Strategic Performance Dynamics

Kim Warren: London Business School

Sussex Place, LONDON NW1 4SA
tel. 07802 48 58 69 : e-mail kwarren@london.edu

Best Paper in Strategic Management

British Academy of Management Conference, 2002

ABSTRACT

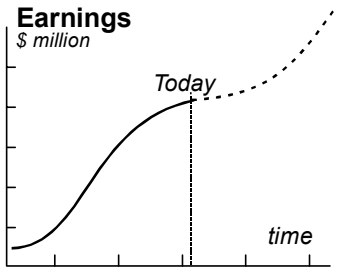
Firm profitability and other performance outcomes are, at any moment, strongly accounted for by resources available to the firm – customers, staff, capacity, etc. – plus certain attributes of those resources, and exogenous factors. Explanations for the time-path of performance must therefore build on explanations for the time-path of those resources. Since resources behave as asset stocks, accumulating and depleting over time, their level at any moment is identical to the sum of every resource-item ever added, minus every resource-item ever lost. Resource accumulation cannot occur without the use of existing stocks of assets, including that resource-itself. The firm is thus a system of interdependent resources, whose performance over time reflects ubiquitous processes of accumulation and feedback.

The system is open, since resource-accumulation depends on exogenous factors, and because certain resources must be developed from outside the firm, and defended against loss. Potential resources can themselves are brought into existence by the activities of firms. Performance over time therefore depends on developing these potential assets, capturing them from rivals, and retaining them. The firm's success in accumulating and retaining resources is constrained by its capability in each resource-building task – capabilities themselves being asset stocks whose rates of accumulation reflects the firm's experience.

Introduction.

A principal quest of strategic management research is to explain firm performance, usually expressed in financial terms. Since investors value expected future returns, however, instantaneous explanations are not sufficient - useful explanations of strategic performance must account for the stream of earnings through time (Figure 1).

Figure 1: The time-path of financial performance



The resource-based view (RBV) asserts that performance is a function of firm resources (Wernerfelt, 1984). Earnings at any moment are quite accurately calculated in firms' profit and loss and cash flow statements, calculations that rely merely on a sub-set of resources (customers, staff, capacity etc.), certain attributes of those resources (customers' purchase rates, employee salaries, production costs etc.), and certain exogenous items (e.g. market price). Attributes will be shown also to be resources, so RBV can be expressed mathematically as ... *the performance of the firm, Π, at time T depends on the levels of strategic resources R_1 to R_n, and on exogenous factors E* (Equation 1).

$$(1) \qquad \Pi(T) = f\left[R_1(T),..,R_n(T),E(T)\right]$$

This leaves unexplained the role of the many other resources that clearly affect future performance, but are not involved in this current calculation of earnings. Such non-P&L resources include, for example, the current range of products, stock of technologies, and intangible factors, such as staff morale and market reputation.

If current performance is calculated directly from the limited set of items just mentioned, then that is true not only at this precise moment, but also at all other times in the firm's past or future. An adequate explanation for performance over time must therefore explain the trajectory that the levels of these resources follows, through time.

Resources as accumulating asset stocks.

Amit and Schoemaker (1993, A&S) define resources as '*... stocks of available factors that are owned or controlled by the firm ...*'. However, firms commonly use stocks of items that they do not own or control, but to which they simply have somewhat reliable access. If 'reliable' means the likelihood that a resource-unit available today will still be available in the future, then customers and distributors can be more reliable resources than employees, for example. This definition of 'resources' therefore needs extending to '*... stocks of items that the firm owns or controls, or to which it has somewhat reliable access*'. This paper also follows A&S in distinguishing resources from capabilities - both categories are asset stocks, but resources do *not* include capabilities.

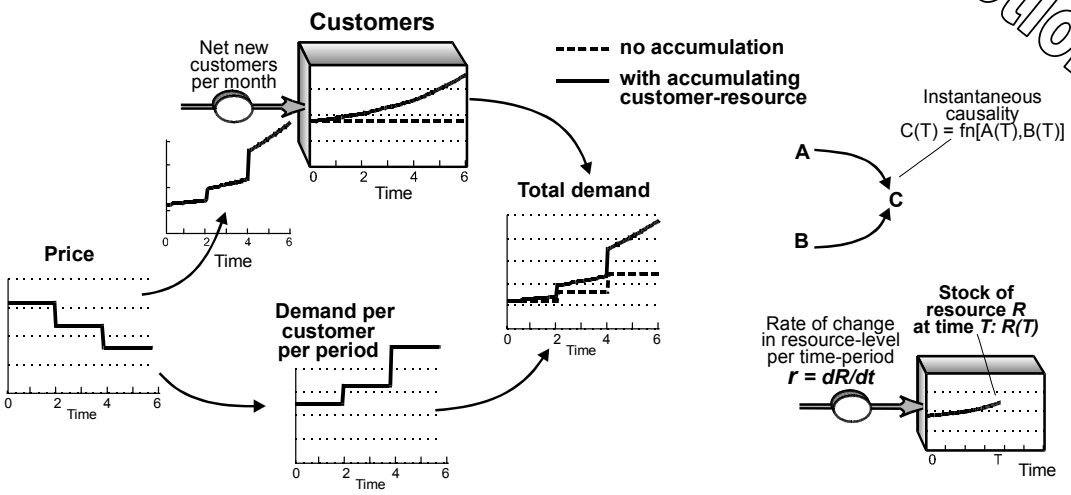
The distinctive characteristic of resources is their tendency to accumulate and deplete over time (Dierickx and Cool, 1989). The level of a resource (or any asset-stock) at any moment is identically equal to the sum of all resource ever added, minus all resource ever lost, a relationship captured by the mathematics of integral calculus. So … *the current level of resource R at time T is the sum of its net rates of accumulation r since time t=0, plus its initial level,* (Equation 2).

$$(2) \qquad R_i(T) \equiv \int_0^T r_i(t)dt + R_i(0)$$

Equation 2 has important implications. First, if the current quantity of resource is precisely the sum of all historic gains and losses, there is no possibility that statistical methods can provide an improved explanation for resource levels. Secondly, since performance depends on these resource levels, there is also no possibility for statistical analysis to explain performance outcomes. To illustrate, today's profit rate depends on today's customer-base, which is the sum of all customers ever won, minus all those ever lost. A customer won yesterday is exactly as relevant to today's profit-stream as a customer won ten years ago, *ceteris paribus*. Thus, the effectiveness of marketing spend or pricing choices at those two points in time have precisely the same consequences for today's profitability.

Figure 2 provides conventions for a graphical representation of the resource accumulation process. In the remainder of this paper, these conventions carry only the precise meanings given here, and do not merely imply some ill-defined coincidence between variables.

Figure 2: The accumulation of a strategic resource, and its consequences



(*Note that the upward steps for the inflow of customers in Figure 2, reflected in changes to the slope of the customer resource, are not readily discernible by visual inspection of the stock of customers*).

Resource accumulation depends on existing resource-levels.

We now turn to the question of what is required for resource-stocks to accumulate. It appears that no case exists in which resource accumulation can take place without dependence upon *existing* resource-levels. Even for new enterprises, for example, cash can be raised, and key staff hired, only if the entrepreneur possesses a stock of experience and credibility.

The growth rate of a particular resource may also depend upon the current level of that resource itself, as when existing customers recommend the firm to others. Exogenous factors play a part once more, for example when economic recession causes loss of customers. Thus *… the current rate of accumulation r_i of resource i at time T is a function of the current level of all existing resources, including that of resource i itself, and on exogenous factors E* (Equation 3).

$$(3) \qquad r_i(T) = f_i\left[R_1(T),..,R_n(T),E(T)\right]$$

Dependence of resource-flows on particular levels of existing resources may be either positive or negative. A larger resource-stock of sales people may raise the rate of customer-acquisition, for example, whilst insufficient service staff may cause customer loss-rates through poor service.

Equations 1 to 3 constitute a basic model of the firm as a system of interdependent resources. The system is open, not only because its resource accumulations and depletions are partly determined by exogenous factors, but also because many of the required resources must be developed from outside the firm, and defended against loss. A firm's performance over time therefore depends on its rate of progress in developing these potential assets, capturing them from rivals, and retaining them.

Since the firm need only have somewhat reliable access to resources, ownership is not necessary, and the model is not sensitive to the location of firm-boundaries. Performance over time can be equally captured, for example, whether the firm manufactures in its own facilities, or subcontracts production.

Furthermore, the model does not rely on judgements as to whether any resource is 'strategic', in the sense of being particularly crucial to competitive advantage. The firm's performance depends on having the appropriate level of each resource, whether or not that factor is readily identified and obtained. Any difficulty that does arise is captured by the function in Eq.3, and manifest in a slower than desired rate of accumulation.

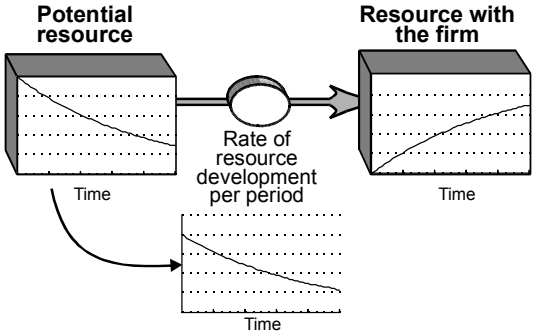
The model is also insensitive to the extent of rationality of decision-making. The function identified in Eq.3 implicitly incorporates the revealed decision-making heuristics of management, however rational or otherwise. Since future performance depends on future resource-levels, and future resource-levels depend on accumulation and depletion rates, the effect of managerial decisions is manifest in resource-flow rates, $r_{1\text{-}n}$. To offer a practical illustration, the firm's hiring rate is a function of (amongst other things) the number of full-time-equivalent staff that are allocated to the hiring effort, regardless of whether that number is arrived at by an optimally rational decision-rule, or a boundedly rational heuristic.

The interdependence implied by Eq. 3 gives rise to feedback structures within the firm's system. Feedback may take one of two forms. Resource-changes may be self-reinforced - an increase in r_i at time T causing further changes that result in $r_i(T+1) > r_i(T)$. Alternatively, resource changes can be self-balancing - an increase in r_i at time T causing further changes that result in $r_i(T+1) < r_i(T)$. The organisation's performance dynamics that arise from the interaction of accumulating asset-stocks through feedback can be operationalised by use of the system dynamics method, whose essential components, as they apply to the field of Strategy, are given by Equations 1-3.

Potential resources and rivalry.

Firms must accumulate certain resources from 'potential' stocks, outside their current influence – consumers or firms who might wish to become customers, skilled people who might be hired, and so on. If stocks of these potential resources are plentiful, then the firm's resource-accumulation can be rapid, whereas if the potential stock is empty, then it will not be able to develop the resource at all (Figure 3).

Figure 3: External availability of potential resource constrains a firm's accumulation rate.



Equation 3 therefore needs to be extended, so that … *the firm's net rate of accumulation of resource R, at time T is dependent also upon the availability of potential resource at that time, P,(T)* (Equation 3b).

$$(3b) \qquad r_i(T) = f_i\left[R_1(T),..,R_n(T),P_i(T),E(T)\right]$$

For a particular firm, resource can be won not only from potential sources, but also from rivals. Competitive performance thus depends on the firm's success at persuading customers, skilled staff and other contestable resources to switch to the firm and remain with it into the future. Since each firm's ability to accumulate and retain any one resource depends upon its existing stock of resources ... *the net accumulation rate of any resource R, by firm j depends on the firm's existing resource-levels $R_{1\text{-}n,j}$, rivals' resource levels $R_{1\text{-}n,1\text{-}m}$, and level of potential resources P_i.* Firm *j* is included within the array of firms *(1-m)* in the industry, so Equation 3b can be extended to deal with rivalry, as given in Equation 3c.

$$(3c) \qquad r_{i,j}(T) = f_i\left[R_{1,1}(T),..,R_{n,m}(T),P_i(T),E(T)\right]$$

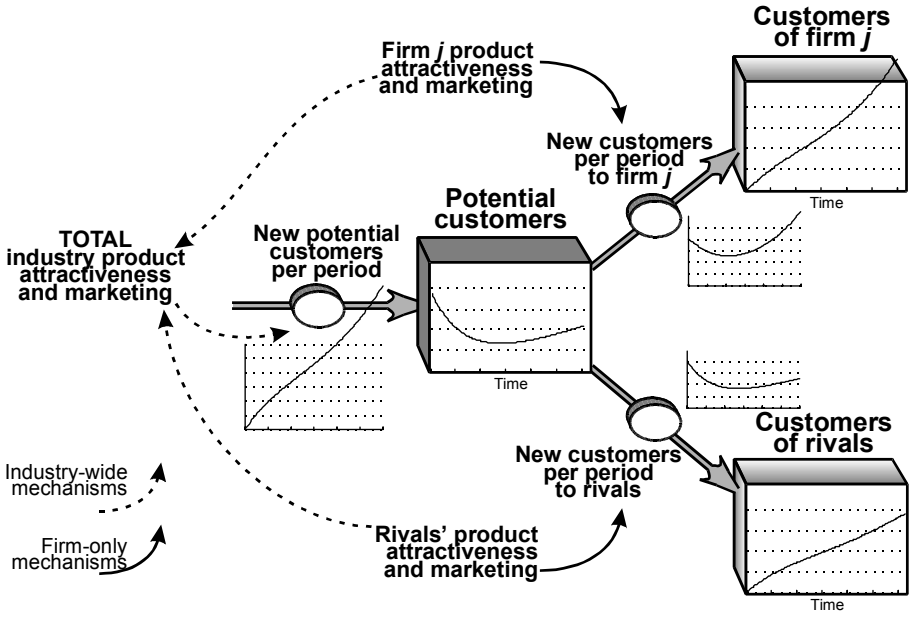
To complete the formulation of rivalry dynamics, it is necessary to reflect the possibility that any pool of potential resource *P* may itself accumulate. Increasing functionality, falling price, and firms' marketing efforts stimulate creation of potential customers. Similarly, perceived

career opportunities and good salaries stimulate creation of potential staff with skills relevant to the industry, from which pool individual firms then seek to attract individual employees. Thus … *the rate, p_i, at which any potential industry resource, P_i, grows at time T depends on the existing stock of resources and potential resources in the industry, and on exogenous factors (Equation 4)*

$$(4) \qquad p_{i,j}(T) = f_{2i}\left[R_{1,1}(T),..,R_{n,m}(T),P_i(T),..,P_n(T),E(T)\right]$$

This dynamic interaction between potential resources and resources developed by rivals is portrayed graphically in Figure 4, for the specific resource of customers.

Figure 4: The dynamics of resource-development and rivalry (type 1).

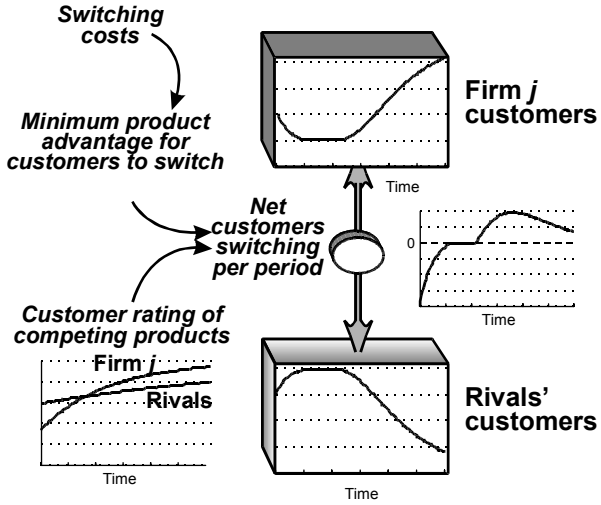


Competition to develop potential resources into the status of being available to the organisation, rather than to rivals, is conveniently referred to as type-1 rivalry, and is most evident in emerging industries. However, type-1 rivalry continues to feature in mature and declining industries – new customers, staff and channels may continue to emerge, simultaneously with the demise of established resources.

In addition to type-1 rivalry, firms compete to steal resources from one another (Figure 5). The resource-accumulation and depletion rates in such processes – termed type-2 rivalry - are still dependent upon the existing resource-holdings of the firms, so this mechanism is already captured by equation 3c. That function (f_i) must also include the impact of switching costs,

shown in Figure 5. Switching costs also obstruct firms' ability to develop potential resources, and should be reflected in Figure 5, though these will be different in nature and scale from switching costs that constrain inter-firm capture of already-developed resources.

Figure 5: The dynamics of type-2 rivalry.



Certain resource-items may be shared with rivals – customers, suppliers, advertisers and even employees may not be exclusively held by a single rival - in which case a third, intermediate stock is added to Figure 5 between firm *j*'s stock and the rivals' stock. In these cases a further form of rivalry (type 3) arises as competing firms attempt to win share of access.

Resource attributes

Individual entities within the population of a resource-stock generally differ from each other on one or more attributes that influence firm performance. This influence may be direct – e.g. customers vary in their rate of purchase from the firm, which directly determines revenue and profitability - or operate through affecting other resource-accumulation processes – e.g. sales staff differ in skill and products differ in functionality, both of which affect customer-acquisition rates, and hence future profitability.

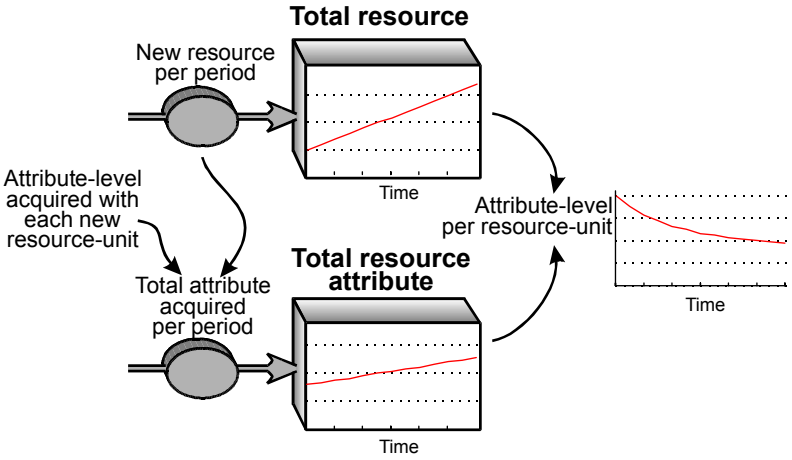
Such attributes, like the resources that possess them, can only be changed by means of in-flows or out-flows. Staff skills, for example, can be raised by training, or lost through lack of practice. Attribute-stocks also rise or fall, however, as their resource-carrier is won or lost – staff skills are added to by new recruits and lost when individuals leave. This mechanism is known as a coincident flow (Forrester[op.cit.]), and is shown in Figure 6. This intimate

connection between a resource R_i and its attributes R_i', R_i'', … implies that *… rates of change of resource-attributes r'_i, r''_i … at time T are a function of the rate of change r_i of resource R_i itself.*

$$(4) \qquad \begin{aligned} r'_i(T) &= f'_i\, r_i(T) \\ r''_i(T) &= f''_i\, r_i(T),\ldots \end{aligned}$$

However, although resource attributes differ in character from resources themselves (being intimately tied to a specific resource-carrier) it nevertheless remains true that their accumulation rate depends on the firm's existing resource-levels, rivals' resource levels, levels of potential resources, and exogenous factors. Equation 3c, above, therefore applies equally to attributes as to resources themselves.

Figure 6: Resource-attribute co-flow.



Firm capabilities, resource-building, and system performance

The firm's success in accumulating and retaining resources is also constrained or enabled by its capabilities. Again, for consistency and clarity, this article builds on A&S$^{op.cit.}$, who define organisational capabilities as … *'a firm's capacity to deploy Resources, usually in combination, using organisational processes ... that are firm-specific and are developed over time ...'* However, this definition must be developed somewhat for present purposes. It has been shown that firm performance is directly and immediately accounted for by current resource-levels and exogenous factors. Capabilities do not therefore, feature in Equation 1 (capabilities are not used in the computation of the P&L account or cash flow statements). What, then, is the purpose served for the firm in 'deploying resources' well or poorly?

A continuing puzzle in strategic management is to explain how resource-poor firms emerge to challenge dominant, resource-rich rivals. Differences in resource-system design may partly explain such dynamics, reflected in a particular firm's choice of the function given in Equation 3c. However, it is also apparent that some firms are more *capable* than rivals at building the resource – strong capabilities in product development, financial control, marketing and training, for example, result respectively in rapid development of product functionality, cash, the customer-base and the staff skills of the organisation. If this is the case, then capabilities only have meaning in connection with the resources of the firm.

To overcome this limitation of established definitions, 'capability' must be redefined as relating to a specific resource-building and resource-sustaining task, i.e. as … *a firm's capacity to build and sustain a particular resource, for any given availability of the other resources needed for that task, that is developed over time*.

Note that the phrase 'developed over time' in the A&S definition implies that capabilities, like resources, are asset-stocks that accumulate and deplete. So … *the current level of capability C at time T is the sum of its net rates of accumulation c since time t=0, plus its initial level,* (Equation 5).

$$(5) \qquad C_i(T) \equiv \int_0^T c_i(t)dt + C_i(0)$$

To some degree, resource-building performance reflects the co-flow of staff skills, as new hires bring their skills to the team, as resignations deplete that skill-base, and as training efforts boost those skills. However, capability is more than simply the sum of individuals' skills since, as the A&S definition notes, it depends upon the effectiveness of organisational processes. Capability captures how well individuals operate with those processes, with available information, and with available resources to accomplish the resource-building task.

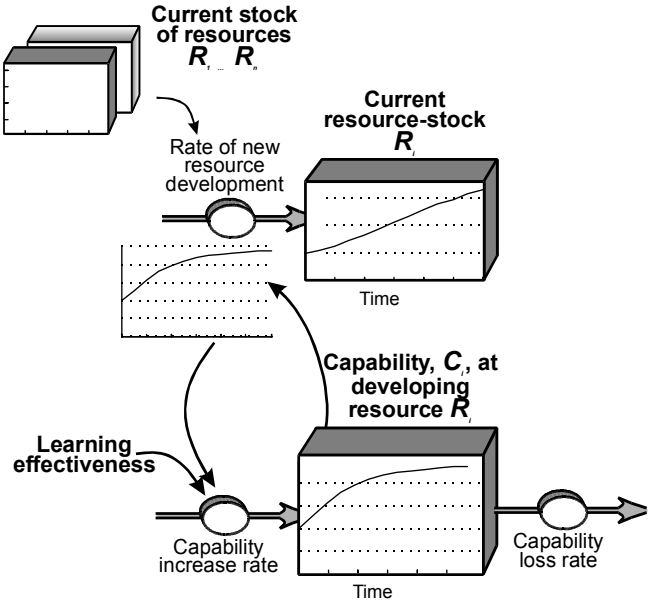
Capability C_i thus operates as a moderating factor on the existing resource-building rate, r_i, given by function in Equation 3c. The remaining challenge, therefore, is to explain the accumulation rate, c_i, for capability C_i. If the firm never undertakes any activity to build resource R_i, it is unlikely to develop the corresponding capability. Conversely, the more experience it gains in this task, the more opportunities it has to develop effective organisational processes, information, and information flows to enhance its effectiveness.

This implies that ... *the rate of accumulation, c_i, of capability C_i, is a function of the corresponding resource-building rate, r_i.* (Equation 6).

$$(6) \qquad c_i(T) = f\left[r_i(T)\right]$$

Firms do not exhibit a uniform tendency to accumulate capability in any resource-building task, in spite of relatively equal opportunities to learn. In practice, therefore, equation 6 must include a factor to reflect the firm's learning effectiveness (Figure 7). Since this learning effectiveness itself is capable of developing through time, it too will be an accumulating asset-stock, and the representation of firm capabilities becomes recursive.

Figure 7: Representing capability in the building of a resource.



Note that resource-building or maintenance tasks may be focused upon particular functions or staff groups, but are often contributed to, or hindered by, others in the firm. Customer service staff, for example, whilst dominating efforts to retain customers, may be undermined if order-processing or delivery departments perform poorly. An organisation may thus exhibit poor resource-building rates, in spite of employing skilled people in key functions, or conversely, may exhibit strong resource-building capabilities, whilst operating with relatively unskilled staff.

This discussion and formulation of the nature and role of organisational capabilities leaves no option but to include their influence in the explanation for the critical variable, the resource-flow-rate, r_i. Since capability-levels, like resource-levels, are constrained in their influence by

their *relative* strength versus rivals, Equation 3c must be extended to include the influence of capability *i* for all firms *1…m*. Thus … *the rate of accumulation, r_i, of resource i at time T by firm j is dependent also upon the current level of capability, C_i, at that resource-building task possessed by firm j, relative to all firms 1…m* (Equation 3d)

$$(3d) \qquad r_{i,j}(T) = f^*_i \left[C_{i,1}(T),..,C_{i,m}(T),R_{1,1}(T),..,R_{n,m}(T),P_i(T),E(T)\right]$$

A pragmatic note

This paper has, thus far, established that the rate of accumulation of strategic resources is central to any sound understanding of strategic performance over time, through its unique role in Equation 2. Yet it might appear that Equation 3(d) has become so extensive and its function *f** so potentially complex that its application in real cases would not be possible. However, experience with use of this perspective to practical cases is more encouraging.

Whilst the general form of resource-accumulation function is indeed given by Equation 3(d), the rate at which any specific resource for any specific firm at any particular moment is readily estimated from a somewhat limited number of driving forces. Customer-acquisition rates, for example, may depend most strongly on relative price and functionality of the firm's product, and on the number of sales people, moderated by the firm's relative sales capability. Similarly, staff resignation rates at any time may be found to reflect relative pay, workload, and the availability of alternative jobs.

The research task in practical cases, then, is to discover the dominant few factors that do indeed feature in the current explanation for r_i. It is at this specific point that established correlation methods are helpful in the search for explanations of firm performance. Executives or researchers may have some insight into the likely causes of customer acquisition or staff attrition, but confidence in that insight is built by quantitative research and statistical analysis. Naturally, a diverse population of customers or staff may feature subgroups, for each of which a different mix of considerations motivates behaviour. But this makes sound explanations for rates of resource accumulation more tractable, rather than less so.

Managerial policy and control

The discussion thus far has not addressed the means by which managers exercise judgment and influence over the structure and performance of the resource-system. A full exposition of this issue is beyond the scope of this paper, but some observations can be made.

If firm performance depends on strategic resource levels, and these can only be changed by resource-flows, then the only influence management can have over strategic performance is by choices that affect each resource-flow, r_i. They can, of course, make certain choices regarding how to spend revenue receipts – for example, by raising expenditure on marketing or training in preference to declaring higher profits, but this unavoidably has consequences for resource-flows, and thus for resource-levels and future performance.

Executives can influence resource accumulation rates via one of two mechanisms. First, they have some discretion as to which resources $R_1 \ldots R_n$ they deploy to drive any resource-flow, r_i. They might choose, for example, to deploy distributors to promote a new product, rather than a direct sales force, or emphasise service support resource rather than product functionality in its marketing. This mechanism includes the search for, and connecting of potential drivers to any desired resource-flow. Management can choose, for example, to research the firm's reputation level with existing customers and use its findings explicitly in new-customer acquisition efforts.

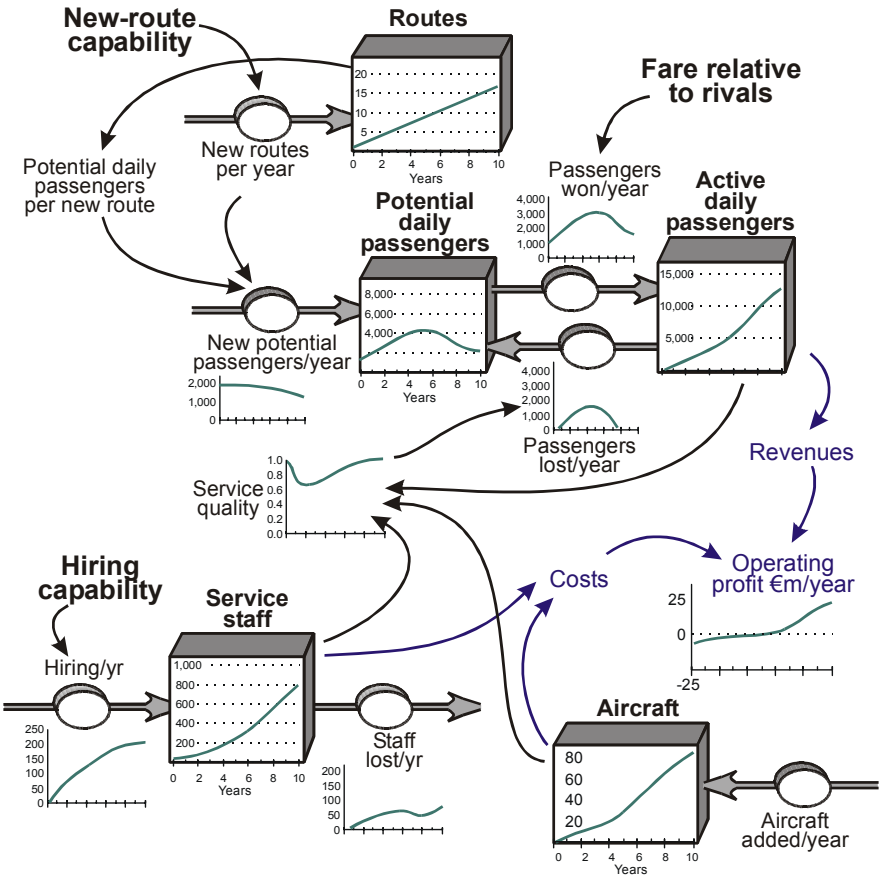
The second form of managerial influence over resource-flows arises in their direct discretion over influential drivers, such as price or marketing spend in the pursuit of new customers, or salaries and training budgets in the search for new staff. These choice mechanisms reflect organisational decision-making processes that may include sociological and political influences, as well as would-be rational optimisation. The resulting decisions at any moment are, thus, informed by information gleaned about the current state and trajectory of business performance and its components.

Management attempts to remain aware of the current rate and trend of earnings, the customer-base, staff morale, and so on, and makes choices designed to bring these into line with evolving goals (goals that may, of course, conflict). In effect, therefore, executives have some scope to define for themselves the form of each function f^*_i

A brief illustration – low-fare airline

A full empirical analysis is beyond the scope of this theoretical paper, but to clarify the application of these frameworks, Figure 8 portrays certain core elements for a low fare airline. This is a substantial simplification - a full representation of such a firm would include several more resources and capabilities, as well as a more complete representation of revenues, costs, and financial measures.

Figure 8: Core strategic architecture for a low-fare airline.



The firm makes an operating profit if its revenues exceed its costs. Revenues are driven by passenger numbers, and costs by staff and aircraft, i.e. the principal resources. Adding a route (a further resource) brings with it access to potential passengers, who are developed into actual passengers if the airline offers a competitive price. Passengers are lost if service quality is poor, reflecting the balance between the demand from passengers and the capacity of staff and aircraft to serve that demand. Figure 8 illustrates where two capabilities would arise – the capability to find and develop quickly new routes that offer access to high

numbers of potential passengers, and the capability to hire and train new staff. The figure would become too complex if rivalry, too, were shown, but this would be manifest in the rate at which *this* airline develops routes and passengers, as compared with the rate at which rivals accomplish the same tasks.

Conclusions and Implications

This paper has offered an integrated theoretical model of the determinants of firm performance over time – a model that might be termed a 'dynamic resource-system view'. No attempt has been made to justify the theory empirically – rather, its form has been derived from combining already accepted relationships, together with a small number of assertions inductively arrived at, and open to falsification (notably the assertion that asset-stock accumulation cannot arise in the absence of existing resource levels).

The paper has built on established, core ideas in strategic management, but clearly departs from traditional, micro-economic explanations for performance. Nevertheless, the framework offered does not exclude market-based influences – customers' choice of supplier and of purchase rates from that supplier remain conditioned by their assessment of functionality versus price, for example. However, the present framework offers a means for capturing other important influences on those same decisions (e.g. the extent and capability of sales effort), not merely in principle, but empirically and quantitatively. Since the frameworks offered here are not predicated solely on analysis of competitive markets, they are equally applicable to governmental, charitable and other non-profit cases as they are to commercial situations. Clearly, the performance trajectory of concern in such cases (Figure 1) may be non-financial.

The fundamentals of the framework are amenable to extension in a number of directions. Additional scope exists for extending the dynamics of inter-firm rivalry in order to capture the evolution of industry structure, the interdependence between resources and capabilities implicit in the architecture (and hence performance) of multi-business firms, and the mutual development of resources between separate firms in joint-ventures, alliances and business webs.

References

Amit, R. and P. Schoemaker (1993), 'Strategic Assets and Organisational Rent', *Strategic Management Journal*, **14**, pp. 38-46.

Dierickx, I. and K. Cool (1989), 'Asset Stock Accumulation and Sustainability of Competitive Advantage', *Management Science*, **35**, pp.1504-1511

Forrester, J.W. (1961), *Industrial Dynamics*. Pegasus Communications: Cambridge MA.

Wernerfelt, B. (1984), 'A Resource-Based View of the Firm', *Strategic Management Journal*, **5**, pp.171-180.