget for Factory Overhead in the following manner:

You can estimate fixed costs for each element which you then add to arrive at a total. Fixed expenses do not generally fluctuate with changes in activity or output.

Variable costs fluctuate with changes in activity or output. You can often find a stable relationship between these costs and "*Direct Labour*" hours. Calculate the following ratio for the past several years.

$$\textbf{Rate for Variable Factory Overhead} = \frac{\text{Variable Factory Overhead Expenses}}{\text{Direct Labour Hours}}$$

Therefore: Variable Factory Overhead Expenses equals Rate times Planned Direct Hours.

Now add your fixed costs with your variable costs to determine your total factory overhead.

STEP 3 Determine the budget for Operating Expenses in the following manner:

You can estimate fixed costs for each element which you then add to arrive at a total. Fixed expenses do not generally fluctuate with changes in activity or output.

Variable costs normally vary most closely with sales. Calculate the following ratio for the past several years.

$$\textbf{Rate for Variable Operating Expenses} = \frac{\text{Variable Operating Expenses}}{\text{Sales}}$$

Therefore: Variable Operating Expenses equals Rate times Planned Sales.

Now add your fixed costs with your variable operating expenses to determine your total operating expenses.

STEP 4 Complete the Manufacturing Expense Budget by dividing the total amounts you have determined for both Factory Overhead and Operating Expenses into twelve months as illustrated in Figure 8.

EXAMPLE: ABC MANUFACTURING LTD

Figure 8 Manufacturing Expense Budget

TOTAL OPERATION									
MONTH	FACTORY OVERHEAD				OPERATING EXPENSE				TOTAL
	FIXED	VARIABLE			FIXED	VARIABLE			
		ACTIVITY (DIRECT LABOUR HOURS)	RATE	AMOUNT		ACTIVITY (SALES)	RATE	AMOUNT	
January	$8,334.00	2,222	1.33	$2,963.00	$13,334.00	$83,332.00	.03	$2,500.00	$27,131.00
February	8,334.00	1,112	"	1,482.00	13,334.00	50,000.00	"	1,500.00	24,650.00
March	8,334.00	2,222	"	2,963.00	13,334.00	83,332.00	"	2,500.00	27,131.00
April	8,334.00	3,889	"	5,186.00	13,334.00	133,334.00	"	4,000.00	30,854.00
May	8,333.00	5,555	"	7,407.00	13,333.00	183,334.00	"	5,500.00	34,573.00
June	8,333.00	6,667	"	8,890.00	13,333.00	216,666.00	"	6,500.00	37,056.00
July	8,333.00	7,222	"	9,629.00	13,333.00	233,334.00	"	7,000.00	38,295.00
August	8,333.00	7,778	"	10,368.00	13,333.00	250,000.00	"	7,500.00	39,534.00
September	8,333.00	7,222	"	9,629.00	13,333.00	233,334.00	"	7,000.00	38,295.00
October	8,333.00	6,667	"	8,890.00	13,333.00	216,666.00	"	6,500.00	37,056.00
November	8,333.00	5,555	"	7,407.00	13,333.00	183,334.00	"	5,500.00	34,573.00
December	8,333.00	3,889	"	5,186.00	13,333.00	133,334.00	"	4,000.00	30,852.00
TOTAL	$100,000.00	60,000 hrs.	1.33	$80,000.00	$160,000.00	$2,000,000.00	.03	$60,000.00	$400,000.00

(2) a - **Factory Overhead Fixed Costs** are estimated by category and sum to $100,000.00 for the year, 1/12 is allocated to each month.

b - **Factory Overhead Variable Costs**

$$\text{Rate for Variable Factory Overhead} = \frac{\text{Variable Factory Overhead Expenses}}{\text{Direct Labour Hours}} = \text{\$1.33 per hour (based upon past experience)}$$

Variable Cost = $1.33 x Planned Direct Labour Hours
= $1.33 x 60,000*
= $80,000.00

* from Direct Labour Budget (Figure 7)

(3) a - **Operating Expense Fixed Costs** are estimated by category and sum to $80,000.00

b - **Operating Expense Variable Costs**

$$\text{Rate for Variable Operating Expense} = \frac{\text{Variable Operating Expenses}}{\text{Sales}} = \text{.03 or 3\% of sales (based upon past experience)}$$

Variable Cost = .03 x Planned Sales
= .03 x $2,000,000.00**
= $60,000.00

** from Sales and Production Plan (Figure 5). Note, however, that unit sales would first have to be converted to dollars and summed for all products. This is not shown in Figure 5.

(4) A completed Manufacturing Expense budget is illustrated in Figure 8.

PERFORMANCE EVALUATION

At this point, you have all the information you require. However, you need a presentation format which will enable you to compare the plan to the results reported through The One Book Accounting System for Manufacturers. This guide offers two models. The first is for the small manufacturer who has selected the simpler version of the One Book system. The second is for the larger "growth" manufacturer who has selected the more comprehensive version of the One Book system.

The Small Manufacturer

STEP 1 Prepare a Budgeted Income Statement similar in format to the example in Figure 9. Please note that the amounts entered in this example will not correspond with figures in the earlier illustrations because the information in Figure 9 reflects the operations of a small manufacturer.

STEP 2 Transpose the information from sources generated in the previous steps you have worked through.

STEP 3 Beginning and ending values for finished goods inventory are the only amounts that you will be unable to determine from previous steps. Use a worksheet similar to the example in Figure 10, Monthly Inventory Value, to estimate monthly inventory values. If you are using the One Book System for Manufacturers, you can estimate these amounts by using last year's figures as a guide.

EXAMPLE:

Figure 9 Budgeted Income Statement

SMALL MANUFACTURING COMPANY
BUDGETED INCOME STATEMENT
FOR THE PERIOD ENDED: March 31/90

Gross Sales					+	120	200	00	354	800	00
Less: Returns & Allowance					-	2	500	00	7	800	00
Equals: Net Sales					=	117	700	00	347	000	00
Less: Cost of Goods Sold											
Finished Goods - Beginning Inventory	+	56	400	00							
Plus: Cost of Goods Manufactured*	+	87	650	00							
Cost of Goods Available for Sale	=	144	050	00							
Less: Finished Goods - Ending Inventory	-	54	200	00							
Cost of Good Sold	=				-	89	850	00	265	100	00
Gross Profit					=	27	850	00	81	900	00
Less: Operating Expenses											
Variable Cost											
Advertising	+	4	525	00					13	575	00
Delivery	+	3	980	00					11	940	00
Office Supplies	+		420	00		8	925	00	1	260	00
Fixed Costs											
Owner - Salary	+	3	430	00					8	390	00
Administrative Salaries	+	5	100	00					15	300	00
Office Employee Benefits	+		700	00					2	100	00
Telephone	+		220	00						660	00
Interest	+		450	00					1	350	00
Dues and Licences	+		400	00					1	200	00
Legal and Audit	+		650	00					1	950	00
Other	+		825	00		11	775	00	2	475	00
Operating Expenses	=				-	20	700	00	60	200	00
Income from Operations					=	7	150	00	21	700	00
Plus: Other Income					+		237	00		690	00
Net Income Before Taxes					=	7	387	00	22	390	00
Less: Income Taxes					-	2	500	00	7	500	00
Net Income					=	4	887	00	14	890	00

Figure 10 Monthly Inventory Value

Year - 1990		$	%
January 1st	Inventory at Cost	$ 57,000.00	
Plus Jan.	Purchases at Cost (col. 19)	60,340.00	
Plus Jan.	Factory Expenses (cols. 21-29) Plus Depreciation	25,800.00	
Less Jan.	Net Sales at Cost	87,140.00	76%
February 1st	Inventory at Cost	56,000.00	
Plus Feb.	Purchases at Cost (col. 19)	62,130.00	
Plus Feb.	Factory Expenses (cols. 21-29) Plus Depreciation	25,400.00	
Less Feb.	Net Sales at Cost	87,130.00	76%
March 1st	Inventory at Cost	56,400.00	
Plus Mar.	Purchases at Cost (col. 19)	59,330.00	
Plus Mar.	Factory Expenses (col. 21 - 29) Plus Depreciation	27,920.00	
Less Mar.	Net Sales at Cost	89,450.00	76%
April 1st.	Inventory at Cost	54,200.00	
Plus Apr.	Purchases at Cost (col. 19)		
Plus Apr.	Factory Expenses (col. 21-19) Plus Depreciation		
Less Apr.	Net Sales at Cost		
	ETC.		

NOTE: The January 1st **Finished Goods Inventory** value of $57,000 is the actual cost value as determined by the year-end count. The cost of a unit of finished goods inventory includes the cost of direct material, direct labour, and factory overhead (e.g. factory employee benefits, repair and maintenance, factory supplies expense, utilitites, factory supervisory salaries, rent, property and business tax, insurance expense, and depreciation).

To the January 1st finished goods inventory value of $57,000 add the January purchases of $60,340 at cost, which is column 19 from the One Book for January. Then add Factory Expenses of $25,800 for January, which is the total of expenses from columns 21 to 29 inclusive from the One Book Expense Distribution, as well as the monthly depreciation expense. Then subtract January Net Sales at cost calculated as follows:

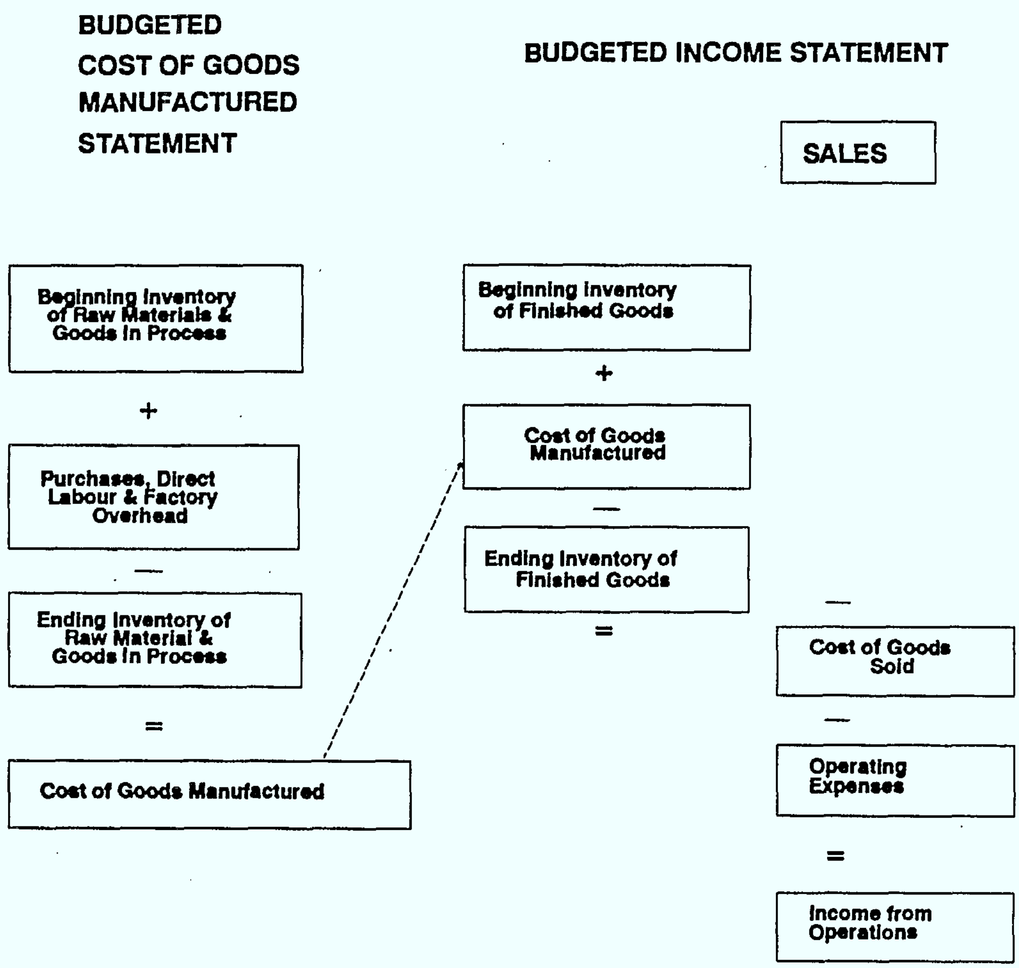
Gross Sales (Col. 17)
Less: Sales Returns (Col. 18)
Equals: Net Sales (at retail)
Times: Approximate Cost of Goods Sold Percentage of sales (e.g. 76% assumed on worksheet)*
Equals: Net Sales (at cost)

* The 76% is the same percentage used to estimate the cost component of one unit of finished goods inventory.

The result is finished goods ending inventory ($56,000) at cost. Simply follow the procedure each month so that you have a "running tally" of inventory valued at cost.

The Larger "Growth" Manufacturer

STEP 1 Prepare a Budgeted Statement of the Cost of Goods Manufactured (Figure 11a) and a Budgeted Income Statement (Figure 11b).



STEP 2 Transfer the information to the Budgeted Cost of Goods Manufactured Statement and the Budgeted Income Statement from information sources generated in previous steps.

STEP 3 Beginning and ending values for three classes of inventories are also used on the Budgeted Cost of Goods Manufactured Statement and the Budgeted Income Statement. They are determined as follows:

Raw Materials represent the unused portion of raw materials purchased. You determine the amount at the end of a period by taking a physical count of the raw materials which have not yet been placed in production.

Goods in Process consist of the partially completed goods on hand at the end of a period. Again, you determine the amount by taking a physical count. In order to cost these partially manufactured goods, you estimate the costs of raw materials, direct labour, and factory overhead associated with them.

Finished Goods include the finished goods on hand and awaiting sale to customers at the end of a period. The costs of these finished units are the sum of the raw materials, direct labour and factory overhead costs.

Use the Cost Sheet as illustrated in Figure 4 to value the above inventories.

STEP 4 The budgeted statements in Figures 11a and 11b have been prepared in the same format as statements reporting through the One Book System. Comparing the two provides you with an overall monitoring system for manufacturing operations.

EXAMPLE: ABC MANUFACTURING LTD

Figure 11a Budgeted Statement of Cost of Goods Manufactured

FOR THE PERIOD ENDED Dec. 31/90

GOODS IN PROCESS - Beginning Inventory				100 000 00 +
PLUS: RAW MATERIAL				
Beginning Inventory		+ 60 000 00		
PLUS: Purchases (Fig. 6)		+ 900 000 00		
EQUALS: Raw Material Available for Use		= 960 000 00		
LESS: Ending Inventory		- 40 000 00		
EQUALS: Cost of Raw Material Used		=	+ 920 000 00	
PLUS: Direct Labour (Fig. 7)			+ 600 000 00	
PLUS: Factory Overhead				
Variable Costs (Fig. 8)				
Factory Employee Benefits	+ 30 000 00			
Repair & Maintenance	+ 24 000 00			
Factory Supplies Expense	+ 10 000 00			
Utilities	+ 16 000 00			
TOTAL VARIABLE COSTS		+ 80 000 00		
Fixed Costs (Fig. 8)				
Factory Supervisory Salaries	+ 40 000 00			
Rent	+ 26 000 00			
Property and Business Taxes	+ 12 000 00			
Insurance Expense	+ 6 000 00			
Depreciation	+ 16 000 00			
TOTAL FIXED COSTS	=	+ 100 000 00		
FACTORY OVERHEAD		=	+ 180 000 00	
TOTAL MANUFACTURING COSTS			=	1 700 000 00 +
Total Cost of Goods in Process During the Period				1 800 000 00 =
LESS: Goods in Process - Ending Inventory				80 000 00 -
EQUALS: COST OF GOODS MANUFACTURED*				1 720 000 00 =

*entered on Income Statement Figure 11(b)

Figure 11b Budgeted IncomeStatement

FOR THE PERIOD ENDED Dec. 31/90

GROSS SALES			+	2 020 000 00		
LESS: Returns & Allowances			-	20 000 00		
EQUALS: NET SALES			=		2 000 000 00	+
LESS: Cost of Goods Sold						
Finished Goods - Beginning Iventory			+	220 000 00		
PLUS: Cost of Goods Manufactured*			+	1 720 000 00		
EQUALS: Cost of Goods Availabe for Sale			=	1 940 000 00		
LESS: Finished Goods - Ending Inventory			-	200 000 00		
EQUALS: COST OF GOODS SOLD			=		1 740 000 00	-
EQUALS: GROSS MARGIN					260 000 00	=
LESS: Operating Expenses						
Variable Costs (Fig. 8)						
Advertising	+	20 000 00				
Delivery	+	30 000 00				
Office Supplies	+	10 000 00				
TOTAL VARIABLE COSTS	=		+	60 000 00		
Fixed Costs (Fig. 8)						
Owner's Drawings	+	50 000 00				
Administrative Salaries	+	70 000 00				
Office Employee Benefits	+	10 000 00				
Dues & Licenses	+	2 000 00				
Interest	+	20 000 00				
Legal & Audit	+	4 000 00				
Telephone	+	2 000 00				
Other	+	2 000 00				
TOTAL FIXED COSTS	=		+	160 000 00		
OPERATING EXPENSES			=		220 000 00	-
EQUALS: INCOME FROM OPERATIONS					40 000 00	=
PLUS: Other Income					20 000 00	+
EQUALS: NET INCOME BEFORE TAXES					60 000 00	=
LESS: Income Taxes (if applicable)					20 000 00	-
EQUALS: NET INCOME					40 000 00	=

* From Budgeted Statement of Cost of Goods Manufactured, Figure 11(a)

PART A dealt with the assignment of all costs (direct material, direct labour, and overhead) to a unit of production and developed procedures to control these costs at the unit level. Following these procedures, you should be able to price competitively and profitably to ensure favourable financial results.

PART B has given you the means to ensure that this result is achieved through "Top End" operations monitoring. The year's operations are planned from the bottom up and by comparing actual results reported through the One Book System with budgeted amounts developed in similar formats in PART B, you should achieve an appropriate level of control over manufacturing operations.

APPENDIX
BLANK FORMS

Cost Sheet

Description:									
Quantity:									
A.	LABOUR COST					C.	OVERHEAD		
DATE	DEPARTMENT	OPERATION	HOURS	RATE	AMOUNT		RATE	AMOUNT	
TOTAL						TOTAL			
B.	MATERIAL COST					D.	COST SUMMARY		
DATE	DESCRIPTION	QUANTITY		PRICE	AMOUNT		ESTIMATE Date: May	ESTIMATE Date: July	VARIANCE
TOTAL						TOTAL			

Overhead Distribution Sheet

OVERHEAD DESCRIPTION	TOTAL	SERVICE CENTER					PRODUCTION CENTER				
		A.	B.	C.	D.	E.					
DISTRIBUTION TOTAL											
A.											
B.											
C.											
D.											
E.											
ALLOCATION TOTAL											
DIRECT LABOUR DOLLARS											
BURDEN RATE											

Sales and Production Plan

MONTH	ESTIMATED SALES	PLANNED FINISHED GOODS INVENTORY END OF MONTH	PLANNED FINISHED GOODS INVENTORY BEGINNING OF MONTH	PRODUCTION REQUIREMENTS
January				
February				
March				
April				
May				
June				
July				
August				
September				
October				
November				
December				
TOTAL				

Direct Labour Budget

DIRECT LABOUR BUDGET ALL PRODUCTS						
			DIRECT LABOUR HOURS			
MONTH	PROCESS	PROD'N UNITS REQ'D	REQ'D PER UNIT	TOTAL REQ'D	LABOUR RATE	DIRECT LABOUR COST
		+	x	=	x	=

Direct Materials Budget

DIRECT MATERIALS BUDGET ALL PRODUCTS									
				MATERIALS			PURCHASES		
MONTH	RAW MATERIAL NAME	PROD'N UNITS REQ'D	MATERIAL REQ'D PER UNIT	REQ'D FOR PROD'N	PLUS: RAW MATERIAL ENDING INVENTORY	LESS: RAW MATERIAL BEGINNING INVENTORY	TOTAL RAW MATERIAL REQ'D	COST PER UNIT	TOTAL COST
		+	x	=	+	-	=	x	=

Manufacturing Expense Budget

TOTAL OPERATION									
MONTH	FACTORY OVERHEAD				OPERATING EXPENSE				TOTAL
	FIXED	VARIABLE			FIXED	VARIABLE			
		ACTIVITY (DIRECT LABOUR HOURS)	RATE	AMOUNT		ACTIVITY (SALES)	RATE	AMOUNT	
January									
February									
March									
April									
May									
June									
July									
August									
September									
October									
November									
December									
TOTAL									

Budgeted Statement of Cost of Goods Manufactured

FOR THE PERIOD ENDED ______________

GOODS IN PROCESS - Beginning Inventory				+
PLUS: RAW MATERIAL				
Beginning Inventory		+		
PLUS: Purchases (Fig. 6)		+		
EQUALS: Raw Material Available for Use		=		
LESS: Ending Inventory		-		
EQUALS: Cost of Raw Material Used		=	+	
PLUS: Direct Labour (Fig. 7)			+	
PLUS: Factory Overhead				
Variable Costs (Fig. 8)				
Factory Employee Benefits	+			
Repair & Maintenance	+			
Factory Supplies Expense	+			
Utilities	+			
TOTAL VARIABLE COSTS	=	+		
Fixed Costs (Fig. 8)				
Factory Supervisory Salaries	+			
Rent	+			
Property and Business Taxes	+			
Insurance Expense	+			
Depreciation	+			
TOTAL FIXED COSTS	=	+		
FACTORY OVERHEAD		=	+	
TOTAL MANUFACTURING COSTS			=	+
Total Cost of Goods in Process During the Period				=
LESS: Goods in Process - Ending Inventory				-
EQUALS: COST OF GOODS MANUFACTURED*				=

Budgeted Income Statement

FOR THE PERIOD ENDED ____________________

GROSS SALES		+	
LESS: Returns & Allowances		-	
EQUALS: NET SALES		=	+
LESS: Cost of Goods Sold			
Finished Goods - Beginning Iventory		+	
PLUS: Cost of Goods Manufactured*		+	
EQUALS: Cost of Goods Availabe for Sale		=	
LESS: Finished Goods - Ending Inventory		-	
EQUALS: COST OF GOODS SOLD		=	-
EQUALS: GROSS MARGIN			=
LESS: Operating Expenses			
Variable Costs (Fig. 8)			
Advertising	+		
Delivery	+		
Office Supplies	+		
TOTAL VARIABLE COSTS	=	+	
Fixed Costs (Fig. 8)			
Owner's Drawings	+		
Administrative Salaries	+		
Office Employee Benefits	+		
Dues & Licenses	+		
Interest	+		
Legal & Audit	+		
Telephone	+		
Other	+		
TOTAL FIXED COSTS	=	+	
OPERATING EXPENSES		=	-
EQUALS: INCOME FROM OPERATIONS			=
PLUS: Other Income			+
EQUALS: NET INCOME BEFORE TAXES			=
LESS: Income Taxes (if applicable)			-
EQUALS: NET INCOME			=