Assessing the effectiveness of business consulting in operations development projects

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Abstract

Purpose – The purpose of this paper is to address the question of the effectiveness of business consultants in operations development projects. It does this by analysing the results of collaboration between a multinational firm and business consultants who applied the theory of constraints to a series of development projects.

Design/methodology/approach – Following the presentation of an overview of business consultants and the need to measure the effectiveness of business consulting practices, the paper presents empirical data on the return on investment achieved from 20 development projects in the multinational company under study.

Findings – The findings indicate that the involvement of business consultants in development projects has a positive impact on outcomes and can be justified in financial terms.

Research limitations/implications – The generalise ability of the results in service sector companies remains to be tested. The data is limited to a set of internal operations development consulting projects within one multinational company. Management consultants and managers will benefit from the results of study.

Originality/value – The study provides important insights into the assessment of the effectiveness of business consultants in operations development.

Keywords Management consultancy, Organizational effectiveness, Project management

Paper type Research paper

1. Introduction

Critiques of corporate spending on management consultants have been common for at least two decades. The frequency of these critiques reflects long-standing mistrust and doubt about the usefulness of business consultants in general (De Burgundy, 1998). The competence and value of business consultants has long been mistrusted; indeed, it has been suggested by Lindon (1995, p. 23) that business consultants are people "who would borrow our watch to tell us what time it is" (Lindon, 1995). In a similar vein, Blunsdon (2002) has contended that business consultants are largely irrelevant because the problems experienced by managers are well known and the solutions offered by business consultants are always the same.

But are the criticisms of the role of consultants justified? Should their clients assume some of the responsibility when projects fail? In this regard it is interesting to note that

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there are few contributions in the literature that attempt to justify a positive role for consultants. In particular, there is a definite lack of empirical studies that have attempted to make an objective analysis of the input costs and output benefits of projects involving business consultants.

The present paper addresses this deficiency in the literature by assessing the effectiveness of business consultants in consulting projects for operational development in a large multinational firm. The study does this by analysing the input costs against the output benefits of a series of projects in which business consultants utilised the methodology of the "theory of constraints" (TOC) (Goldratt, 1990).

The reminder of this paper is organised as follows. Following this introduction, a literature review considers business consulting in general terms, and the assessment of the effectiveness of such consulting in particular. In the following section, the paper provides a brief introduction to the TOC methodology. The empirical study is then presented in which twenty consulting projects and their results are interpreted by applying basic statistical methods. Finally, conclusions are discussed and further research in this area is proposed.

2. Literature review

2.1. Definitions

It has been said that the notion of "business consultancy" first appeared at the beginning of the twentieth century, when Frederick Taylor published his treatise on "Scientific management" in 1911 (Massey, 2003; Pellegrinelli, 2002). However, despite its long history, the concept of "business consultancy" remains nebulous and difficult to define. According to McLarty and Robinson (1998, p. 256), the Institute of Management Consultancy (IMC) attempted to provide an "official" definition of business/management consultancy when it defined "management consultancy" as "... the service provided to business, public and the other undertakings by an independent and qualified person". However, although this definition enjoys "official" status, it is apparent that it does not specify the actual role played by management consultants in providing the "service" to which it refers.

Greiner and Metzger (1983, p.7) provided more detail when they defined "business consultancy" as:

> ... an advisory service contracted for and provided to organizations by specially trained and qualified persons who assist, in an objective and independent manner, the client organization to identify management problems, analyze such problems, and recommend solutions to these problems and help when requested in the implementation of solutions.

According to this definition, "business consultancy" requires specific skills and an appropriate level of knowledge if consultants are to help clients identify and solve their management problems.

Berry and Oakley (1993) agreed that business consultancy is essentially about acquiring and sharing knowledge; indeed, they referred to the "knowledge industry" when talking about business consultancy and introduced the idea of "praxis", which they defined as the "... task of the fusion of theory and action in the continuing experience of working on serious problems" (Berry and Oakley, 1993, p. 12). According to these authors, "praxis" characterises the role of business consultants and acts as "... a bridge and a structure to knowledge creation and knowledge application" (Berry and Oakley, 1993, p. 13).

Despite these insights, Clark and Salaman (1998, p.155) maintained that business consultancy remains an "... intangible and difficult service to define". According to these authors, a proper understanding of the role of business consultants can only be achieved if the entire consultancy process is analysed.

2.2. Motivation for engaging business consultants

Pellegrinelli (2002) and Massey (2003) have both noted that the most common motivation for senior managers seeking the services of business consultants is their need for assistance in selecting an appropriate management strategy from the plethora of alternatives that are available. In many cases, managers are uncertain about the fast-changing business environment and how they should respond. According to Arnaud (1998, p. 469), the initial request for assistance often "... reveals an awareness, more or less vague, of the existence of an organizational situation needing change". This view has been supported by Wittreich (1966, p. 130), who noted that "... often a client who wishes to purchase a professional service senses that he has a problem, but is uncertain as to what the specific nature of his problem really is". Similarly, Blunsdon (2002, p. 5) contended that uncertainty is the basis of demand for consulting services when he observed that:

> ... the consultancy industry exists because of the presence of persistent organizational and management problems which creates an atmosphere of uncertainty and exerts pressure on managers to be seen to be acting both rationally and innovatively.

Against this background, Sturdy (1997) has argued that the first responsibility of business consultants is to provide clients with a reassuring sense of control that reduces their uncertainty and anxiety. In a sense, business consultants play the role of "therapists" by relieving managers of the anxiety that prevents them from doing their job efficiently.

2.3. Variety of roles of business consultants

Massey (2003) asked three consultants to describe their consultancy role in metaphorical terms. The first chose to compare his role to that of a pilot of a ship undertaking a voyage; the second compared himself to a gardener taking care of an eco-system; and the third opted for the role of a guide. In a similar vein, Steele (1975) identified nine metaphorical roles that a consultant can adopt when working on a project with a client:

(1) teacher;
(2) student;
(3) detective;
(4) barbarian;
(5) clock;
(6) monitor;
(7) talisman;
(8) advocate; and
(9) ritual pig.

The variety of metaphors suggested by these authors demonstrates how difficult it is to conceptualise and define the role of a business consultant with any degree of specificity.

Indeed, according to one school of thought, there is no single role for a business consultant. For example, Lippitt and Lippitt (1986, p. 57) observed that a consultant "... fulfils a number of roles that he or she judges to be appropriate for the client, the situation, and his or her own style". Similarly, Chapman (1998, p. 212) concluded that "... consultants can fill a variety of roles depending on the demands of the situation". Massey and Walker (1999, p. 38) agreed with these views in observing that: "... if the consultant selects appropriate roles that are aligned with client expectations ... the assignment is more likely to be successful in achieving the agreed goal".

In a similar vein, Crucini and Kipping (2001) referred to a "translation process" – whereby the knowledge of business consultants is adapted to specific client needs. The need to offer customised solutions to clients was also emphasised by Fullerton and West (1996), who suggested that both clients and consultants must find a "tailor-made" solution, rather than the consultant simply giving an "off-the-shelf" solution.

2.4. The process consultation model of business consultancy

Kakabadse *et al.* (2006) describe the idea as suggesting that consultancy must first been seen in terms of process. Since, Kubr (1996) identified two basic roles of business consultants:

(1) the "resource role" (helping clients with their problems by using the consultants" experience and knowledge); and

(2) the "process role" (helping clients to solve their own problems by making them aware of appropriate organisational processes).

In a similar vein, Schein (1988, 1999) proposed three models of the role of business consultants:

(1) the "purchase model" (in which the client purchases a particular expertise or skill that the client knows is currently lacking in its organisation;

(2) the "doctor-patient model": in which the client is uncertain of the problem and the role of the consultant is to diagnose the problem and prescribe a solution that alleviates the pain being experienced by the client; and

(3) the "process consultation model": which involves the creation of relationships that enables clients to perceive and understand the problems with a view to the clients solving the problems by themselves.

Williams and Rattray (2004, p. 184) commented on the last of these models in the following terms:

> ... the consultant's role is therefore one of helping the client become a sufficiently competent diagnostician. A key part of the process consultant is that the client must see ... the problems for themselves as well as generate any solution if they are to have ownership and take responsibility.

According to the "process consultation" model, the role of the consultant is thus not restricted to solving problems; rather, the role involves helping the client to understand what the issues really are and encouraging the client to take ownership of the solution.

2.5. Organisational learning and change management

It is apparent from the above discussion that the emphasis of consulting has changed from merely "solving problems" to building the capacity of clients to diagnose their own problems and thus manage their organisations more effectively. As Turner (1988) has noted, the role of business consultants has essentially become that of a facilitator of organisational learning. This requires consultants to develop their "people skills" in a manner that facilitates learning and change.

Many authors have recognised the importance of learning during the consultation process. For example, Steele (1975, p. 175) contended that ". . . learning is the essence of the consulting process", and Burnes *et al.* (2003) insisted that organisations cannot survive if they fail to learn at least as fast as the business environment is changing.

Argyris and Schön (1978, p. 16) stated that organisational learning occurs when:

> . . . individuals within an organization experience a problematic situation and enquire into it on the organization's behalf... that lead them to modify their images of organizational phenomena and to restructure their activities so as to bring outcomes and expectations.

Werr *et al.* (1997) contended that such organisational learning is a central element of the consultancy process, and Larwood and Gattiker (1986) suggested that the role of business consultants is to fill the gap between their own body of knowledge and that of their clients.

However, effective organisational learning also requires organisational change to develop an enhanced learning capacity. This view was held by Nonaka and Takeuchi (1995, p. 120), who argued that:

> . . . the essence of strategic change lies in developing organizational capability to acquire, create, accumulate and exploit the knowledge domain.

Thus, if the role of business consultants is to bring new skills and knowledge that will be disseminated within the client organisations, consultants can be considered to be agents of change. In this regard, Brown and Eisenhardt (1997) argued that the best-performing companies do not merely respond to change, but actually set the pace and rhythm of change. If this is so, it can be argued that the role of consultants is not only to transfer their skills to clients, but also to help them to achieve the organisational change that enables real organisational learning to keep abreast of a rapidly changing environment.

3. Evaluating the effectiveness of consulting

The effectiveness of a business consultancy should be assessed for at least three reasons:

(1) *To validate consulting as a business tool:* Because consulting is only one of many actions that an organisation can take to improve its performance and profitability, consulting must be formally compared with alternative business tools.

(2) *To justify the costs incurred in consulting:* Thorough quantitative justification of the costs of consulting is required to resist cuts in consulting budgets in times of economic stringency.

(3) *To improve the design of consulting:* Objective evaluation of consulting programs is required to ensure that business consultancy is continuously improved to provide better value and increased benefits to clients.

Various methods are used to evaluate a business consultancy. Measurement can be in monetary terms and/or non-monetary terms. Table I gives some examples of common evaluation methods.

Most firms prefer to make their assessments in monetary terms, and return on investment (ROI) is the most commonly used method for evaluating the overall success of any project. However, it should be noted that ROI is unable to assess all aspects of the consulting process; for example, ROI cannot reflect such non-financial criteria as employees' reactions, the learning that has been achieved, or the extent to which behaviour has changed.

To calculate ROI, it is necessary to estimate or measure the costs and benefits associated with a consulting. Table II shows some examples of the costs and benefits that can be considered for calculation of ROI.

The ROI of investing in a consulting program is calculated as the quotient of benefits and costs, expressed as a percentage, over a specified period of time. Assuming that the benefits will continue to accrue for some time after the consultation

Method	Explanation
Direct costs	Measurement of fees and expenses incurred directly as a result of the implementation of a consulting program. Many organisations consider only direct costs when evaluating consulting
Indirect costs	Measurement of expenses indirectly associated with consulting – such as salaries of in-house employees and the costs of rooms and equipment. Any analysis of the true costs of consulting should include both direct and indirect costs
Efficiency	Time required to achieve a desired output after consulting; the greater the efficiency of a consultancy, the less it will cost
Performance to schedule	If a consultancy must be completed by a given date to achieve a particular business objective, the extent to which a consulting program performs to schedule is a critical measure of success
Income received	Income received as a result of consulting is a vital measure of the success, although not as accurate as return on investment
Reactions	Reactions are measured with a 'happy sheet'. If employees react negatively to consulting, they are less likely to transfer what they learned to their work and more likely to give bad reports to their peers
Learning	Learning of new skills, knowledge, or attitudes can be measured objectively using an objective test or examination
Behavioural change	Behavioural change can be measured through observation before and after consulting
Performance change	A variety of indicators can be used to measure the effect of consulting on performance – including numbers of complaints, sales, output, and so on
Return on investment (ROI)	ROI is a commonly used measure of consulting. ROI can be calculated as either: monetary benefits obtained by an organisation over a specified time period in return for a given investment in a consulting program; or the extent to which the benefits (outputs) of consulting exceed the costs (inputs)

Table I.
Evaluation methods for business consulting

Costs	Examples	Benefits	Examples
Design and development costs	Internal design and development External designers and developers Other direct design and development costs (travel, expenses, etc.) Outright purchase of off-the-shelf materials	Labor efficiency	Reduced duplication of effort Less time spent correcting mistakes Faster access to information
Promotional costs	Internal days of promotional activity Costs of external agencies Other direct costs of promotion (reading material etc.)	Productivity increases	Improved methodologies to reduce effort required Higher levels of skill leading to faster work Higher levels of motivation leading to increased effort
Administration costs	Hours of administration required per employee Direct administration costs per employee	Other cost savings	Fewer machine breakdowns, resulting in lower maintenance costs Lower staff turnover, reflected in lower recruitment and consulting costs A reduction in bad debts
Department	Hours of group consulting Hours of one-to-one consulting (typically face-to-face, but could conceivably be conducted by telephone, video conferencing link or in real-time, online) Hours of self-study Additional hours (preparation time, the time needed to review or mark submitted work) Other expenses (travel, accommodation, subsistence, etc.).	Other income generation	Higher success rate in winning competitive grounds, leading to increased sales Sales referrals made by non-sales staff New product ideas leading to successful product launches
Materials	Consulting materials (books, manuals, consumables, etc.)	Improved use of fixed assets	Improved space utilization
Facilities	Consulting rooms Open learning / self-study rooms Equipment used	More efficient use of net operating working capital	Reduced inventories; interest impact of less cash tied up Shorter cash to cash cycle due to reduced lead times and improved delivery promptness (interest impact)
Participant's costs	Payroll costs Opportunity cost Travel, accommodation		
Evaluation costs	Accountants fees		

Table II.
Costs and benefits used in ROI calculation

has finished, the period of time that is specified is critical to the interpretation of the ROI figure that is obtained. Some companies choose to specify a period of time (perhaps one or two years) that fits with their planning cycle. Alternatively, some companies choose to calculate the ROI over the lifetime of the benefit.

The basic calculation of ROI therefore proceeds as follows:

$$\text{ROI} = (\text{benefits}/\text{costs}) \times 100$$

Alternatively, ROI can be calculated in terms of the "payback period" – that is, how many months it will take before the benefits of the consultancy match the costs. This is calculated as follows:

$$\text{Payback period} = \text{costs}/\text{monthly benefits}$$

Calculating the "payback period" has two potential advantages:

(1) if the figure is relatively low (perhaps only a few months), management will be encouraged to make the consulting investment; and
(2) there is no requirement for an arbitrary benefit period to be specified.

4. Theory of constraints

The empirical study reported in this paper assessed the effectiveness of a consulting intervention that utilised the methodology of the "theory of constraints" (TOC) (Goldratt, 1990). The TOC is a complex management philosophy that aims to achieve business improvement by focusing on the constraints that prevent a system from achieving a higher level of performance. According to the TOC, every firm has at least one such constraint, which Goldratt (1990) defined as any factor that limits the system from doing more of what it was designed to accomplish. The TOC philosophy thus encourages managers to:

- identify what is preventing them from moving towards their goals; and
- find solutions to overcome this limitation.

In brief, the TOC consists of three interrelated areas:

(1) logical thinking;
(2) logistics; and
(3) performance measurement (Cox and Spencer, 1998; Simatupang and Sridharan, 1997).

For the purposes of the present study, it is necessary to provide a brief explanation of the first and second of these areas.

4.1. Logical thinking

According to TOC, organisations require a process of change to ensure that they move from "where they are now" to "where they want to be in the future". Goldratt (1990) characterised such a process of change as addressing the following three questions:

(1) What to change?
(2) What to change to?
(3) How to achieve the change?

According to Goldratt (1990), the process then proceeds by five steps of logical thinking:

(1) define the system;
(2) define the goal of the system;
(3) define the necessary conditions;
(4) define the fundamental measurements; and
(5) define the role of the constraint(s).

To address the fifth step ("defining the role of the constraints") there is a need to develop a method to focus on the constraints of the system. According to TOC, a focus on the constraints is the most fundamental element in achieving a successful process of change. In this regard, Goldratt (1990) articulated five "focusing steps", as follows:

(1) identify the system's constraints;
(2) decide how to exploit the system's constraints;
(3) subordinate everything else to the above decision;
(4) elevate the system's constraints; and
(5) if, in the previous steps, a constraint has been broken, go back to the first step; but do not allow inertia to become the system's new constraint.

Each of these steps is examined in more detail below.

Step 1: identify. The constraint might be a physical constraint in a logistical process – that is, a true bottleneck. Alternatively, the constraint might be in sales or marketing or another non-logistical area; in these cases, the constraint is a policy and the best way to identify it is by using the "thinking process" to derive a core problem or a core conflict.

Step 2: exploit. Once a constraint has been identified, all efforts must be made to utilise the capacity of the constraint – that is, to make the best of the existing situation using the resources that are at hand. For example, in the case of a physical constraint, organisations should ensure that the material flows as smoothly and continuously as possible through the constraint. A plan or schedule for timely and appropriate input and output to optimise the available capacity is a good way to exploit the constraint.

Ohno (1988) described the exploitation of the existing capacity of a work centre in the following terms:

$$\text{Present capacity} = \text{work} + \text{waste}$$

According to this description, the exploitation of a constraint is understood in terms of eliminating waste. These wastes can include: waiting, over-processing, over-production, and defective products. As the waste component is reduced, the work component of the constraint can (and should) be increased. In addition, organisations should ensure that there are no existing policy constraints or "bad habits" that unreasonably limit the available working time.

Non-logistical implementations might have policy constraints. The simplest way to overcome such an erroneous policy is to replace it.

Step 3: subordinate. Subordination is the key to effective implementation of TOC. Proper subordination means that non-constraints do only what is required to ensure maximum exploitation of the constraint. It is necessary to ensure that the parts are subordinated to the whole – that is, that the subsystems are subordinated to the system.

Once an exploitation plan has been decided on, deviation from the plan can result from:

- not doing what was supposed to be done; or
- doing what was not supposed to be done.

Pouring material in more quickly than the rate of the constraint is a waste. It is the localised waste of over-production.

Non-constraint capacity can be characterised as follows:

$$\text{Present capacity} = \text{work} + \text{localised waste of over-production} + \text{other wastes}$$

The localised waste of over-production destroys so-called "sprint capacity". Such "sprint capacity" on non-constraints is an integral part of buffer management, and buffer management is an integral aspect of ensuring the timeliness of any plan.

Subordinating the local and system measurements to the constraint and the goal of the system is an under-appreciated facet of TOC. If the wrong feedback is provided, it is not surprising that the wrong behaviour ensues. This means that it is not only important to measure and communicate the effectiveness of the constraint, buffer management, and shipping, but also local efficiencies or utilisation of the non-constraints.

Step 4: elevate. Elevation involves bringing in additional resources to raise the capacity of the constraint in some way. The intention is to leverage the constraint so that a small elevation results in a substantial increase in output. In a for-profit organisation, the aim is to decouple net profit from operating expense. In non-logistical solutions, elevation could mean a new break-through idea that enables things to be done that were previously not possible; generally speaking this is not capital intensive.

Step 5: constraint is broken: go back. If a constraint is elevated adequately (and is thus broken), the organisation should go back to the first step and identify the next constraint. The aim is not to allow inertia to take over in the form of satisfaction with the current status. It might be expected that buffer management would have identified the next physical constraint; however, it might not identify the policy constraints that cause physical constraints.

4.2. Logistics

4.2.1. Drum buffer rope. In a production environment, the plant's constraint must be the driving factor in how it is managed because the productivity of the constraint determines the productivity of the entire plant. A TOC approach to managing production through such a constraint is known as "drum-buffer-rope" (DBR). The explanation for these terms is as follows:

- *Drum.* The constraint, linked to market demand, is the "drumbeat" for the entire plant.
- *Buffer.* Time or inventory ensures that the constraint is protected from disturbances occurring in the system.
- *Rope.* Material release is "tied" to the rate of the constraint.

The drum, buffer, and rope provide the basis for building a production schedule that is immune from disruption, avoids the creation of excess inventory, and uses small batches to minimise overall lead time. The overall aim of DBR is to "pull" materials through the system, rather than pushing them through.

But even with the DBR approach, occasional disruptions can require special attention. So-celled "buffer management" is used to mitigate or prevent these disruptions.

Implementations of DBR and buffer management typically result in lean, low-inventory production operations that are capable of consistently achieving 95 per cent (or better) on-time delivery, lead-time reduction of 35-50 per cent, and inventory reduction of 50 per cent – as well as a significant reduction in the need for expediting and rescheduling.

4.2.2. Critical chain. Goldratt (1990) defined a "critical chain" (CC) as the longest chain of tasks involving both task dependencies and resource dependencies in a project. The CC approach recognises that a delay in resource availability can delay a schedule, just as a delay in dependent tasks can do. In addition, the approach recognises that constant pressure to meet task deadlines encourages the insertion of "safety" in each step and that this "safety" is eventually used up. Thus, early task finishes are rarely seen, but delays in tasks propagate – causing project overruns.

According to the CC method, uncertainty is primarily managed by:

- using average task duration estimates;
- scheduling backwards from the date a job is needed (to ensure that work that needs to be done is done, and that it is done only when needed);
- placing aggregate buffers in the plan to protect the entire plan and the key tasks; and
- using buffer management to control the plan.

The key tasks are those on which the ultimate duration of the project depends – also known as the "critical chain".

The explicit steps to identify and manage a CC method are as follows:

(1) Reduce activity duration estimates by 50 per cent. Activity durations are normal estimates, which are known to have a high probability and contain excessive safety time. The 50 per cent probability is estimated by cutting these in half. (The protection that is cut from individual tasks is aggregated and strategically inserted as buffers.)

(2) Eliminate resource contentions by levelling the production plan. The CC can then be identified as the longest chain of path and resource dependencies after resolving resource contentions.

(3) Insert a buffer to aggregate CC contingency time (initially 50 per cent of the critical chain path length).

(4) Protect the CC from resource unavailability by resource buffers. Resource buffers are correctly placed to ensure the arrival of CC resources.

(5) Size and place feeding buffers on all paths that feed the CC. Feeding buffers protect the CC from accumulation of negative variations (for example, excessive or lost time on the feeding chains). This subordinates the other project paths to the CC.

(6) Start gating tasks as late as possible. Gating tasks are tasks that have no predecessor. This helps prevent multi-tasking.
(7) Ensure that resources work as quickly as possible on their activities, and pass their work on as the activities are completed.
(8) Provide resources with activity durations and estimated start times, rather than targets. This encourages resources to pass on their work when done.
(9) Use buffer management to control the plan. Buffers provide information to the manager – for example, when to plan for recovery and when to take recovery action.

4.2.3. Distribution solution. The TOC "distribution solution" collectively analyses the supply side impact with the demand side in the management of the supply chain stocks, particularly with an emphasis on the supply side. If supply is likely to react promptly to demand, there is no need to rely on a forecast at all. Although this situation is unattainable in most business environments, a step in this direction should be considered. In the case of keeping the right amount of stock in the supply chain, the objective is to have good availability of the items at all the consumption points. This objective is limited by the availability of cash and space, which means that it is impossible to keep high stocks of all items at all locations, even when obsolescence is not an issue.

The TOC "distribution solution" is based on constant renewal of the consumed stocks, and is comprised of several steps:

(1) Aggregating as much as possible at the source – the plant or central warehouse setting a high inventory target (called "stock buffer size").
(2) Determining inventory targets at all stock locations (stock buffer sizes).
(3) Enabling the transfer of real consumption data from all stock locations.
(4) Shortening the replenishment time as much as possible.
(5) Replenishing as frequently as possible from the main (plant or central) warehouse to the consumption points – units are shipped only in order to replenish to real consumption (or to readjust buffer sizes).
(6) Monitoring the buffer sizes according to consumption, and readjusting them accordingly.

The distribution solution is applicable not only for distribution of consumer goods, but also for replenishment of standard components that are used in a manufacturing or assembly operation. It is therefore also called the "replenishment solution".

5. Methodology

5.1. Data

To assess the success of business consulting in development projects, project data were collected from twenty projects in a multi-national company called "ABB Ltd". All of the projects involved the development of internal operations through collaboration between an internal operations development group and the respective business units of ABB Ltd. In all of these projects, the TOC philosophy was the main methodology.

For the assessment of input and output of each project, a gate model (Cooper, 1990) was used by the company. The gate model consisted of a series of gates, each of which had certain criteria for assessment. The gate numbers and titles were as follows:

- Gate 0: Start project.
- Gate 1: Start planning.
- Gate 2: Start execution.
- Gate 3: Confirm execution.
- Gate 4: Start introduction.
- Gate 5: Release.
- Gate 6: Close project.
- Gate 7: Retrospective assessment of project.

The stage-gate model required projects to be assessed before each gate to prepare for the next gate. A preliminary benefits calculation was undertaken at gate 2 and the final calculations were generally made at gate 5 or gate 7. The purpose of the assessment was to assist the gate owner in evaluating two issues:

(1) Does the project have the potential to deliver a product/solution that justifies continued investment?

(2) Is the project ready to pass this gate?

The gate model was generally in accordance with the process of change as outlined by Goldratt (1990). In the phase between Gates 0 and 1 the main focus was on identifying and obtaining consensus with regard to: "What to change?" and "What to change to?"; and in the phases between gates 1 and 3, the focus was on: "How to cause the change?"

5.2. Analysis

Data were analysed for each individual project to assess:

- the net present value (NPV) of the project;
- the investment and total cost incurred in the project; and
- the payback period of the project.
- All of these were then averaged. Table III provides the details of the projects

6. Results

Table IV shows the average measures for all projects. It is apparent that the average duration of the projects was 16.6 months and the average NPV was US$14.3 million. The average total cost (including the investment amount) was US$570,600. All projects were profitable or near zero profit. The average payback period was relatively short at 2.14 months.

Figure 1 illustrates the total cost of the projects. The cost of most of the projects was less than US$500,000. Most of the projects required change in operational procedures, but some needed investments in new systems and equipment to facilitate the required process improvement.

The NPV of most of the projects was between US$7 million and US$8 million (Figure 2). There was one project with an NPV of US$160 million, which can be

Table III. Consulting projects input and output data

Projects	Duration month	NPV (MUSD)	Project cost (kUSD)	Invtmnt (kUSD)	Total cost (kUSD)	Payback (m)	Main TOC application(s)
A	24	15.00	3,385	–	3,385	2.71	Drum-Buffer-Rope
B	14	160.00	104	–	104	0.01	Drum-Buffer-Rope
C	22	5.30	506	208	714	1.62	Drum-Buffer-Rope
D	16	0.64	332	68	400	7.50	Drum-Buffer-Rope
E	24	3.73	484	–	484	1.56	Drum-Buffer-Rope
F	13	6.25	307	–	307	0.59	Drum-Buffer-Rope
G	17	6.88	313	–	313	0.55	Drum-Buffer-Rope
H	16	5.98	196	–	196	0.39	Distribution Solution
I	18	4.40	520	249	769	2.10	Drum-Buffer-Rope
J	6	3.00	291	–	291	1.16	Drum-Buffer-Rope
K	9	1.34	98	40	138	1.24	Elevation of Constraints
L	13	6.56	501	–	501	0.92	Drum-Buffer-Rope
M	23	20.30	712	–	712	0.42	Drum-Buffer-Rope
N	16	4.70	433	680	1,113	2.84	DBR + Critical Chain
O	22	6.29	280	–	280	0.53	Critical Chain
P	22	0.10	115	–	115	13.80	DBR + Distribution Solution
Q	15	4.07	82	299	381	1.12	Drum-Buffer-Rope
R	12	1.77	189	–	189	1.28	Drum-Buffer-Rope
S	14	15.10	450	–	450	0.36	DBR + Distribution Solution
Average	16.6	14.3			570.6	2.14	
St. dev.	5.1	35.7			729.7	3.27	
St.dev [%]	31	250			128	153	

considered a special case because of its impact on procedures at fifty manufacturing sites.

The duration of most of the projects was about 24 months, but there were also some projects that were completed in 18 months, 15 months, and six months (Figure 3).

Figure 4 shows that the payback period of the majority of projects was two months. There were also some projects that had payback periods of three months, four months, nine months, and 15 months.

7. Conclusions

This study of the multinational company ABB Ltd has demonstrated how the input of development projects can be compared with output. Having applied the theory of

Table IV. Average measures for all projects

	Duration month	NPV (MUSD)	Total cost (kUSD	Payback (m)
Average	16.6	14.3	570.6	2.14
Std dev.	5.1	35.7	729.7	3.27
Std dev. (%)	31	250	128	153

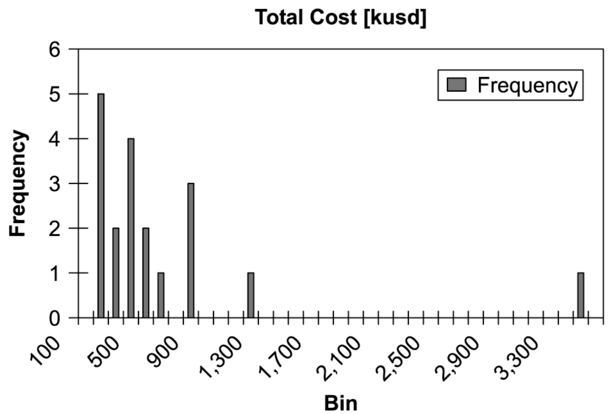

Figure 1. Total cost of projects

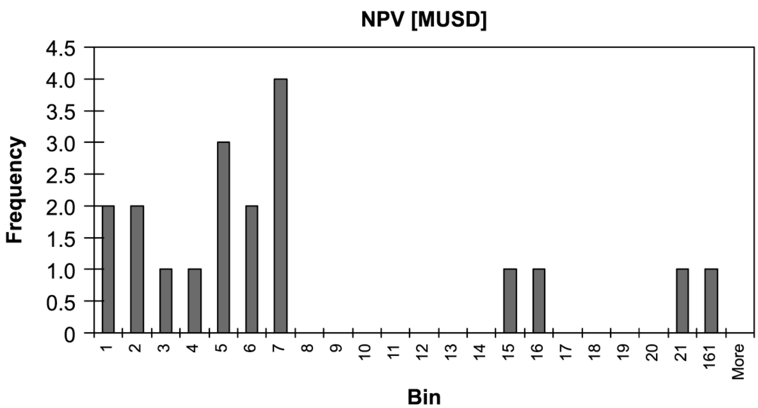

Figure 2. NPV of projects

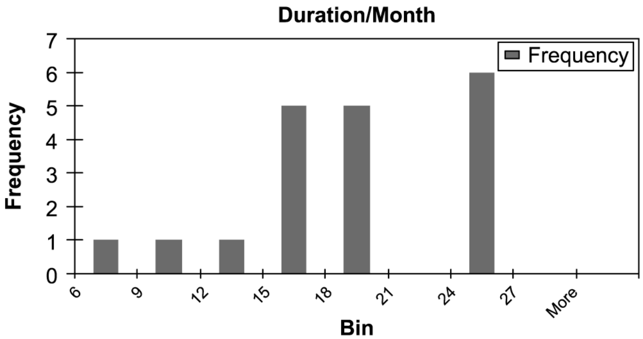

Figure 3.
Duration of projects

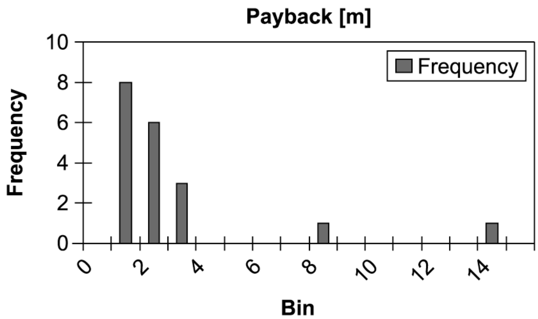

Figure 4.
Payback periods of projects

constraints (TOC) methodology in 20 consulting projects of the case company, a positive impact was recorded. As noted above, the average duration of the projects was 16.6 months and the average NPV was US$14.3 million. The average total cost (including the investment amount) US$570,600. The average payback period was less than three months.

The overall results were very good from the perspective of financial performance; however, it should be noted that the screening that was conducted before initiating even the first step of the stage-gate model had eliminated several projects that might have been less successful.

The results demonstrate the usefulness of the TOC approach in the large dispersed network of a multinational manufacturing company. Other conclusions that can be drawn from the study include the following:

- Operations-development projects are a subset of management consulting, and the same type of methodology can be used in both. The key performance metrics should include measures from both the cost and benefit sides and should be compatible with the management-accounting practices of the company.
- The study shows that TOC projects can yield significant business results in a relatively short time. The projects do not necessarily require investments in capacity or machinery.
- The stage-gate model can be used in managing the progress of operations-development projects in a similar manner to its use in research and

development (R&D) projects. Because large investments are not required, the option of cancelling a project can be considered at any stage.

Further empirical research is required on how consulting in operations development should be managed. In particular, further research is needed to identify the success factors in consulting projects and whether there are industry-specific success factors in such projects.

Finally, it is apparent that operations development is stimulating increasing interest in many manufacturing companies. Decision-makers require reliable metrics to evaluate the potential and real payback of such projects. The present study has provided valuable insights into how this might be done.

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