# METRICS FOR STRATEGIC ALLIANCE CONTROL

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**Abstract**

The paper develops a feedback control model of product development alliance management. The model allows us to place alliance review, and the metrics for this review, in the context of the control problems facing the alliance manager. We then specify a set of alliance review metrics, and outline the characteristics which they must have. Managers have a pressing need for such metrics, given the management challenges of alliances and the difficulties companies face in making them work effectively. The control model is then expanded to allow for changes in the nature of the alliance itself and inter-project learning. The development of the models and of the metrics is guided by the experiences of a large electronic systems manufacturer in alliances with a number of smaller strategic technology suppliers.

## Introduction

The paper develops a set of metrics which the manager of a product development alliance can use to use to review the health of an alliance and so act to improve its chances of being successful.  Significant amounts of research have been done on setting up an alliance to maximize the odds of success (Bailey, Masson and Raeside 1998, Hakanson 1993).  This research, however, may be difficult for the manager actually running an alliance to apply.  It is common for a manager to be in charge of an alliance without having taken part in its initial structuring.  The alliance may not have been set up optimally.  Furthermore, the initial set-up conditions can never guarantee success.  Managing an alliance is not simply a matter of making the *right* decisions in terms of partner selection and contract negotiation and then standing back, but rather one of making the *best possible* decisions at the start and then making them *right* as the alliance develops (Bruce, Leverick and Littler 1995).

Once having set up an alliance, a firm will be committed to making it a success.  As outlined by Ghemawat (1991), an essential aspect of strategy is commitment.  Once an alliance deal has been settled on between two companies, there will be a period of time until the alliance makes its first major deliverable.  During this period, there is considerable uncertainty as to the true nature of partner motives, capabilities, processes and cultures.  Whether or not the alliance is successful depends critically on adjustments made during this stage.  However, the firm will generally not revisit the strategic decision of actually being in the alliance until the first major deliverable. In this situation, the alliance manager is charged with making the alliance a success.

Figure 1 outlines the stages in the alliance process. It is based on previous research (Doz 1996, Ring Smith and Van de Ven 1994) and on our analysis of a number of strategic alliance experiences of a large integrated systems manufacturer to which we had access. Having decided to enter into an alliance, a firm searches for a potential partner. Once a contract is agreed to, the alliance *gets going*, although implementation often starts even before a deal is struck. There will usually be a significant evaluation of the alliance after a "get-going" period which lasts several months. This evaluation often takes place at the time of a major deliverable from the alliance. Based on this evaluation, the alliance will in general either end or be taken to a "higher level" in which the partners agree to continue, and to depend on each other in an even more significant way. The alliance is evaluated again after another significant deliverable and either ends or continues.

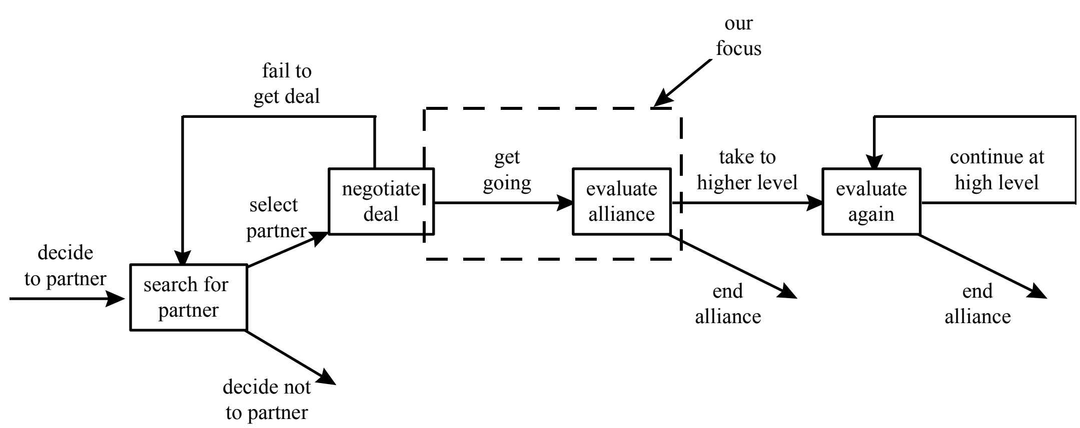


Figure 1: The Alliance Process

As stated above, our focus is on the "get-going" stage. Our point of view is that of the alliance manager for one of the partner companies.

We have developed metrics by explicitly placing the alliance manager in a feedback control system. The rationale is that to develop alliance review metrics it is necessary to understand the nature of the control mechanisms which the alliance manager has available and of the feedback loop of which the mechanisms form a part. In the next section, we discuss the research literature on alliance success. We then present a *road map* for alliance control in the form of a classic feedback control system. We use the road map to outline alliance control mechanisms and alliance review metrics. We then extend our control model by addressing the issues of changing alliance expectations and inter-project learning. We finish by questioning the role of the alliance manager in these expanded models.

**The Research Literature on Alliance Success**

An alliance is an *intermediate organizational form*. It is an inter-firm form of cooperation which falls between the extremes of the integrated firm and an arms length market interaction. As an intermediate form, it has been shown both theoretically and in practice to exhibit some of the best aspects of both extremes (Hennart 1993). The form is increasingly used for product development in which there is significant technological newness and/or requirements for short development times. An alliance is not a joint venture. In a joint venture, a new corporate entity is formed.

The rationale for two companies to form an alliance are diverse: product development, market access and power, learning, etc. The potential advantages of alliances include: speed to market; lower cost, inexpensive and flexible acquisition of required competences; access to distribution channels; and customer intelligence. Alliances do have potential disadvantages, and have not been very successful on average (Mohr and Spekman 1994). The disadvantages of alliances include loss of control, costs and difficulties in meshing the processes and cultures of the partner companies, and communication problems.

The number of projects involved in an alliance between two companies is also an important distinguishing characteristics. In alliances between large companies, there may be several individual projects being carried out concurrently (Doz 1996). In product development alliances between large system product companies and smaller sub-system suppliers--the focus of our study--it is common that the alliance comprises a single development project which may or may not become the basis for a more comprehensive cooperation between the two companies.

In the research literature, there is a focus on initial conditions and ex-post evaluations of success (Bailey, Masson and Raeside 1998, Hakanson 1993, Mohr and Spekman 1994). As mentioned above, this literature is not of direct assistance to the manager running an alliances. The important role of management in the success of strategic product development alliances is highlighted by a study done at Manchester Business School

(Bruce, Leverick and Littler 1995, Bruce, Leverick, Littler and Wilson 1995, Littler, Leverick and Bruce 1995, Littler, Leverick, and Wilson 1998). They show that management influenced issues such as frequent consultation, "even" distribution of benefits, and trust are important predictors of alliance success.

Doz (1996) has investigated the process characteristics of strategic alliances. He also documents the importance of the initial conditions of an alliance on its success, arguing that an initial emphasis on hard deliverables on a tight schedule leads to failure. He observed partners making three types of assessments: the likelihood of the alliance being successful, the trustworthiness and forthrightness of the partner, and the partner's ability to adapt in required ways. More successful alliances "started small and grew big" on all three assessment dimensions. Partners in more successful alliances engaged in a series of iterative and interactive learning cycles over time. Doz used case data derived from multiple projects carried out between three pairs of alliance partners. The focus of this paper is on single first product development alliances between a large integrated system manufacturer and critical technology suppliers.

Trust is a useful concept for considering the *relationship* of an alliance (Nooteboom 1996 and Smith Ring and Van de Ven 1994). Nooteboom (1996) states that trust can concern a partner's ability to perform according to agreements (competence trust), or his intentions to do so (goodwill trust). Thus the trust that an alliance manager has in a partner is related to both partner motives, capabilities and resources.

Metrics are used in a variety of management decision areas. An excellent annotated review of the use of metrics in the management of R&D is by Hauser (1996). The software industry has adopted metrics for managing software development projects (Jacobson et. al. 1992, p. 459). Another use of metrics worth taking note of is the *balanced scorecard* of Kaplan and Norton (1976) in which they develop a set of metrics for judging the success of a variety of managed situations. Marriage is often used as an analogy for an alliance. Metric scales exist for estimating the health of marriages (Spanier1976, Williams and Jurich 1995)

**A Road Map for Alliance Control**

Figure 2 models an alliance as a closed loop feedback system from the perspective of the alliance manager--the manager in the firm charged with the responsibility of ensuring the success of the alliance. We will use the diagram as a road map in developing alliance review metrics.

There are three internal components in an alliance system: alliance structure, development processes and alliance review. The alliance structure encompasses the amount and type of communication carried out between the partners; how much each company depends on the other partner to do; and the monetary and other incentives the alliance provides the partners. We assume that the alliance manager can adjust these aspects of the alliance structure. The development processes includes normal product development issues such as business justification, technical development requirements, task allocation and scheduling, milestones and reporting requirements, quality and functionality measures, testing and verification--carried out, of course, with the alliance partner. It is this latter point, “carried out with the alliance partner”, that makes the development processes discussed here generally little understood a priori. We assume that the development processes are fixed, that is, they do not change for the duration of the “get-going” stage.

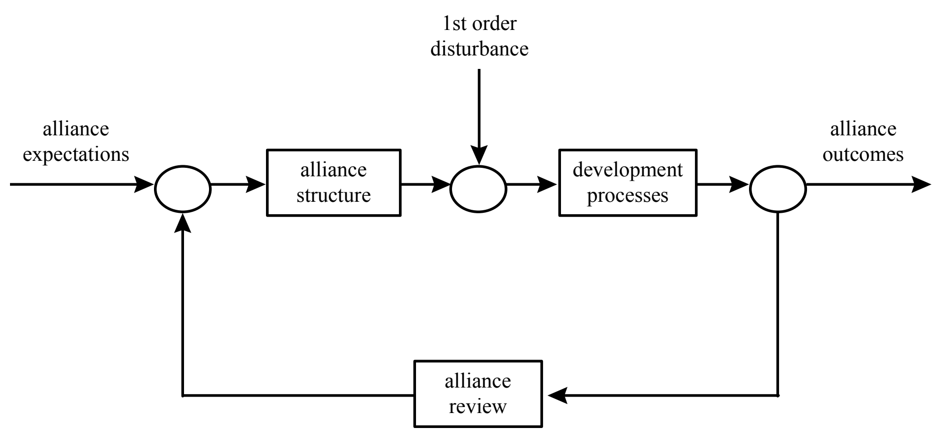


Figure 2: An Alliance as a Closed Loop System

The alliance system has two exogenous inputs: alliance expectations and external disturbance from the environment. Alliance expectations would include timely development of quality product so that the firm can provide a target group of customers with value by a certain date together with expectations for the behavior of the partner firm during the alliance (Doz 1996). The first order disturbance from the environment is information from the environment of the alliance which disturbs the alliance development processes but does not affect alliance expectations.

The outcomes of alliance is measured in the same way as alliance expectations: product development and partner behavior. At the start, the system is not in equilibrium. The role of the alliance manager is to see that alliance output is driven to match alliance expectations. The purpose of the paper is to determine the characteristics of the alliance review: what the metrics should be and how they should be used.

The model in Figure 2 suggests a number of issues that should be addressed when developing metrics for alliance review:

*Alliance review is part of a control system*

In developing metrics, we are designing a control system for an alliance. In this context, the sequence suggested by Burton (1994, pp. 439-440) as typical for the design of physical control systems is instructive:

- determine the relevant properties of the uncontrolled system
- estimate the types of disturbances that the system will likely be subjected to
- establish requirements which the controlled system should meet
- design the controller by specifying how system errors will lead to control actions
- design the sensor system
- test everything and modify if needed

An uncontrolled alliance has no feedback loop through alliance review. Alliance expectations lead to an initial alliance structure which then controls the development processes with no feedback or adjustment to account for environmental disturbance. Doz (1996) outlines well the instability of alliances with improperly designed initial conditions. Based on Doz' description and our own observations, we suggest that it is common that the trust/confidence in the partner held by members of the firm's alliance team can rise unrealistically during the partner search and selection stages only to drop in an equally unrealistic fashion as the kinds of difficulties typical of the "get-going" stage are experienced. Typical timing of this drop in confidence together with the pressure to deliver product is shown in Figure 3.

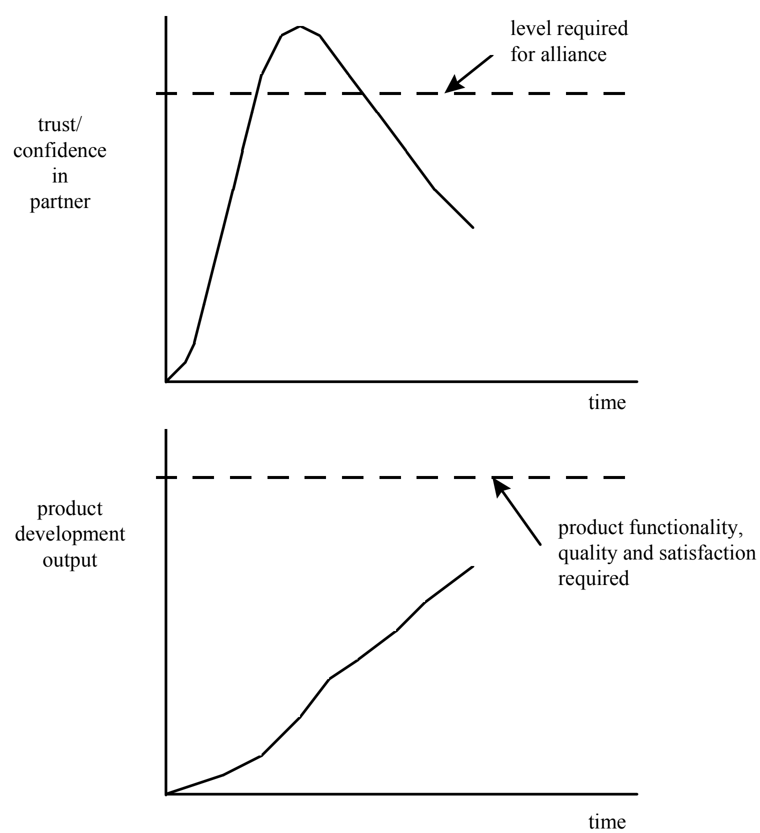


Figure 3: Typical timing patterns of trust/confidence in partner and product development output

The drivers for this deterioration in trust/confidence are several, and can include: divergent and/or unrealistic expectations of the alliance by the partners that becomes evident only when real product development begins; a win-lose mentality on the part of personnel; false motives on the part of one or both partners; internal failure to accept the alliance particularly on the part of those who regard themselves as having the skill set that the partner brings; and general low corporate morale.

There are really two types of disturbance that an alliance system will sustain: disturbances which do not affect the alliance expectations but which the manager wants to attenuate so as to limit possible damage to the alliance; and disturbances which should affect alliance expectations and must be taken into account. We will call these first order and second order disturbances respectively. Our road map in Figure 2 concerns itself with first order disturbances. We keep alliance expectations constant in the face of exogenous disturbance. Typical first order disturbances come from: market channel conflicts as the partner firms find themselves unexpectedly pursuing the same customers; trade press misrepresentations of the nature of the alliance and its development objectives and progress; internal communication disconnects; executive misunderstandings which affect the alliance; the loss to either firm of employees key to the alliance; and problems with either external and/or internal suppliers to the alliance development efforts. These are the kinds of disturbance that an alliance manager wants to contain and keep from throwing the alliance off the rails. We return to the issue of second order disturbance below.

The controller in Figure 2 is the alliance structure block. Burton (1994, p. 446) lists the three primary functions which a system controller must perform: adequate stability, close tracking of input, and disturbance rejection. “Adequate stability” for an alliance system would ensure that the alliance does not move to and remain in a state from which the system cannot deliver on product output expectations. In the example uncontrolled system diagrammed in Figure 4, trust/confidence drops below that which is required. The partner is perceived as either not wanting to or not being able to deliver. The alliance structure block, as controller, must prevent the system from entering and remaining in such a state. Close tracking of input means closing the gap between alliance output and expectations--driving the alliance to deliver on product expectations. In the first order model, disturbance rejection means maintaining system stability and close tracking of input in the face of first order disturbances which do not affect alliance expectations.

The alliance structure control block accepts the input of the alliance expectations and the feedback from the alliance outcomes processed by the alliance review block. For an alliance, the sensor is the alliance review block. System error for an alliance is the difference between alliance outcomes and input expectations. System testing and modification are difficult for alliances because of the difficulty of performing experiments on real alliances. These present an organizational learning problem. We will return to the issue of organizational learning below.

*System stability*

A system is defined as stable if it has a bounded system response. The concept of stability can be illustrated by considering the cone commonly used for the informal serving of ice cream--an ice cream cone. If the cone itself is placed upside down on a flat surface, it is "stable". Tipped a bit it will return to its original position. If the cone is placed on its side, it is neutrally stable. It will role with no tendency to leave the position on its side. If the cone is stood on its bottom tip, it is unstable. Tipped a slight bit it will fall down.

The stability of a system depends on the characteristics of its sub-processes and their interrelationships. The uncontrolled alliance pictured in Figure 4 is unstable. The degree of stability of an uncontrolled alliance will depend significantly on the characteristics of the alliance development processes. A firm can come to understand the nature of its own development processes well as it uses them extensively. This is seldom the case for development in the context of an alliance.

The firm which provided us access to their strategic alliance experiences had, at the time of our data gathering, extremely stable development processes based on gate-review processes and developed to meet the stringent quality requirements and long, careful buy cycles of their markets. Perturbed by either internal or external stimuli, these processes would quickly adjust and return to their specified state. Such stability is a plus if the perturbations are to be attenuated. On the other hand, the ability to easily adjust a firm's development processes to meet the requirements of an alliance is a desirable characteristic. Processes can be too stable.

For alliance success, development processes need to have characteristics which lead to flexibility--that is, the ability to change in the face of internal or external stimuli which ought to be adjusted to--and so would tend to be less *stable*. Regardless, because of the relative lack of experience of firms with alliance development as opposed to internal development, the stability characteristics of alliance development processes are less well understood. Process stability and flexibility are related to the idea of process maturity (Paulk et. al. 1993). A lack of process maturity would mean that a process is neither stable nor flexible. The relative lack of maturity of alliance development processes means that it is harder to design control processes--alliance review and alliance structure in our case--which produces both suitable system stability and responsiveness.

*PID controllers for physical systems*

A PID controller is one which combines two or all of proportional control, derivative control and integral control. PID controllers work well in practice for many physical systems (Burton 1994). In proportional control, the system error--the difference between the input and the feedback--is multiplied by a factor $k_p$ to become part of the controller output. Increasing the gain--the value of $k_p$--increases the responsiveness of the system and drives the output more quickly to that desired as specified by the input. Increasing the gain, however, also makes the system less stable--the output would increasingly tend to overshoot the target input. In the context of an alliance, proportional control would mean that the alliance manager monitors the alliance output and compares it with what is desired. Corrective action would be taken to the extent that there was a mismatch. Increased gain would increase the extent of the action taken.

In derivative control, the rate of change of the system error is multiplied by a factor $k_d$ to become part of the controller output. Increasing $k_d$ dramatically increases both the responsiveness and instability of a system. Derivative only control of systems is generally not advisable. For the alliance manager, derivative control would mean that he or she takes corrective action on the basis of rate of change of the gap between alliance output and what is desired rather than the difference in magnitude. Thus, a deterioration of alliance output would lead to corrective action although the difference between output and input may still be small.

In integral control, the integral of the system error over the life of the system is multiplied by a factor $k_i$ to become part of the controller output. This means that mismatches between system output and input that occurred some time ago continue to lead to corrective action. Thus even a small system error can lead to appreciable effect over time. One advantage of integral control is that it generally improves steady state behavior. For alliances, a relative dependence on integral control (large $k_i$ relative to $k_p$ and $k_d$) can be related to the trust that the alliance manager has for the partner. If system error appears and seems to be worsening, corrective action would not be radical if the history of the alliance is one of small error. If there is significant trust, a lack of old errors would temper corrective action. On the other hand, if there is a lack of trust, integral control would be de-emphasized relatively.

The summary insight from the practical importance of PID controllers for many types of systems is that an alliance manager can usefully consider his or her control actions as being driven by three aspects of system error: the error itself, the rate of change of the error, and the history of errors, where error is the difference between alliance outcomes and that input as alliance expectations.

*Timing and time delays*

Response time is a key element of system control. A fast, stable response is desirable. It is difficult to perform a precise analysis for an alliance system due to its complexity. However, the concept of system response can play a useful role in alliance management. If the manager can ascertain the time required to complete one feedback loop (i.e. Alliance Structure, Development Processes and Alliance Review), a characteristic time can be assigned to the system. This time indicates how long one feedback cycle will take. The alliance manager can then set about understanding why such time is required and determining how it can be reduced.

Reducing the characteristic time is important. Typical time-to-market considerations will dictate a finite amount of time for project completion. The lower the characteristic time, the greater the number of feedback loops which can occur. This allows the alliance system to be more responsive to errors or disturbances and increases the likelihood that the system output will match input.

We then need to ask what should the timing be for alliance review and for corrective changes to the alliance structure. Should they be continuous, periodic or driven by particular events? If periodic, then how frequent. If event driven, then by which events, e.g., missed milestone, poor quality statistics, dispute between partner teams, learning measures, etc.? Or should some combination of these three patterns be used? Of course, the cost of alliance review and alliance structure adjustment must be factored in--high cost would mean a slower optimal frequency of review and adjustment so that low cost metrics and review processes are desired.

System control with time delays is obviously tricky. Consider a simple example. You are in the shower trying to get the temperature just right. There is an abnormally long pipe between your temperature controller and the shower head. You increase the temperature setting because the water is too cold. It stays cold for you because of the length of pipe between the controller and the shower head--so you increase the temperature setting again. Pretty soon you are trying to adjust the shower while outside of the water flow because the water is so hot you cannot stay in it. Now compound the difficulty by having unpredictable inflows of different temperature water into the pipe between the controller and the shower head--a tough problem.

If in an alliance system there are large delays in the alliance review block, the system decays to one that is uncontrolled and hence less stable. This shown formally in an Appendix.

## The Controller--Alliance Structure

We now turn to the nature of the controller in an alliance system--the alliance structure in Figure 2. From our observations of the strategic alliance experiences of the large electronic systems manufacturer to which we had access, we conclude that an alliance manager can control aspects of three parts of an alliance: interface structure--the structure that supports communication between the alliance partners; responsibility balance----how much the firm depends on the partner to do; and incentives--monetary and other incentives the firm provides the partner.

### *Interface structure*

The interface structure of an alliance is composed of: the mix of communication media (mechanisms) used, the frequency and timing of communications; the allocation of communication responsibilities; and the use of bonding information to reduce partner uncertainty and increase partner trust.

Daft and Lengel (1986) distinguish between seven information handling mechanisms using their media richness model. The model specifies that various organizational media have different capacity to handle the level of equivocality in information. Equivocality is defined as the absence of shared or defined meaning with the potential for multiple or unclear interpretations (Daft and Lengel 1986). Nadler and Tushman (1989) distinguish between five coordination mechanisms on the basis of their information processing capacity, cost, and dependence on the informal organization.

Agency theory (Fleisher 1991) has demonstrated the economic rationality of voluntarily providing costly information to partners in cooperative situations. Part of the role of the alliance manager is to spend time and money making sure that the partner understands and has confidence in the motives and capabilities of the firm. The trust that is engendered in the partner will result in behavior which is of benefit to the firm in the alliance.

One of the attractions of using changes in interface structure to control an alliance is the short delay times required to implement changes. Changes in alliance interface structure can be enacted quickly and at relatively low cost. They can also be done frequently, and undone if required.

*Responsibility balance*

Adjustments in the balance of responsibility between the firm and the partner can be carried out in a variety of ways. The simplest is to adjust the balance between the partners--the firm can give out or take back parts of the development project. This can be accomplished, for example, by assisting the partner with a project deliverable. Another approach is to start or stop parallel development either internally or externally with another partner.

Adjusting the responsibility balance between the partners by giving out or taking back parts of the project can be done with relative ease and fairly quickly. Assisting the partner with a project deliverable is also not difficult. On the other hand, starting or stopping parallel development would have significant fixed costs and delays, and could not be done frequently.

*Incentives*

Incentives be provided in a variety of ways including: cash bonuses to the partner for milestone completion, sub-system price and licensing fees, revenue and profit sharing, and market and distribution allocation. Such changes in incentives present the most problematic timing and delay issues, and cannot occur frequently.

**The Sensor--Alliance Metrics**

In deciding whether and when to implement one or more of the three types of control mechanisms described above, the alliance manager will be concerned with five issues: the motives of the partner in the alliance; the partner's capabilities; its resources; its development processes; and its culture.

*Motives*

It is all too frequently the case that the motives of the partners in alliance are not clear--even to themselves. Key alliance manager concerns are to increase both the clarity and quality of partner motives and to make these motives widely known among alliance personnel. This is true as well of partner expectations. Expectations concerning what the partner will do and not do, and what the alliance will and will not deliver are closely connected with partner motives. Other important characteristics of motives in addition to clarity that are important to consider are: uncertainty (a partner's motives may be clear but liable to change in the face of small disturbances), commitment (related to uncertainty--a partner's motives are uncertain if it is not committed to them), and congruence of motives between the partners. It is motive congruence that really drives the formation of an alliance in the first place. Motives change, however, and the level of motive congruence is something that an alliance manager must monitor. What to do about differences in motive if they develop is a tough problem. We maintain, however, that the alliance manager has communication, responsibility balance and incentives at his or her disposal to attempt to maintain a "win-win" situation given fixed alliance expectations.

*Capabilities*

For a product development alliance, we consider that the capabilities of a partner centre on technical and design competences. The degree to which a partner has the capabilities required is part of the initial decision to partner, but may well change during the partnership as well. What will definitely change will be the alliance manager's estimates of the extent of partner capabilities as more concrete information becomes available during development. Important as well will be the certainty that the partner has the required capabilities--this uncertainty should decrease as development proceeds--as well as its congruence with the firm's capabilities and its appropriateness for the task at hand. The location of capabilities within the partner is also an issue--who has which capabilities?

*Resources*

Other partner resources of importance to the alliance manager are managerial and financial. Does the partner have managers experienced in running alliances; are these managers improving their abilities in this regard, or are those partner managers who acquire a level of experience being revolved out of the alliance. The financial resources of the partner are very much related to the motives for partnering.

*Development processes*

The characteristics of the development processes for the partners provides another important set of issues for the alliance manager: their stability, maturity, appropriateness for the development task at hand, and their congruence with each other.

*Culture*

Matching organizational cultures has been found to increase the chances of an alliance being successful. It is not likely that the organizational cultures of the partners will change measurably during the course of an alliance product development project. The alliance managers understanding of the match will, however. If the manager comes to believe that there are significant cultural mismatches between the partners, he or she can take action to mitigate their negative effects.

The assessment of organizational culture using metrics is well developed, although the scales available are not very intuitive for the alliance manager. A widely used scale is provided by Cooke and Rousseau (1988), for example. They identify 12 cultural styles around three organizational issues: how people in the organization find satisfaction (achievement, self-actualize, humanistic-helpful, affiliative); how they deal with other people (avoidance, dependent, conventional, approval); and how they approach tasks (oppositional, power, competitive, competence/perfectionist). These style descriptions are technical, but can be used if the manager is willing to take the time to study them. Consider approach to tasks: oppositional describes organizations in which confrontation prevails and negativism is rewarded; power is descriptive of organizations structured on the basis of the authority inherent in members' positions; competitive describes organizations in which winning is valued and members are rewarded for outperforming one another; and in competence/perfectionist organizations perfectionism, persistence and hard work are valued. So, as an example, we include below a set of metrics around approach to tasks taken in the partner organizations. Scales for satisfaction and approach to people could have been developed in the same way.

We regard cultural mismatch between partners as the source of many alliance problems--for example, mistaken assumption about individual and organizational motives, misunderstandings about the meanings of words and actions. The alliance manager must monitor cultural mismatch and the problems that it can generate.

Trust--an alliance managers estimate of a partner's motives, capabilities and resources--is related to risk. An alliance presents a firm and its alliance manager a high level of risk if there is a low level of trust for the partner. Issues of motive, capability, resources, processes and culture all bear on the level of risk that an alliance has for a firm. One of the roles of the alliance manager is to contain this risk to the extent possible. There may be no change in the issues during an alliance, but firm and alliance manager estimates of them will--and that is what counts.

*Metrics*

Consider now metrics for reviewing these alliance issues. Such metrics should have the several characteristics. They should measure and cover critical issues. They should be simple and clear both for the alliance manager and for decision making in a group setting. They should not depend on complex hard to develop data. They should be reasonably easy to evaluate. They must allow for rapid and frequent alliance review so as to avoid the problems of feedback delays discussed above. They must also be actionable-- there must be metric values that lead to changes in alliance control, i.e., to changes in alliance structure.

Alliance review metrics can take a variety of forms. One form is that of a Likert scale. Consider the following example. The alliance manager wishes to estimate the clarity of a partner's motives in a form that adds to his or her ability to act on the estimate, but also on his or her ability to communicate the estimate. The following question and attached scale could be used:

We have a clear understanding of our partner's motives for the alliance.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Strongly Disagree | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Strongly Agree | 8 Don't know |

Metrics can also be in more concrete form. Examples include estimates of the partner's cash flow as a firm, or the partner's expected cash flow from the product(s) being developed in the alliance.

We consider now some example metrics phrased in terms of questions which may be answered using Likert scales or concrete data:

a. Partner Motives

i) clarity of partner motives

How clearly do we understand our partner's motives for the alliance?

How clearly does our partner understand our motives for the alliance?

ii) partner commitment

How committed is our partner to the alliance?

How critical is the alliance for the partner?

iii) motive congruence

How well do our partnering motives fit with those of our partner?

iii) motive conflict

How many customers will both our sales organization and that of our partner pursue?

What conflicts will there be in the distribution channels both we and our partner use?

b. Partner capabilities

i) appropriateness of capabilities

Does the partner have the skills to deliver?

ii) capability complimentarity

Do our partner’s skills compliment our own?

iii) access to required capabilities

Can our partner easily access outside skills.

iv) metrics related to a skill map of partner team

| individual | skill 1 | skill 2 | skill 3 | …… | skill n |
|---|---|---|---|---|---|
| a | X | | X | | X |
| b | | X | | | |
| c | | | X | | |
| …….. | | | | | |
| z | | | | | X |

Are critical partner skills held by only one (two, etc.) person?

What has been the recent partner personnel turnover by skill category?

c. Partner resources

i) managerial resources

Does the partner have deep managerial resources?

Do partner managers have experience in similar alliances?

i) managerial turnover

Has there been recent management turnover in the partner team?

What management turnover is likely in the partner team?

ii) financial resources

What is the total cash flow of partner?

What cash flow will accrue to partner as result of alliance? When?

Can the partner raise new capital? How much?

What are the partner's cash reserves in months?

d) Development processes

i) appropriateness

Are the partner's development processes appropriate for the task?

ii) complimentarity

Do our development processes fit well with those of the partner?

iii) maturity

What level of maturity are the partner's processes?

iv) interaction of development primes

How well do the individuals charged with development in each organization interact?

e. Organizational cultures

i) not-invented-here

What is the level of "not-invented-here" in our team?

What is the level in the partner team?

iii) opposition to the alliance

Do the key players in each organization accept the alliance?

What parts of the partner organization are against the alliance?

What parts of our organization are against the alliance?

iii) core values

What are the core values in our organization?

What are the core values in the partner organization?

How different are these core values?

iii) decision speed

How fast do important alliance decisions get made in our organization?

How fast does the partner make them?

How different are the decision speeds?

What alliance problems derive from the difference in speeds?

iv) approach to tasks

In the partner organization, to what extent do individuals approach their tasks on the basis of opposition, power, competition, and competence/ perfectionism?

In our organization, to what extent do individuals approach their tasks on the basis of opposition, power, competition, and competence/ perfectionism?

How different are the approaches to task in the two organizations?

### A Second Order Model

A more general feedback control model is shown in Figure 4. Alliance expectations are not fixed for any period of time as assumed in the first order model. The firm can change its alliance expectations on the basis of second order input from the market environment and the firm's overall corporate strategy. Second order disturbances provide information on the demand for the product being developed and its timing. They could include: failure of the technology on which the product development is based to diffuse adequately into the marketplace; arrival on the market of an alternative product which provides greater customer value; an economic downturn which alters demand and timing forecasts; and industrial restructuring which eliminates the demand for the product.

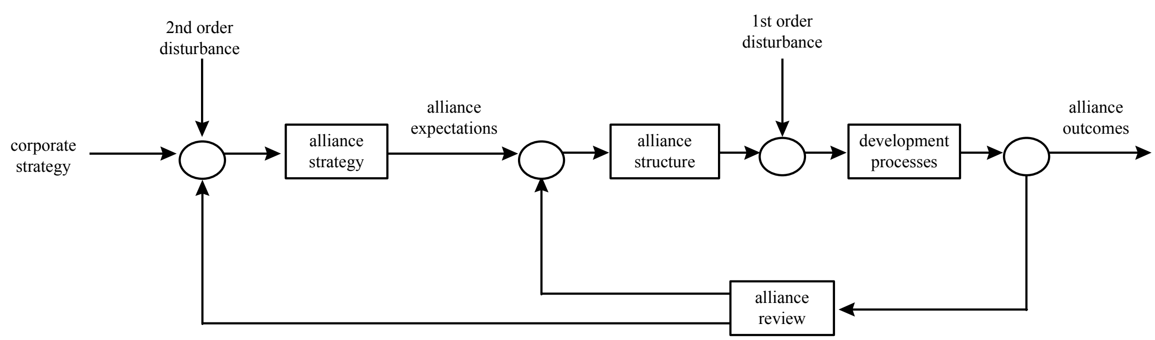


Figure 4: Second order alliance control road map

In this second order model, the alliance manager control objectives are expanded. In the first order model, the manager was decreasing the gap between alliance outcomes and fixed alliance expectations. Now the manager will want to drive the alliance review so as to get what he or she regards as the *right* alliance expectations. There must now be metrics which compare the current expectations and the product development output with the second order disturbance. Bruce, Leverick and Littler (1995) found case evidence that second order disturbances can be ignored by alliance managers. There is certainly considerable friction for the alliance manager in effecting a realignment of alliance expectations through the alliance strategy process. As described above, alliance strategy is not revisited continually. The nature of the management delegation process in companies means that the alliance manager is charged with making an alliance a success without easy recourse to changing its expectations.

**Alliance to Alliance Learning**

Figure 5 puts inter-project learning in perspective. To learn from alliance to alliance the firm must have an Alliance Learning process which uses the output of an alliance to improve Alliance Strategy, Alliance Structure, Development Processes and Alliance Review.

There is a large literature on organizational learning (Dodgson 1993) which has become popularized as a source of competitive advantage for firms (Senge 1990). To learn, an organization must overcome a variety of obstacles--foremost of which is the resistance in many organizations to regard learning as an important deliverable. To learn how to manage alliances better a firm needs a system like Figure 5 in place, together with the will and the resources to make it work.

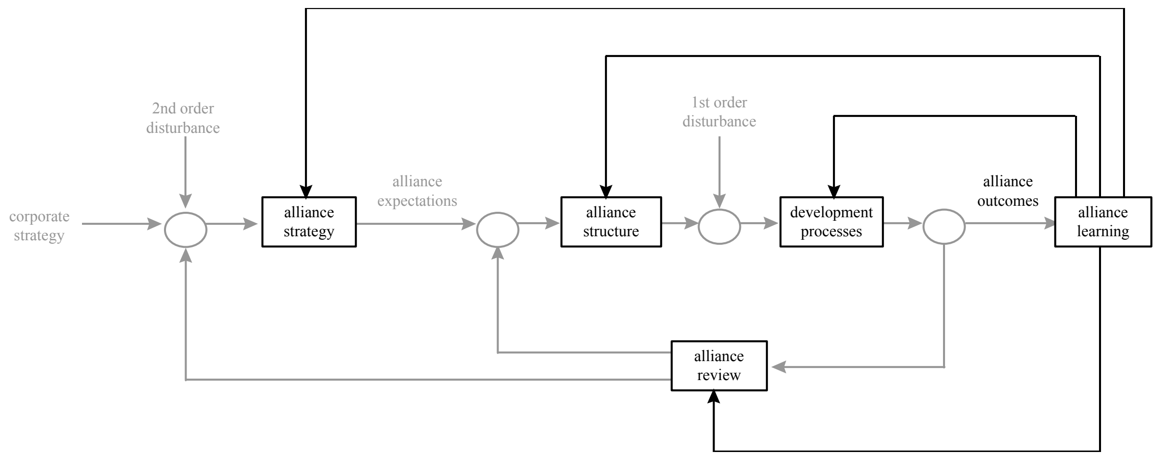


Figure 5: Learning from Alliance to Alliance

For organizational learning, models such as these are essential (Bartezzaghi et. al. 1997). Only with such models can data be captured in a structured way so that they can be stored and transmitted throughout the organization. The questions then are: what data; who does the data capture, storage and transmittal; and how is the data used.

Two possibilities for data suggest themselves. First, a log of the timing of alliance review and control actions could be kept by the alliance manager. This then could be compared with a time line of the alliance output. Second, real time manager impressions of the effectiveness of the alliance review and control mechanisms could be captured.

There has to be a learning infrastructure that assists alliance managers to participate in such a process and the incentives to do so. This is a difficult problem because of the pressure on alliance managers to produce concrete deliverables. What organizational learning roles can an alliance manager play. There are at least two: (i) documenting his or her learning achieved during an alliance (by experimenting with review and control processes), between alliances run simultaneously (by trying different review and control processes in each project), or at the end of an alliance (through a post-project audit), and (ii) teaching other managers based on this individual learning. Is it possible for other individuals or groups to do this documentation and teaching. Yes, of course, but their functioning can neither become overhead for the alliance manager or team, nor perceived as unimportant by upper management.

The models in Figures 2, 4 and 5 can then be used to assist in the transmittal of the learning results throughout the organization.

**Role of the Alliance Manager**

Figure 6 outlines the components of the role of the alliance manager in the first order control model. These components are clear.

Less clear are appropriate role components for the alliance manager in the second order model illustrated in Figure 4, and in the learning model of Figure 5. The role of the project manager has been shown an important factor in new product development success (Clark and Wheelwright 1992). What then is the appropriate set of powers and responsibilities for the alliance manager charged with making an alliance a “success”?

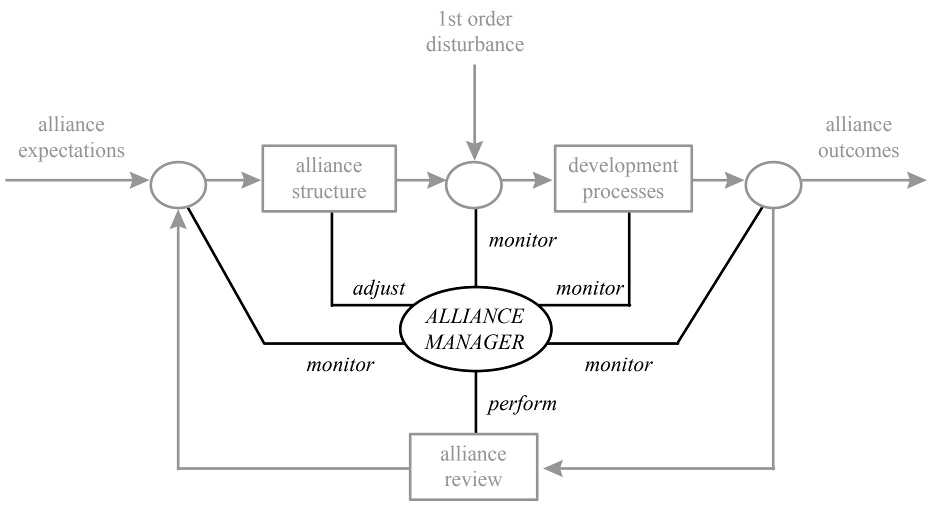


Figure 6: The Role of the Alliance Manager

**Summary**

We developed a feedback control model of product development alliance management. The model allowed us to place alliance review, and the metrics for this review, in the context of the control problems facing the alliance manager. We then specified a set of alliance review metrics, and outlined the characteristics which they must have. The control model was then expanded to allow for changes in the nature of the alliance itself and inter-project learning. The development of the models and of the metrics was guided by the experiences of a large electronic systems manufacturer in alliances with a number of smaller strategic technology suppliers.

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Appendix: The Laplace Transform Solution for the System Output

We consider a linear control system model of an alliance as diagrammed in figure A1. The system has an input i and a disturbance m. The output is o. There is a “plant” D which is to be controlled and a controller A. Feedback from the output is carried out through a sensor R. There are two time delays in the system: T1 after the sensor and T2 after the controller. They delay the outputs from the sensor and the controller by periods of time T1 and T2 respectively. The delays are made explicit so that the effects of delays on system control can be seen more easily.

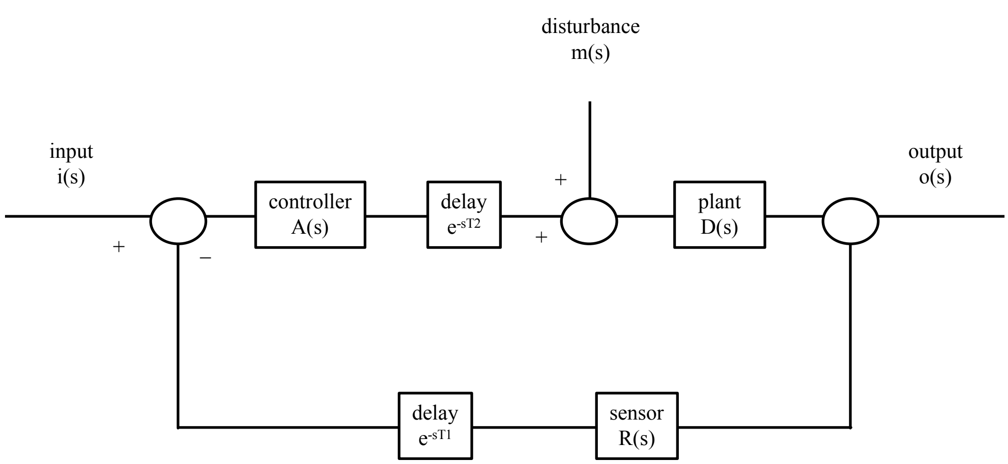

Figure A1: Alliance Linear Control System

The output of a system such as this can be found as the solution to a set of linear differential equations. A common approach to the solution of such linear differential equations is to use Laplace transforms. The Laplace transform of the derivative of any function f(t) equals s times the transform of the function, F(s), minus the initial value of the function. This result can be used recursively for higher derivatives. This feature of the transform together with the fact that there is a unique one-one relationship between a function and its Laplace transform turns the solution of a set of linear differential equations into an algebra problem. Using this approach on the system in Figure 4 allows us to solve for o(s), the Laplace transform of the system output:

$$o(s) \;=\; D(s)\{m(s) + A(s).e^{-sT2}[i(s) - R(s).e^{-sT1}.o(s)]\}$$

or

$$\begin{aligned} o(s) \;&=\; \{D(s)[A(s).e^{-sT2}.i(s) + m(s)]\}.\{1/[1 + D(s).A(s).R(s).e^{-s(T1+T2)}]\} \\ &=\; \qquad openloop(s) \qquad . \qquad feedback(s) \end{aligned}$$

Looking at the formula for the system output, o(s), one can see that the system output is the product of two factors: openloop(s) and feedback(s). openloop(s) would be the output if there was no feedback loop: it is the sum of

- the input i(s) operated on by three "transfer functions"--the Laplace transforms for the controller, A(s), for the time delay, $e^{-sT2}$, and for the plant, D(s)), and
- the disturbance m(s) operated on by only D(s).

feedback(s) is the factor which adjusts this result for the fact that there is feedback in the system through the sensor R(s).

Note that for large T1, feedback(s) goes to zero and o(s) approaches openloop(s).

The control problem is to decrease the gap between the output of the system and the input in the face of the disturbance. The system input is often considered to be a step function. The input is zero until time zero at which time it moves up to a value which remains constant. The disturbance is also often modeled as a step function--that is, a one time disturbance that occurs some time after time zero and remains constant thereafter.