Breakeven Analysis - Part 2

Results from Modern Purchasing Environments Non-recurring Expenditures Associated with Product Creation Projects

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Breakeven calculation approaches have been around for 70 years in their present form. Conventional wisdom asserts that enterprises produce goods for one standard cost and sell this at a previously identified optimum sales price to determine the highest profit. They thus ensure sufficient capacity to achieve this required volume. Hence, most entrepreneurs approach the problem by undertaking a series of breakeven calculations. This approach suggests an optimum production volume to maximise profit. The fundamental underlying perception is that manufacturing enterprises produce goods as independent entities. This article disputes this latter perception, presenting volume/profit data from a non-disclosed source as evidence.

Dual, multi, sole and single sourcing are strategies used by procurement functions to ensure their businesses obtain appropriate quality, low purchase price and reliable deliveries [1]. Such strategies emphasise long-term, profitable orders to suppliers. In return for these assurances, suppliers are required to be involved in new product creation processes [2], designing optimum manufacturing layouts and co-ordinating logistics.

This article examines conventional breakeven calculations by assuming a dual supplier scenario that takes account of two modern manufacturing paradigms: concurrent engineering [3] and customer supplier relationships. A non-attributed financial case study demonstrates significant differences in profitability profiles from the conventional theoretical smooth profit profile that results from competitive bidding and dual sourcing.

The article examines the benefits of undertaking the product creation aspects of the product life cycle. The article identifies various competitive strategies that extend from Porter's usual arguments and proposes a range of scenarios when the strategies can be used.

Conclusions focus on the need for suppliers to be aware of their customer's strategic procurement policies for various products and take account of these policies when estimating the profit they might expect when participating in sole, single, dual and multi-sourcing environments. Product creation processes can be as profitable as low volume production runs. Since investment can be significant, it may be more profitable for a company to focus on designing components, prototyping, pre-production runs, and process optimisation. Their aim therefore may be to develop and transfer knowledge on a consultative basis.

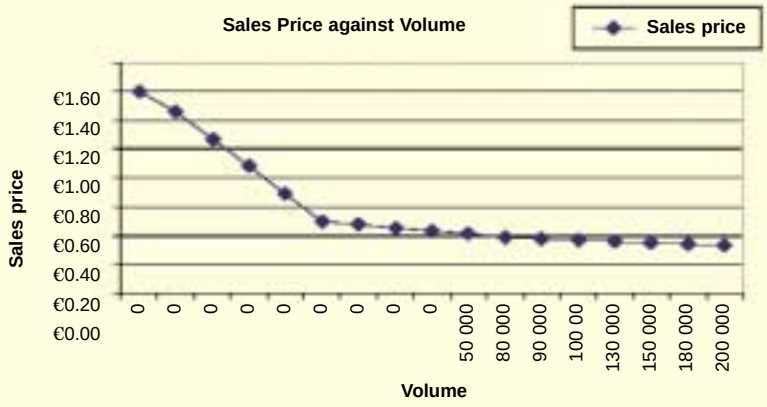
PROFITABILITY PROFILE RESULTS: THE COMPLEXITIES OF LIMITED VOLUME MARKET SECTORS AND COMPETITION

The automotive industry in various countries has typified both adversarial and partnership sourcing paradigms [4, 5, 6 and 7]. In order to reduce risks, increase competitive pressure on suppliers or globalise, the industrial buyer has the option of choosing from a number of strategic options including: single sourcing, sole sourcing, dual sourcing and multi-sourcing.

Multi-sourcing is the approach taken when parts are commodities or made to common specifications. This approach allows the buyer to acquire parts at the most competitive price, and forces each competitor to achieve this. The dual sourcing strategy is an effort to limit the number of suppliers to two, and consequently the costs of maintaining relationships are also reduced as a result of focus on process capable suppliers. Also, there may be volume or capacity constraints at suppliers that determine that two sets of tooling are required. Dual sourcing is an ideal method of gathering benchmarking data via key performance indicators. Single sourcing relies on obtaining a single part code number from a single supplier. Typically, volume requirements from a family of parts or product group are allocated part code by part code to only one supplier. Sole sourcing indicates the supplier has a monopoly supply agreement, or is a technology or product leader and is the only supplier available. Sole sourcing is useful if the supplier has clear cost and technological leadership over its competitors and if they have sufficient global capacity. On

Figure 1

An Example of Narrow Price Bidding Range to Ordered Volume



occasion, such suppliers are located in only one site, for example as a result of a unique source of raw materials, or due to the intense capital investment required to set up facilities.

Given these scenarios, highly competitive trading environments involved in multi, dual and single sourcing scenarios would force a narrow price band within which suppliers would need to quote in order to achieve a share of the production volume. This narrow price band is in direct contrast to the wide price band shown in Part 1, Fgure 3. Part 2, Figure 1 shows an example sales price against volume graph for this more demanding business environment. In this example, sales prices above €0.40 would likely achieve zero sales. Prices up to €1.40 have been shown for comparability to the example shown in Part 1 Figures 3, 4 and 5.

Figure 2 shows a breakeven analysis for various volumes that uses data from Figure 1. To create competitive pressure on suppliers to improve their efforts to reduce total costs, a buying company could easily decide to adopt a dual sourcing strategy based on a 50:50 split [8]. The buyer may make a bargain with its two suppliers, that if they do not comply with requirements based on service class, quality or costs, the buyer will have the flexibility to adjust the order ratio. If they decide to re-split the volume demand to 70:30, the volumes on a gross demand of 200k would be 140k and 60k. This would put the supplier with 60k in a loss making position and virtually double the profit for the supplier delivering 140k.

If the buying company provides materials on a free-issue basis to its suppliers, the supplier is restricted to reducing fixed costs and variable costs associated with the conversion process. This consequently is a stimulus for flatter organisational structures and re-engineering value-adding processes. An alternative to these two options is to focus on creating value by providing consultative and product development services. The supplier then enters into the market searching for non-recurring expenditure contracts (NREs) from companies that are leading in terms of their innovative products and willingness to create niche markets. These products typically command a premium from early adopters and for the supplier they provide a relatively low fixed cost method of generating income. The example is then extended with an example of a non-recurring expenditure contract, to show the gross profit for various quantities.

The first line in the table shows an example of a non-recurring expenditure. Typically NREs are associated with developing new products [9]. The concurrent engineering approach allows a customer company to commission its suppliers to undertake product development projects. In this instance, fixed costs of €10,000 based on overhead absorbtion rates are associated with the project. A unit price is adjusted to €130 in order to arrive at a reasonable profit. This profit allows for reasonable unforseen costs, and hence both reduces the risk

Table 1

Calculations used to create Figure 2 and 3

Total Fixed costs	€10,000,00
Variable cost per unit	€0,25

Anticipated sales X	Price y	Revenue x.y	Total Var.Cost x,€0,25	Fixed Cost €10,000,00	Profit Rev.-Vc-FC	Total Costs (Vc.x)+Fc
100	€130,00	€13 000	€25	€10 000	€2 975	€10 025
0	€1,26	€0	€0	€10 000	€10 000	€10 000
0	€1,07	€0	€0	€10 000	€10 000	€10 000
0	€0,88	€0	€0	€10 000	€10 000	€10 000
0	€0,69	€0	€0	€10 000	€10 000	€10 000
0	€0,50	€0	€0	€10 000	€10 000	€10 000 0
0	€0,48	€0	€0	€10 000	€10 000	€10 000
0	€0,45	€0	€0	€10 000	€10 000	€10 000
0	€0,43	€0	€0	€10 000	€10 000	€10 000
50 000	€0,41	€20 500	€12 500	€10 000	€2 000	€22 500
80 000	€0,39	€31 200	€20 000	€10 000	€1 200	€30 000
90 000	€0,38	€34 200	€22 500	€10 000	€1 700	€32 500
100 000	€0,37	€37 000	€25 000	€10 000	€2 000	€35 000
130 000	€0,36	€46 800	€32 500	€10 000	€4 300	€42 500
150 000	€0,35	€52 500	€37 500	€10 000	€5 000	€47 500
180 000	€0,34	€61 200	€45 000	€10 000	€6 200	€55 000
200 000	€0,33	€66 000	€50 000	€10 000	€6 000	€60 000

Figure 2

Example of a Breakeven Analysis for a Dual Sourcing Scenario in a Competitive Market with Small Profit Margins

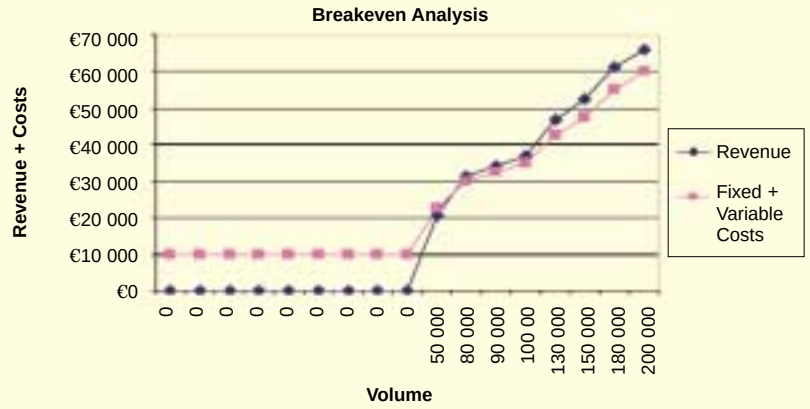
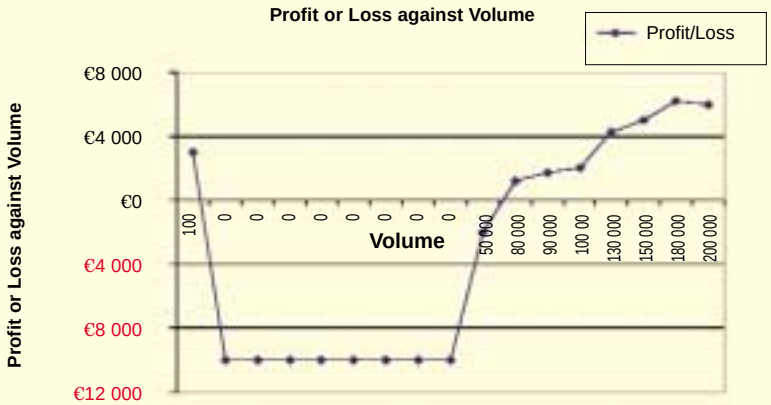


Figure 3

Profit and Loss Based on Various Volumes and Prices



and increases the attractiveness of the development contract. The reasonable profit also may stimulate specialist contractors to set up project-based development consultancies.

Figure 3 shows the profit either company would make for both the non-recuring expenditure and for various volumes.

DISCUSSION

The profit/loss line no longer shows a steady trend similar to the theoretical model shown in Part 1, Figures 3 and 4. Companies could use smoothing coefficients to make a best fit, though the ragged profile more accurately reflects profitability in multi and dual sourcing scenarios.

To achieve significantly higher profits, suppliers need to combine both non-recurring expenditure development contracts and be a sole source supplier. In that way, they avoid having to share the secrets behind their newly developed technical capabilities. Suppliers may be limited to supplying only the corporation that funded the NRE for a limited period. IBM used this strategy when they funded NREs specifically to develop computer memory devices and other equipment. For the first 6 months after launch, IBM had exclusive rights to sell products developed as a result of NREs. This gave IBM a competitive edge in the market over other assemblers that could not buy similar specification equipment, or who could buy only limited functionality in the same parts. After six months, the supplier was free to supply the parts to other assemblers. By this time, however, IBM had brought on line other parts designed as a result of other NREs from other suppliers.

Nissan, the automobile assembler, proposed five key elements that define how they compete: QCDDM – Quality, Cost, Delivery, Design and Management. Quality, unit cost and delivery reliability and accuracy are the most commonly cited axes for industrial organisations to achieve and sustain competitive advantages. The profitability implications associated with costs associated with stock in the pipeline due to distance and delivery problems [10], and costs of quality [11] are previously discussed in *Control*, and hence are not discussed here. However, with reduced life cycles caused by frequent model releases and expectations that the product sales price will not increase results in the need to search for new materials and manufacturing efficiencies.

Design becomes a differentiating factor between suppliers, in effect design has become an order winner and in some instances become an order qualifier. Design is reliant on the innovativeness of individuals and teams that constantly search for alternatives; they ask "why do it?" "what will happen if the activity is not done?" If the activity is required, they ask "why do it that way?"

It is clear that management from both the customer and the suppliers must work together. Many texts suggest that without senior management involvement, change, and hence improvement, will simply not be achieved.

Getting on with each other may be a requisite to doing business, however, suppliers must be aware of the profitability profile that may be being encouraged by their economic partners. Their partners are their customers. By definition, customers have all the power – they control the purse strings and hence from which suppliers they wish to purchase

goods. The suppliers do not have the 'power', while they do have the technical knowledge and spend the time close to their own processes to become experts by asking the why questions in the previous paragraph. To redress the power issue, supplier's management must seek a means of achieving the competitive advantages that ensure they continue to supply, while simultaneously providing their customers with enhanced value. The following section outlines identifies such strategies.

IDENTIFIED MEANS OF ACHIEVING COMPETITIVE ADVANTAGE

Michael Porter [12] identified some of the axes of competitive advantage. The list below identifies other now established strategies that can be used to ensure that the business will likely be able to land orders for volume supply:

- Focusing on niche market segments,
- Creating product differentiation using modular systems; included in this are project management capabilities and module integration technologies
- Configurable product mass customisation
- Lowest cost price based competition
- Adding value via design to provide solutions to technical problems
- Services oriented toward availability and customer response
- High profile marketing campaigns that emphasize performance
- Selling machine time based on free issue materials – a capacity management / utilisation approach
- Providing a significant technical advantage over conventional methods
- Providing unusual and/or highly efficient processes including parallel processing,
- Proprietary technologies that produce value, eg. unique surface finishing capabilities, unique assembly techniques.

The choice taken by a supplier's strategic management team depends on:

- The type and uniqueness of value-adding processes possessed – if a processes has already been proven to be stable, repeatable and reproducible
- Investment and payback policies – investments include knowledge worker's years and cost associated with the development of new concepts, setting specifications, detailed viability studies, project management, hardware and software detail design and tooling. Payback may be based on non-recurring expenditures or via volume produced. Production volume requirements - What is the probability of high, medium and low volume? What price is chargeable if the premium good becomes the standard specification?
- Human creativity – knowledge management in a learning organisation, motivation and entrepreneurship; the size of the product development team;
- Time available to create, develop and improve the core product – if there is a follow-on product, will there be commonality, compatibility and carry-over?
- The rate of advance and access to technology – limited to cartel like groups, rate set by trend setters or by specialised businesses that focus on core technologies
- The timing of technological releases – when are technologies marketed, differences between consumer durables and commercial solutions
- Locations of materials, suppliers, production facilities and customers – proximity, rapid logistics, cost of transport
- Existing technological solutions that are 'on the shelf' – are they adapting current requirements capable of being met by current or previous product development projects.

CONCLUSIONS

Conventional profitability calculations have a number of tacit assumptions. Significant amongst these are:

1. the falsity that the market is unlimited
2. the relationships are linear, or at least curvy-linear and
3. that one set of relationships exist to govern each volume and price.

Notable exceptions identified here are the prototype examples that are produced to provide designers with an intermediate stage solution. Prototypes are required as a means of gauging the validity of product and component concepts and are used to test for conflicts, logic errors and to define with greater certainty the hard tooling required for production volumes.

Suppliers should be aware of any attempt or preference by their customers to purchase single, dual or multi-sourcing. Suppliers must involve themselves in the design process in order to influence the design of the product, specifications and process sequencing. If the design can be tailored to their process capabilities, they should be aware of if the part is common to all goods – hence the total assembled equals the number they will supply. Equally, suppliers should ensure their long range volume forecasts are in line with their key customers'. This will allow them to invest, or jointly invest, in sufficient production capacity to ensure that they are the dominant supplier in their component or process type.

To achieve significantly higher profits, suppliers need to combine both non-recurring expenditure development contracts and be a sole source supplier. In that way, they avoid having to share the secrets behind their newly developed technical capabilities. Suppliers may be limited to supplying only the corporation that funded the NRE for a limited period.

Suppliers must make sure they have binding non-disclosure agreements in place with their customers to engender trust and avoid expensive unauthorised information leeks. Suppliers should aim for sole or single sourcing agreements. Unless it will free up capacity for more profitable contracts, it is recommended that suppliers avoid dual sourcing contracts if the agreement freely allows the buyer to alter the volume split.

Even for numerically controlled manufacturing environments, designing costs. Small and medium sized

enterprises must make sure that the investments in computer aided design packages and training are returned via NREs. If the customer can order small quantities of specially designed parts at competitive prices, suppliers must ask themselves if they are in the right market, or if they have the right relationship with their customers. Customer organisations want to know that if they outsource product creation activities, their expectations with respect to delivering solutions on time will be met. Hence suppliers must manage their product creation activities. They should learn how their customers manage their design processes, including specific vocabulary, design process models and procedures, milestone reviews and expectations.

Supplier's management must consider developing a portfolio of small quantity bespoke parts for customers that will require high volume manufacture and low volume technically challenging product and process development projects. This mix will ensure the product and component design process is predictable, efficient and has 'off the shelf solutions' already identified and perhaps developed.

Product creation processes are potentially as profitable as low volume production runs. Since investment can be significant, for those companies engaged in it may be more profitable for a company to focus on designing components, prototyping, pre-production runs, and process optimisation. Their aim therefore may be to develop and transfer knowledge on a consultative basis.

Above all else, suppliers must firstly determine with their customer the purchasing policies and breakeven profiles associated with particular components and assembly activities, and secondly agree the activities to be undertaken and manage them to ensure losses are not incurred. Supplier management must actively encourage organisational learning, recording what was done, how, by whom and where are the data recorded. This allows management to draw lessons to learn from previous development projects and predict with greater certainty the dynamics of the business environment in which they operate.

REFERENCES

1 Baily, P., Farmer, D., Jessop, D., Jones, D. *"Purchasing Principles & Management",* (7th Ed) Pitman Publishing London, 1994.

2 Barkan, P. "Productivity in the Process of Product Development - An Engineering Perspective in Susman, G. 1992 Integrating Design and Manufacturing for Competitive Advantage", Klein Symposium on the Management of Technology, Penn State., Oxford Uni., 1990.

3 Newlands, D. " Supply Chain Re-engineering: A Case Study", *Control,* Institute of Operations Management, February,2003, pp18-20.

4 Womack, J., Jones, D., and Roos, D., *" The Machine That Changed The World,"* Harvard Business Review, New York, 1990.

5 Dyer, J. and Ouchi, W. "Japanese-Style Partnerships: Giving Companies a Competitive Edge", *Sloan Management Review,* Fall, 1993, pp51-63.

6 Dyer, J. *"How Chrysler Created an American Keiretsu",* Harvard Business Review, July-August, 1996, pp42-54.

7 Edwards, C. and Samimi, R. *"Japanese Interfirm Networks: Exploring the Seminal Sources of their Success", Journal of Management Studies,* July, Vol. 34, No. 4, 1997, pp489-510.

8 Leenders, M. *"Improving Purchasing Effectiveness Through Supplier Development",* Harvard Business School, Harvard, 1965.

9 Clark, K., "Project Scope and Project Performance: The Effect of Parts Strategy and Supplier Involvement on Product Development", *Management Science,* Vol. 35, 1989, pp1247-1263.

10 Newlands, D. and Steeple, D. "Logistics and Supply Chain Development: Part 3 - A Quantitative Simulation for Logistics Opportunities", *Control,* Institute of Operations Management, July, 2000, pp21-23.

11 Newlands, D. and Hooper, M. "Cost Analysis for World Class Change, Part 2: The Costs Associated with Supplier Development and Quality", *Control,* Institute of Operations Management, Apr, 2001, pp15-18.

12 Porter, M., *"Competitive Strategy: Techniques for Analyzing Industries and Competitors",* The Free Press/MacMillan Inc., New York, 1980.

About the author

David Newlands has worked in various industrial positions, from his apprenticeship through to sales, system calibration, test engineering, lecturing and research into supply chain issues. He gained a B.Eng. in Manufacturing Systems Engineering and his PhD in supply chain methodologies that focused on supplier development.

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