
Complexities of collaborative product development

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Abstract

The complexity, shorter lead times and high costs of product development have lent momentum to collaborative ventures. So much so that part of the 'received wisdom' of information and communication technology (ICT) suppliers is that collaboration is the preferred route for product development. In this paper, it is argued that the alleged benefits of collaboration may not always be achieved in practice and consequently it is important to pay attention to managerial and other factors that may influence the outcome of collaborative product development.

1. Introduction

The view that collaboration in product development is an effective means of reducing development time and lowering organizational risk and work is in widespread currency. As Hamel et al. [1] state:

"...the case for collaboration is stronger than ever. It takes so much money to develop new products and to penetrate new markets that few companies can afford to go it alone."

Collaborations are, however, themselves risky, with a significant proportion not meeting the expectations of collaborating organizations. Harri-gan [2], in a study of over 1000 collaborations, found that only 45% were mutually agreed by the partners to be successful. Norburn and Schoenberg [3] refer to a study where 40% of strategic alliances failed to deliver the expected results.

The focus of this paper is on collaborative product development in information and communication technology (ICT) sectors. The paper reports

the salient findings of a research programme which entailed a mail questionnaire of over 300 UK suppliers of ICT products [4] and cases of collaboration in three ICT sectors, namely: computerized business systems, mobile communications and electronic data interchange (EDI). Cases from the latter two sectors are reported here. The survey aimed to identify the major features which affected the management and outcomes of collaborative product development. The cases complemented the survey by enabling a more in-depth analysis of the contextual influences on the processes of managing collaborations.

Various types of collaborative product development can occur ranging from, for example, collaboration between separate companies to collaboration between different groups within the same organization. The two cases considered in this paper represent a product development collaboration between different firms, and one that was within the same organization. After a review of the main issues discussed in the literature relating

to collaborative product development, the relative merits of a collaborative approach are appraised and the factors affecting the outcome of collaborative product development explored. It is clear from the survey that collaborative product development needs to be treated more critically than at present, and the cases reinforce this by showing that the context in which partnerships take place needs to be acknowledged. Attention has to be given to managerial and other factors that influence the outcome of the collaborative process.

2. Perspectives on collaboration

2.1 Stimuli to collaboration

The advantages to be gained by collaborating in product development include the ability to secure access to new technologies and skills or to share or acquire information for product development [1, 5, 6]. Blonder and Pritzl [7] suggest that:

"In the light of industries such as computing and telecommunications moving closer together, one company might not be able to exploit promising opportunities by itself. The more an alliance is able to pool different competencies of the partnering companies, the more likely is a successful outcome."

Similarly, collaboration may provide a means of sharing the apparently increasing costs and correspondingly increased risks of product development [8–10]. Further, some authors assert that collaboration can not only reduce the costs and risks of product development associated with independent development but can reduce the time taken in product development [11, 12].

Marketing considerations must also play an important role. The rapid rate of product obsolescence does, according to some, focus attention on securing rapid access to markets so that new products can be marketed virtually simultaneously in several regions [6, 13].

Firms may also enter into collaborative arrangements in order to manage competition; by turning

potential rivals into allies; or to preempt competitors entering into collaborations [10, 14, 15].

Finally, imitation may provide a significant impetus towards collaboration in product development. If competitors are engaged in extensive collaboration, then there may be considerable, at least implicit, pressures to do likewise. We would suggest that in certain sectors, such as IT and communications, a strong collective wisdom has arisen as to the value of cooperation. Collaborative agreements are certainly common in these areas [16]. This therefore raises the issue as to whether or not organizations involved in ICT are compelled by a pervasive and apparent logic to engage in collaborative product development arrangements because to do so is regarded as crucial to competitiveness.

2.2 Risks of collaboration

In an atmosphere generously disposed to collaboration, it is rare to find an analysis of the potential disbenefits that collaboration can involve. Yet it is clear that there can be significant costs and risks to partners in any collaborative arrangement. As Porter [17] states:

"Alliances are not a panacea; most alliances are unstable, difficult to manage (and anyway risk creating a rival). Only alliances that are highly selective will support true competitive advantage."

First, there can be a leakage to its collaborating partners of a firm's skills, experience and general 'tacit' knowledge that may form the basis of its competitiveness. There is a danger that its partners not only acquire the competencies which the firm brings to the product development, but also gain access to the knowledge and skills which the firm employs in other business areas [1]. Second, a firm may provide information and insights into possible markets and future possibilities which otherwise may have been its exclusive domain. Farr and Fischer [5] suggest that some companies might be reluctant to create "potential competitors for themselves", or dependency on a key supplier

or partner. Lorange and Roos [9] describe the risk in the following way:

“The strategic resources generated through the strategic alliance now belong to both parties and cannot be used by one firm solely for building new competitive positions. Therefore, there is the prospective threat of the partner subsequently using this knowledge and insight in a non-cooperative way.”

Third, whilst the majority of authors claim that collaboration reduces the costs involved in product development, often the costs of administering such collaborations have not been fully considered. These include the significant costs of setting up the collaboration and in monitoring progress, often through meetings involving senior management time. Again, Farr and Fischer [5] refer to the time costs involved in decision-making because of, for example, the need to gain approval from different parties. Communication may be cumbersome and time consuming when environmental pressures point to the need for the contrary. Fourth, the whole process of entering into a collaboration for product development is likely to lead to a reduction in the direct control held by one organization over the development in question, a loss with which some managers might be unhappy [18].

As Collins and Doorley [19] state:

“Strategic partnership is appropriate only when you don’t want control, you can’t afford it, you don’t need it, or you aren’t allowed it.”

There may also be a loss of efficiency and/or effectiveness in an attempt to ensure an equitable distribution of effort. Some development effort may be allocated to those which do not have the strongest competencies in particular aspects of the development. The maintenance of the collaboration may itself become an all-consuming objective, at the expense of the specific product development for which it was originally founded. Indeed, the collaboration may establish its own agenda which may differ markedly from that of its principals.

Collaboration, then, is clearly but one route to product development and we would argue that,

given the risks collaborative activity can entail, a critical perspective is taken as to its suitability as a strategy. However, there may not always be a clear alternative to collaboration, or the potential benefits might outweigh the risks, in so far as these factors can be identified and assessed in advance. Under these scenarios, the question is how to minimize the risks of failure. In order to shed some light on the issue, an understanding of the factors which discriminate between ‘successful’ and ‘less successful’ collaborations is needed.

2.3 Factors affecting collaboration outcomes

Considerable attention has been directed towards the influences affecting the collaboration process. However, the subject is made complex by the fact that what is regarded as a successful outcome is by no means straightforward. As Dodgson [6] states:

“It is notoriously difficult to define success in collaboration. The range of firms’ circumstances and their expectations and experiences of collaboration are so variable as to make uniform definitions of success and failure unwise.”

‘Success’ will often be defined in terms of whether or not the collaboration has met its original objectives; for collaborations aimed at product development, these are likely to relate to whether the product was developed as planned, and to cost and time allocations [4]. The termination of an agreement cannot inevitably mean the collaboration has been unsuccessful since the original objectives may have been met [20]. Moreover, the objectives might change as the collaboration progresses and the collaboration itself might evolve and develop into a longer term relationship. Terminating a product development venture, which if continued may have incurred substantial sums with little if any return, could be seen as highly successful management [21], if only because it may have saved organizations coming to the same conclusion on an independent and even more costly basis.

It also has to be recognized that 'success' can be multifaceted. There can, for instance, be unintended advantageous side effects, whilst even a prematurely terminated collaboration might yield beneficial experience and knowledge and assist in developing competencies. As Hlavacek [21] states:

"The terms success and failure contain ambiguities. A 'failure' may result in knowledge or experience that is later used very profitably."

Despite these issues, there are likely to be some factors which improve the likelihood of beneficial and productive collaborative product development. Research has identified a number of factors which appear to have some bearing on the outcome of collaborative ventures. The first relates to the choice of collaborative partner. A particular issue here is the compatibility of the respective cultures of the cooperating organizations [22]. Devlin and Bleackley [23] state:

"It cannot be over-stressed that, having identified the alliance route as being the best strategic business development route or one of the routes to follow, an in-depth search for the right partner must be undertaken. All too often senior executives have been heard to remark, in hindsight, that they were of the opinion that they should have been more rigorous in the search for, and evaluation of, prospective partners ... divorces can be costly."

Lorange [24] argues for compatibility of operating 'styles':

"The member organisations [involved in a collaboration] must be able to communicate with each other, having a 'language' that they all understand. They must have a working style which is complementary, in the way they go about reaching decisions, their problem solving style and so forth. Above all, their behavioural styles must be compatible."

Ideally, the assessment of such organizational rapport should be made in advance of any cooperative agreement being made. This, however, is likely to be problematic. Differences are more likely to

emerge as the collaboration proceeds, and therefore much depends on the ability to resolve any difficulties that may consequentially arise.

There is also evidence suggesting that collaborations which are related to the existing activities of the cooperating parties are more likely to be seen as successful [25], whilst Harrigan [2] found that similarity of experiences of cooperation also had a favourable impact. In fact, Farr and Fischer [5] emphasize the value of general experience of collaborations as a factor that enhances the probability of future collaboration 'success'.

Some have stressed the importance of clearly establishing the ground rules for the collaboration in such ways as ensuring that there are clearly defined goals, objectives and responsibilities for the collaboration which are fully understood by all parties involved [5, 26, 27]. Gyenes [28] stresses the necessity of preparing detailed and binding initial collaboration agreements in order that future ambiguity is avoided. It also needs to be recognized that circumstances change and this factor alone suggests that there may be a need for, first, frequent appraisal of the collaboration and, second, scope for adaptability.

The importance of establishing the limits to the collaboration has also been noted in order that the risk of 'leakage' of the firm's skills and experience does not occur [1, 10, 24]. As Nueno and Oosterveld [29] state:

"Companies are concerned with the potential unplanned loss of knowledge through coalitions. It is difficult to control what exactly goes on in many meetings between scientists from the different companies involved in a common project. Some companies indicate that it might be possible for a group of scientists from a company to gather elements of information which allow them to identify the position of another company within a technological field or its major lines of advance."

Hamel et al. [1] advise collaborators to impose restrictions and exclusivity clauses in order to limit the transfer of core technologies:

"Companies must take steps to limit the scope of the formal agreement. It might cover a single technology rather than an entire range of technologies; part of a product line rather than the entire line ... the objective is to circumscribe a partner's opportunities to learn."

The practicality of actually drawing boundaries around certain company assets must be questionable, however, given the often extensive communication at all organizational levels and functions that collaboration can involve.

The need to establish collaboration limits has been discussed as an issue of considerable importance in establishing a collaborative project. There does, though, need to be a balance between protecting the proprietary interest of the firm and establishing trust and openness with its partners, the latter being regarded by many as equally critical ingredients in the continuation and effectiveness of inter-organizational relationships [10, 30]. Partners also need to reconcile the underlying tension between the requisites of collaboration with the perhaps more natural tendency to compete. This can have the net effect of undermining the trust which cements many cooperative relationships. The task for those involved in collaboration management is to balance these potentially conflicting issues as the collaboration evolves.

Related to the establishment of clear ground rules for collaboration is the corresponding need for the monitoring of progress. It is frequently argued that there should be defined procedures for monitoring and control of collaborations [22, 24]. Deviations from intended trajectories can be identified, analysed and potential problems possibly overcome as they arise. One way in which this can be tackled is through the establishment of collaboration 'milestones': significant points at which progress can be measured and reviewed. However, it is obvious, too, that at the outset it is difficult to plan for all the possibilities that might emerge as a collaboration proceeds, and this again highlights the need for frequent reappraisal and for a certain degree of flexibility.

A factor purported as undermining the effective-

ness of product development collaborations is the tendency to allocate insufficient financial resources [24]. Whilst this is of obvious concern, it is often the allocation of *management time and effort* that can have a disproportionate influence, and the importance of senior management's visible commitment to collaborations is difficult to underestimate.

The perceived mutuality of contribution and benefits from the various parties involved in a collaboration has also been highlighted as important [14, 26]. Any asymmetries are likely to lead to dissatisfaction, resentment and possibly termination of the agreement.

Essentially, collaborations are constructed and developed through the individuals involved and therefore it is not surprising that there is some considerable attention devoted in the literature towards the actions and relationships between the people involved in the collaboration. Individuals can as much shape and direct a collaboration towards protective ends as they can undermine and jeopardize it, and 'personal chemistry' [31] is likely to be a vital ingredient of any smooth and effective collaboration. The presence of one or more 'collaboration champions' [32], or 'mentors', who have a wholehearted commitment to making the collaboration work and a determination to overcome any difficulties, has also been noted. As Lynch [27] states:

"Management support in the form of resource allocation and executive commitment will make or break most [collaborative] ventures. The presence of a strong, high-ranking 'champion' within each of the companies involved is a key factor."

Such individuals, who either are at a senior management level or have the support of top management, are likely to have a role akin to the 'product champions' identified as important to the success of new product development [33]. It should also be noted, however, that such 'champions' have their disadvantages; they can, for example, be so committed that a flawed project gets pushed through [34].

The broader context within which the collabor-

ation takes place is also likely to have a significant bearing on the collaboration outcome. Changes in the wider economic environment and in the various partners' markets, and redefinitions of the collaborators' missions and objectives, can affect collaboration. Lynch [27] comments:

"Alliances are established to tackle inherently risky environments. Neglecting contingency plans to deal with the unpredictable and unknown will leave the venture on shaky ground. ... failures result from dramatically changing strategic conditions."

There is a danger, however, that maintaining the necessary external focus is awarded subsidiary importance to the administrative demands of maintaining the collaboration, and that the often overriding desire to ensure the collaboration *per se* is perceived as proceeding successfully by the participants.

3. Research methodology

The purpose of the study reported here was to analyse various aspects of collaboration management aimed at the development of existing or new products. The study was part of a wider programme of research into collaborative product development in UK information and communication technology sectors. The reason for the focus on ICT sectors was that ICT sectors have been described as particularly competitive and volatile and where collaborative relationships are not uncommon [35].

The research used two methods, in parallel: (1) mail questionnaire to 300 UK companies; (2) case studies of eight companies in three ICT markets—computerized business systems, mobile communications and electronic data interchange. Cases from the latter two sectors are discussed here. The intention was to build on the relative strengths of each approach: the survey enabled data to be gathered from a large sample, at a general level, whilst the case approach enabled a more detailed understanding of the specific organizational and

market factors influencing the collaboration management processes involved.

All the companies in the survey, the sample for which was selected randomly from appropriate UK trade directories,¹ are involved in some way in information technology or telecommunication sectors. That is, they are manufacturers of mobile communications components or equipment; computer component, hardware or systems manufacturers; or computer software producers. Between October 1992 and January 1993, a total of 300 companies were sent a copy of a postal questionnaire on the subject of collaborative product development. 106 complete and usable returns were obtained, a response rate of 36%, which is more than acceptable for a survey requiring a high level of detail.

All of the respondents had been involved to some extent in collaborative product development and some had considerable experience, having participated in several collaborations over a period of some years. In the last two years, 61% of the sample had been involved in a major collaborative product development project. This may reflect a degree of sample bias, in that respondents with a major involvement in collaborative product development would have been more likely to complete and return a questionnaire on the subject. Further details of the respondent sample are contained in Table 1.

This paper focuses on just one aspect of the study: the factors likely to improve the effectiveness of product development collaboration. This was approached from two angles in the questionnaire survey. First, an analysis of the factors discriminating between examples of 'successful' and 'unsuccessful' collaborations was undertaken. The issue of identifying 'successful' collaborations is one which has received some attention in the literature and was discussed earlier. In our analysis, examples of 'successful' and 'unsuccessful' collaborations were self-nominated by respondents in order to avoid the difficulties of classification by the researchers. Further discussion of the way in which 'success' was defined by respondents is contained in ref. [4]. Second, survey respondents were asked

TABLE 1 Respondent sample details²

	% of respondents
<i>Nature of main business</i>	
Telecommunications equipment manufacturers	43
Computer hardware/systems manufacturers	23
Computer component manufacturers	15
Computer software producers	19
<i>Number of employees</i>	
1–50	11.3
51–100	24.7
101–200	12.3
201–500	22.6
501–1000	10.3
1001 plus	20.6
<i>Turnover (1992/3)</i>	
Under £5 million	19.6
£5 million – £9.99 million	13.4
£10 million – £19.99 million	19.6
£20 million – £49.99 million	17.5
£50 million – £99.99 million	12.4
£100 million plus	17.5
<i>Pre-tax profit (loss) (1992/3)</i>	
Over £10 million	10.3
£5 million – £9.9 million	5.2
£1 million – £4.99 million	18.6
Up to £0.99 million	30.9
(Up to £0.99 million)	20.6
(£1 million – £4.99 million)	4.1
(£5 million – £9.99 million)	5.1
(Over 10 million)	5.1

to indicate freely the factors which, from their own experience in collaboration management, contributed most to effective product development collaboration.

Case studies of eight companies in three ICT markets were conducted in parallel to the survey. The companies were major UK companies in the ICT sectors under investigation and, at the start of the research, the outcome of the collaborative product development was not known. The case research was not carried out, as is sometimes suggested in the literature [36], as an exploratory phase of the research to generate hypotheses to be tested at a later phase by a more 'rigorous' and 'more scientific' method. Rather, the purpose of the case research was to provide a more in-

depth account and to give some insight into the specific context of product development collaboration that could not be investigated by the survey method.

An *aide-mémoire* was prepared and used as a basis for open-ended interviews with managers from marketing, R&D, development and corporate strategy areas who were particularly involved in the collaborative ventures in the companies participating in the research. Representatives from the different companies were interviewed to gain a full account of the collaboration from different perspectives. The main questions related to experience in product development in general, and collaborative product development in particular; policy and practice for product development; management of the process; and comparisons of more and less successful collaborative ventures. The interviews lasted about 1 to 1½ hours and transcripts were sent back to the respondents for checking and clarification. Repeat visits were made a year later to the company and, where possible, to the respondent(s), to assess the progress of the collaboration and how the outcome of the collaboration was perceived.

The sample size for the case research was small, thus limiting the reliability but enabling greater validity through the in-depth nature of the research. The cases reveal the richness of the decision-making process by capturing the complexities of the collaborative process, and thereby provide insights into the procedures and practices affecting the outcome of the collaboration.

4. Results

4.1 Mail questionnaire survey

4.1.1 Process of collaboration

The effect of collaboration on product development was considered. The respondents were asked:

"From your experience, how does collaboration affect the process of product development?"

Respondents were requested to indicate their strength of agreement with a number of statements on the effect of collaboration on the product development process.

From Table 2, it is clear that many respondents regarded collaboration as making product development more costly, complex and difficult to control and manage. Whilst these are perceptions, they suggest that the widespread unqualified enthusiasm for collaboration needs to be tempered somewhat.

These results were backed up by comments made by respondents on the potential risks of collaborative product development. Collaboration was seen as involving such risks as the leakage of proprietary information and the potentially unique distribution of partners' commitment. However, the reservations expressed had not deterred the participants from embarking on collaborations for product development, and a proportion had considerable experience of collaborative ventures.

4.1.2 Factors affecting collaboration outcome

Table 3 contains a list of 20 factors which, after a review of the literature, were considered by the researchers as possible influences on the outcome of product development collaborations. Respondents were asked to indicate the extent to which each of the factors shown in Table 3 was present in a self-nominated example of a 'successful' collaboration and an 'unsuccessful' collaboration, using a scale of 1 (strongly disagree) to 5 (strongly agree). In order to achieve a measure of the importance of each factor in discriminating between 'successful' and 'unsuccessful' collaborations, the mean scores of each factor were calculated for both 'successful' and unsuccessful' collaborations.

From Table 3, it is clear that a number of factors were particularly influential in contributing to effective collaboration. The most powerful discriminating factors between 'successful' and

TABLE 2 The effect of collaboration on the product development process [41]

We asked:			
<i>From your experience, how does collaboration affect the process of product development?</i>			
Collaboration generally. . .	Agree/ Strongly agree (%)	Disagree/ Strongly disagree (%)	Average score
Makes product development more costly	51	22	2.66
Complicates product development	41	35	3.03
Makes it more difficult to control and manage the product development process	41	38	3.08
Makes product development more responsive to supplier needs	36	26	2.76
Makes product development more efficient	35	41	3.36
Emphasizes accountability in product development	30	44	3.38
Allows product development to adapt better to uncertainty	27	43	3.30
Accelerates product development	25	58	3.46
Makes product development more responsive to customer needs	22	50	3.40
Allows product development to respond better to market opportunities	15	63	3.74
Enhances the competitive benefits arising through product development	12	65	3.72
Facilitates the incorporation of new technology in product development	7	70	3.77

TABLE 3 Factors discriminating between successful and less successful product development collaborations [41 (adapted)]

Factor	Difference in mean score, all respondents
The collaborating partners failed to contribute as expected	2.31
There was a lack of frequent consultation between the collaborating partners	1.52
Benefits between the collaborators were perceived as 'evenly' distributed	1.38
The relationship was perceived as being very important to the collaborators	1.31
There was a champion for the collaboration	1.31
There was little 'trust' between the collaborating partners	1.29
A long-term view of strategic benefits was taken	1.12
There was little consultation between marketing and technical personnel	1.05
There was clear project planning with defined 'task milestones'	1.02
Adequate staff resources were made available to the collaboration	0.97
Little attention was given to marketing issues	0.86
Sufficient budgetary resources were made available to the collaboration	0.79
Senior management were closely involved in the collaboration	0.78
Sufficient time resources were made available to the collaboration	0.75
Corporate systems and management style were flexible	0.75
Specific roles and responsibilities were not clearly allocated	0.72
The product development did not fit naturally with existing businesses	0.57
There was little previous experience of collaboration management	0.22
Purely financial measurements of progress in the collaboration were avoided	0.14
The product or concept being developed was highly innovative	0.08

'unsuccessful' collaborations were whether: the collaborating parties contributed as expected; there was frequent consultation between partners, and between marketing and technical staff in particular; benefits were perceived as evenly distributed; the relationship was perceived as important by all the parties involved; there was a 'collaboration champion'; there was a substantial degree of trust between collaborating parties; and there was clear project planning with defined task milestones.

Respondents were also asked to indicate freely the major factors which, in their experience, contributed most to the success of collaborative product development. An open-ended question format was used and the responses obtained were categorized by the researchers. These categorized responses were then grouped further to reveal that six types of response were particularly frequently mentioned: *choice of partner*, *establishing the ground rules*, *ensuring equality*, *processual factors*, *people factors*, and *environmental factors* (see Table 4). It should be noted here that these groupings are somewhat arbitrary and are significant only for the purposes of simplifying the presentation of results. However, they do reflect, to some degree, an existing emphasis in the literature on collaboration. As Table 4 shows, factors relating to establishing the 'ground rules' for collaborative product development, and agreement on clearly defined collaboration objectives in particular, were the most frequently cited. However, confirming some of the results shown in Table 3, the importance of frequent consultation; perceived mutual benefit; the existence of a 'collaboration champion'; and the presence of mutual trust and openness were also some of the most frequently mentioned issues.

4.1.3 Cases of collaboration

Whilst the survey results provided an overview of the factors affecting product development, details of the specific context in which product development collaboration occurred were missing. By using a case study approach in parallel, it was possible to generate in-depth information about the management processes associated with collaborative product development. Two cases are reported here: one from the area of telecommunications, and the other from the area of electronic data interchange (EDI). Each explores the contextual factors influencing the outcome of the collaboration by considering a particular collaborative product development project.

TABLE 4 Respondents' views of factors affecting outcomes of collaborative product development [41]

We asked an one-ended question:

In the light of your experience, what factors contribute to the success or failure of product development collaborations in general?

Factor	% of respondents freely mentioning factor
<i>Choice of partner</i>	39
Culture/mode of operation	13
Mutual understanding	12
Complementary expertise/strengths	12
Past collaboration experience	2
<i>Establishing the ground rules</i>	67
Clearly defined objectives agreed by all parties	41
Clearly defined responsibilities agreed by all parties	19
Realistic aims	10
Defined project milestones	11
<i>Processual factors</i>	45
Frequent communication/consultation	20
Mutual trust/openness/honesty	17
Regular progress reviews	13
Ensuring collaborators deliver as promised	9
Flexibility	3
<i>Ensuring equality</i>	42
Mutual benefit	22
Equality in power/dependency	11
Equality of contribution	9
<i>People factors</i>	54
Commitment at all levels	21
Collaboration champion	11
Top management commitment	10
Personal relationships	10
Staffing levels	3
<i>Environmental factors</i>	25
Market need for product	17
Economic factors/recession	3

4.2 Telecommunications

4.2.1 The origins and scope of the relationship

This case refers to the collaboration between Manufacturer A, a telecommunications equipment supplier, and Operator B, one of the UK operators

of the telepoint service. The objective of the collaboration was to develop a handset for use on the telepoint network and, to this end, the two organizations worked together on what was to become the Concept Z handset between January and December 1989.

Telepoint is one of a set of 'mobile' communications technologies [37]. The service is based on the use of pocket-sized cordless telephone handsets which can connect via a radio link to publicly sited base stations. Through these base stations, calls are connected to the British Telecom or Mercury telephone network. Calls can be made within 200 metres or so of a base station. Telepoint does not have the capacity to receive incoming calls, although, as with established cordless telephones, base units can be purchased in order to receive calls in the home.

Operator B was one of the four operators licensed by the UK Government to provide telepoint services, and was one of the three which launched a service between the end of 1989 and the start of 1991, but subsequently withdrew because of a poor market response. Manufacturer A, which is a small organization established in 1986 as a spin-off from a research-based organization, had a primary goal of developing a simple-to-use, low priced, low weight and compact consumer telephone handset. The development had already commenced before the collaboration with Operator B was initiated.

At the outset of the collaborative arrangement, A continued to undertake technical handset development, while B provided inputs on design features based on some market research carried out amongst potential telepoint subscribers and, probably more so, on its managers' own 'feel' concerning the design of the handset. On this basis, the product development process was regarded by both organizations as being highly consultative.

Both parties to the collaboration report that there were frequent face-to-face meetings between representatives of the two organizations who formed part of the 'development team' set up by A and B. On Operator B's side, the development team was a 'multidisciplinary task force' of

employees from the areas of marketing, technology and finance. B placed considerable pressure on A to adopt a similarly multidisciplinary approach, which A did to some extent and to the satisfaction of B, although A's team was based primarily around engineering expertise.

When interviewed, the Managing Director of B noted two main features of collaboration with telecommunications equipment suppliers. First, past experience suggested that contacts with telecommunications suppliers tended to be associated with engineering, resulting in a number of communication problems with the marketing-dominated multidisciplinary teams favoured by Operator B. These suppliers were regarded by B as being "too far removed from the customer perspective" and to have little understanding of customer requirements. In the case of A, Operator B remarked that: "It is nearer to customer understanding than many other companies".

Second, Operator B stated that the attitude of some equipment manufacturers is best described as "here's a useful idea, now go out and sell it". The equipment manufacturer develops the product itself, and expects the service provider to sell it. But, again, A was viewed as being more actively cooperative. Manufacturer A found that B did not create difficulties by frequently altering product specifications.

The Concept Z telephone was launched as part of B's telepoint package in December 1989. However, in assessing the collaboration, it is important to take into consideration two additional factors: the history of the telepoint service itself and, in particular, the development of the CAI telepoint standard.

4.2.2 Development of telepoint

Initial forecasts of growth for telepoint suggested a market worth £1 billion per year in the early 1990s, with an estimated 3.6 million subscribers by 1995 [38]. However, market response to the initial launch of telepoint in late 1989 and early 1990 was disappointing, with only an estimated 5000 subscribers opting for the new service provided by the three operators. Amongst the possible

explanations for the poor take-up are: the lack of an adequate network of base stations; the original marketing strategy adopted; and the insufficient attention paid to the customer values offered by the new service [39].

A further factor of possible significance was the Common Air Interface (CAI) standard. When the telepoint licences were awarded in 1989, there was no agreed technical standard, with the result that the original three telepoint services were technically incompatible. However, the UK Government had specified that by the end of 1990 all systems must conform to the CAI standard for telepoint. The Concept Z handset did not conform to CAI, as both Manufacturer A and Operator B saw a window of opportunity, before CAI standard implementation, to gain telepoint subscribers. This attitude was shared by the other two operators which launched their non-CAI standard telepoint services at around the same time.

4.2.3 The outcome

Any evaluation of the success of the Manufacturer A – Operator B collaboration must take into account the poor performance of B's telepoint service offering. The Managing Director of A believes that the impending introduction of CAI effectively killed off the development of telepoint. He noted:

"CAI actually stagnated the [telepoint] industry for eighteen months while firms were trying to sort out their policy towards it. It has a lot to answer for."

He stated that during the early phases of the development of the telepoint industry, and even at the launch in 1989, the availability of operational CAI equipment was seen as 'some way off', and it was felt that it was highly unlikely to be available to meet the Government's deadline of the end of 1990.

Manufacturer A was developing non-CAI equipment with both B and another telepoint operator, and subsequently embarked on a dual technology product strategy, continuing to produce proprietary equipment whilst also developing CAI equipment,

assuming that it would be the sole supplier to B when CAI was introduced. This assumption proved incorrect: B undertook a supplier re-evaluation and a decision was reached not to be dependent on one supplier. This was prompted by the view that it was difficult to predict which of the equipment suppliers would produce the best CAI equipment and, equally important, which would produce on time. Although the relationship between A and B continued, on a non-exclusive basis, it is clear that, as Littler and Leverick [40] point out, permanence of collaborations cannot be guaranteed in the case of such emerging new technology-based sectors. However, in July 1991, in view of the perceived poor prospects for its telepoint service, B withdrew from the market, and the relationship between Manufacturer A and Operator B terminated.

4.2.4 *Assessment of the collaboration*

The collaboration between Manufacturer A and Operator B can be seen as having a positive outcome only in that a product, the Concept Z phone, resulted. Thus, the original objective of the collaboration was achieved. By any other measure of success, its performance was disappointing.

However, the internal management of the collaboration was viewed in a highly positive manner by the parties involved. It is clear that many of the factors considered to influence a collaboration favourably were present. In particular, this collaboration featured a high level of involvement of the personnel from both organizations. Frequent consultation occurred, commitment of both technical and marketing personnel was evident and senior management was closely involved. The collaboration was also regarded as important to both organizations; there was, at least initially, extensive trust between both parties and the benefits were generally seen as equitable to each organization. It was only after the product launch that some of these conditions were seen as being unfulfilled. In terms of resources, there seems to be no evidence that either party was unwilling to invest sufficient financial, time or staff resources.

Finally, there was a clear allocation of specific roles and responsibilities.

What this collaboration demonstrates clearly is that an evaluation of collaboration outcomes cannot be made without consideration of the context in which it took place. That is, the influence of factors external to the collaboration can have a significant impact. It was the influence of such external factors which appeared to contribute most significantly to the outcome of the Manufacturer A – Operator B collaboration. Whilst considerable attention was paid to internal management factors, the fact that the product did not conform to CAI standards and the lack of attention devoted to marketing considerations undoubtedly contributed to the poor adoption of the innovation. It is also worth noting the danger that a company becomes tied into a collaborative product development relationship having assumed that its partner will necessarily have an understanding of customer requirements for the product in question. This may have been an important factor here, with Manufacturer A expecting Operator B to undertake a certain level of customer research which did not, in reality, actually take place. The collaboration was also somewhat parochial, with little account apparently taken of the global nature of the telecommunications market. Instead, the focus was placed firmly upon a single, non-standardized product designed to operate on a single mobile communications system in a single country. The collaboration processes may in fact have concentrated too much on ensuring inter-organizational harmony and on personal relationships rather than on the development of a marketable product.

From this perspective, it is difficult to assess the collaboration in anything but a negative fashion. However, what is highlighted is that the terms 'success' and 'failure' merit further examination. On one level, the venture was seen as 'successful': the original objectives were met and the internal management was positive. On another level, the venture might be seen as a 'failure': the resulting product was not widely adopted and the agreement was terminated. Collaboration assessment is clearly

a complex issue and in this collaboration, as in others, the participating organizations will have gained valuable experience and insights that might be applied to future collaborations. It is important to have in place organizational processes by which experience can enter the collective organizational memory and be subsequently accessed.

4.3 Electronic networking

The collaboration discussed here is that between US and a UK telecommunications company to develop a new electronic networking service. The US company owned the UK company but the companies operated independently and so the product development reported here was effectively a collaboration.

4.3.1 *Origins and score of the relationship*

Company Z is a large US telecommunications company. It has, as one of its strategic objectives, the intention to establish itself as a major supplier in Europe. Indeed, its mission is to:

“establish Company Z in the top three Information Technology Service organizations in Europe” (Internal document, 1992).

One division of Company Z bought a UK company, Company Y, to help it to move into the European telecommunications market. The UK firm was a small, innovative company with considerable strengths in the electronic networking market, being one of the two major service suppliers.

Company Y had been formed in 1984 as a systems integration house with a telecommunications background. Three years later, when the UK firm was bought out by its management, it became clear that the company was starved of finances and could not afford to carry out extensive product development to remain innovative, or indeed to survive in the longer term.

4.3.2 *Product development policies*

A major thrust of product development activity for Company Z comes from acquisitions and

from collaborations with suppliers and customers. Examples include the setting up of a new company to develop software to source suppliers. The rationale for collaboration varies from project to project but, in general terms, is considered in terms of access to expertise; sharing of development costs; acquisition of local market information; the bolstering up of a long-term position in the market; and extension of its product range.

A longer-term collaboration is constantly evaluated to ensure that it is meeting the organization's needs, and contracts are drawn up, at the outset, so that the different parties can withdraw without too much difficulty at any stage.

4.3.3 *The electronic network collaboration*

At the beginning of the 1990s, Company Z had to combat a steadily falling UK market share in the electronic network market. Its strategy was to offer an enhanced networking service to update its offering in the market and to position itself as the leading European supplier of electronic messaging services. This meant that resources had to be devoted to product development. This was a longer-term plan, covering a three-year period. Alongside this activity organizational changes, with the merging of the British and American companies, were taking place and a European marketing, sales and customer support operation was being established.

The collaborative product development reported here was to establish a robust electronic network service that would last for a number of years and would provide a cost-effective service for the customer base. Throughout 1992, the British team in Company Y prioritized 24 functions that needed to be added to the service to provide a competitive offering in the UK and European market. But these features for the European service were estimated as needing twenty years to develop. US labs were reluctant to commit resources to such a major product development activity and so the UK team planned a schedule to gradually develop the product over an 18-month period. Negotiating this was perceived by the UK team to be a time-consuming and frustrating process that had to be

undergone at a time when the market was changing rapidly, so that any delay could mean that the market opportunity would be lost. Without top-level commitment and the willingness of the US Division to support the case for the product development, the UK team felt they could do little.

At the time that the product development schedule was being negotiated, changes were being made to key personnel in the US. The staff turnover was high in the US and UK, people left of their own accord and others were asked to leave if they did not fit into Company Z's corporate culture.

The collaboration involved two different cultures: Company Z was a huge telecommunications company that was seen by Company Y as bureaucratic and inflexible, whereas Company Y had been a small, organic firm, and an opportunistic niche player in the UK telecommunications market with a small product base. The managers of the UK firm found the new corporate culture very different to their previous experience and were critical of the long time it appeared to take to make decisions about product and business development. The whole experience of having to find senior managers in the US, then build up relationships with them and argue their case for resources against competing projects, was a new experience.

Nonetheless, collaboration between the US and UK divisions was required. As the Marketing Manager stated:

"Our services are global and any changes or developments have to be decided with product managers on a global basis. In many cases the responsibility for product management is taken in the US and the R&D resource is in the US. Hence, we can't undertake product development on our own. We need the US to work with us, so that we can achieve our goals. The US need to collaborate with us, in order to have access to local market information, to know about the UK's market needs."

However, the UK managers questioned whether the US Division really understood the UK market. One consequence of the collaboration was that the US managers were perceived by the UK team as being reluctant to invest in a product development that might not sell well in the US. The fall of the company's UK market share served to support this view and to reinforce the negative perception held by the UK team of their US counterparts.

Top level commitment was needed, by the project team, to secure major levels of investment in product development to ensure the longer-term viability of the electronic network service. But this commitment was not forthcoming, given the concerns of the senior executives and the high rate of staff turnover. Eventually, in the latter part of 1992, a new executive who supported the proposals for a new service was brought into the company and a direct reporting line was formed via the UK's Managing Director to US executives. It was anticipated that this would facilitate the release of resources to bring about the implementation of the fully fledged new service.

In 1992, all of the product development activity was moved to the US. Whilst the centralization of resources could be seen to be efficient from the perspective of the US division, in fact the consequences were delays and problems for the UK and European operation. The new procedure was regarded as not able to respond quickly to the demands of the European operation.

4.3.4 Assessment of the collaboration

Part of the output of the collaboration was delivered, but the other phases of the fully fledged electronic network service have yet to appear. The personal commitment and tenacity of the UK managers was responsible for ensuring that the plans for the full service were implemented. However, the effort of doing so has not been without costs in that UK key personnel have left the organization after getting to a stage of feeling completely 'burnt out' with the effort of establishing relationships with their counterparts within Company Z and trying to work politically within a

constantly changing organizational structure. This created an atmosphere of uncertainty, concern about job security and the frustration of trying to attain commitment and resources for strategic product development.

The project was a major investment to establish a robust electronic network service that would last for a number of years and provide a cost-effective service. However, problems in gaining resource allocation for product development were a major issue and this was perceived by UK managers in Company Y as being due to the lack of top-level commitment.

Product development collaboration in the context of two different corporate cultures almost certainly affected the outcome. The personnel of the UK firm were used to a culture of flexibility, opportunism and top-level commitment to invest in product development. Company Z was a large, bureaucratic organization that centralized core resources, such as R&D, and had a structured procedure for product development.

The removal of product development capability out of the UK and to the US slowed down the process of product development. Geographical distance meant that the UK marketing managers could not ensure that product improvements would be forthcoming, nor delivered on time.

5. Conclusions

It is evident from the survey of collaborative product development in information and communications technology sectors that the 'downside' of collaboration had been encountered by many of the participants. Over 40% of respondents expressed the view that, in their experience, collaboration made product development more costly, more complicated, less efficient, more time consuming and more difficult to control and manage. Negative views of collaboration were clearly not universally held in this study, and analysis pointed to the possibility that some of the major risks of collaboration are lessened as experience in collaboration is gained.

The research was not primarily oriented to generating formulae for achieving 'successful' collaborations. However, a number of factors were highlighted as discriminating between more and less successful collaborative product development arrangements.

Which these results are clearly of interest to those involved in collaboration management and support some of the advice contained in the literature, a note of caution should be sounded. First, the measurement of collaboration 'success' is by no means a straightforward issue, as has been discussed earlier. The value of a collaborative product development project which does not meet the objectives set out for it could be measured in terms of the experience in collaboration management gained, although our analysis did not clearly point to past experience in collaboration management as a factor significantly affecting collaboration outcome.

Second, and relatedly, there is a clear danger in the application of a set of mechanistic 'rules for success'. There are so many intangible and unpredictable factors which might affect the manner in which collaborations develop. The survey reported here represents a snapshot in time and the focus was on specific collaborative projects aimed at developing a single product or a group of products. However, collaborative product development is an evolutionary process. Its form, scope and the reasons for its initiation and continuation may change considerably over time. The case approach enabled some of the changing contextual factors to be revealed; for example, during the process of collaborative product development, changes occur to personnel, to objectives and priorities and to the market potential of the product being developed, all of which may effect the outcome of the collaboration. In the telecommunications case, the market potential of the product was altered by changes to the external environment, but those were virtually ignored and attention was focused on the dynamics of the collaboration. Thus, despite the negative outcome, the overall management of the collaboration in terms of commitment from senior staff and from

marketing and technical personnel was regarded favourably and a trusting and equitable collaboration was apparent. In contrast, the management of the collaboration in the electronic networks case appeared to greatly affect the process of product development. Lack of commitment at a senior level meant that resources were not guaranteed to the project to ensure its successful outcome. The *modus operandi* of the two organizations was very different and the cultures appeared to be incompatible, so much so that staff felt unappreciated, with the result that many left the UK and US organizations. A US orientation overshadowed the needs of the European markets, resulting in apparent neglect of the European environment. The cumbersome nature of decision-making meant that market opportunities could not be speedily exploited but were likely to have been missed.

The telecommunications case highlights the importance of the factors facilitating collaborative product development identified by survey respondents, and pinpoints problems of failing to take these into account. For example, neglect of environmental conditions and change appeared to be a major factor in the less than 'successful' outcome. The electronic networks case similarly complements the survey findings but also serves to augment these by revealing the cumulative problems that can arise if collaborative product development is not managed effectively. Problems with collaborative product development can arise whether these are between separate companies, as with the telecommunications case, or within the same organization, as with the electronic networks case. Those factors influencing collaborative product development, arising from the cases, are shown in Table 5.

The survey and the cases were conducted in parallel. This research design enabled the outcomes of the survey and cases to be 'checked' as the research progressed and this, we felt, strengthened the overall validity of the research. For example, the interview data fed into the design of the survey questionnaire and the pilot results were available as the first stages of the cases were prepared. In

TABLE 5 Key factors affecting outcome of collaborative product development

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- Importance of personalities, personal relationships, cultural factors/compatibility, trust, and frequent communication
 - Importance of involving *both* technology *and* marketing (including personnel, perspectives, expertise and analyses)
 - Importance of involving senior management and of building commitment to the collaboration as a strategic asset
 - Importance of having a collaboration project manager and a flexible management style within a context of clear responsibilities
 - Importance of clear and profitable market prospects for the output of the collaboration
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this way, both the survey and case approach complemented each other.

The case research has not only reinforced the salient results of the survey research but has done so in a way that particularly emphasizes the significance of contextual factors on the collaboration outcome and, as such, provides some insights into the management of collaborations, particularly the importance of top-level commitment, cultural compatibility between the parties and an awareness of the dynamics of the external environment. The cases reflect the complexities entailed in collaborative product development and it is clear that 'recipes' for collaboration success cannot be universally applied without giving due attention to these complexities and to the specific context in which the collaboration is placed.

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Notes

¹ *Computer Users' Yearbook*, 1992; *Software Users' Yearbook*, 1992; *Communications Users' Yearbook*, 1992.

² The sample details given in Table 1 are derived from the responses of 97 of the 106 respondents to the questionnaire, the remaining 9 respondents wishing to remain entirely anonymous.

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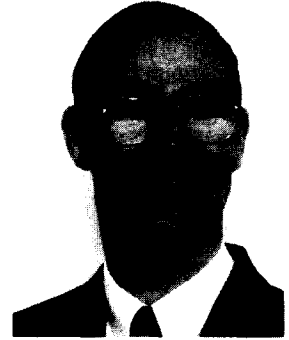
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