Why myopic policies persist?
Impact of growth opportunities and competition

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Abstract

Several case studies have documented myopic allocation of organizational resources among capabilities that payoff in short vs. long-term. We capture a general class of organizational resource allocation problems in a simple model that exhibits the typical worse-before-better dynamics commonly believed to be responsible for persistence of myopic policies. Next we examine the endogeneity of resources and the impact of competitive pressures on the efficiency of allocation policies. Endogenous resources and competition are both shown to significantly shift the optimal allocation towards myopic policies. Short-term policies become beneficial as they strengthen the positive loop between performance, resources, and capabilities. In fact strategic selection of allocation policy in a competitive market can force the firms to allocate all the resources to the short-term capability. These results provide an alternative explanation for the persistence of myopic organizational decision-rules that does not rest on psychological and learning arguments.

Keywords

Dynamic, capability, myopic, long-term, short-term, resource allocation, competition

Introduction

Understanding the sources of counterproductive managerial policies has been a cornerstone of system dynamics research on organizations. Several studies have shed light on different processes that provide management with misleading feedback and lead to adoption and reinforcement of potentially harmful policies. For example the experimental work on beer game shows that physically salient information such as inventory and backlog override the less salient cues and lead to deficient ordering rules that destabilize a supply chain (Sterman 1989; Sterman 1989).

More recently this literature has highlighted tradeoffs in resource allocation between different activities that can lead to emergence and persistence of inefficient policies. Allen (1993) documents how in allocation of organizational resources between planned and reactive maintenance, organizations can tip into a process of investing more in reactive maintenance and obtaining increasingly poorer performance. An initial cut in planned maintenance due to environmental pressures does not readily harm the organization, however, with some delay results in an increase in machine breakdown. That increases the demand for reactive maintenance which further cuts down on resources available for planned maintenance, and pushes the organization towards an inefficient allocation of maintenance resources. The reverse process, however, is less likely to happen: an increase in planned maintenance needs to be sustained for a long time before the benefits in terms of reactive maintenance demand and therefore overall costs is materialized. Such worse-before-better conditions induce managers to adopt myopic resource allocation policies that hurt the organization in the long-run.

Similar tradeoffs are at work in process improvement initiatives. Repenning and Sterman (2002) show how a temporary performance shortfall can trigger a shift in organizational investment towards production processes that payoff relatively fast, to the detriment of process improvement activities which despite their effectiveness, take more time to pay off. Consequently, process improvement initiatives are more often aborted prematurely, especially in the contexts where their results are materialized with more delay, such as product development.

Investment of organizational resources between different phases of product development process can harbor similar dynamics. Repenning (2000; 2001) shows how a product development organization can tip into under-investing in concept design activities, despite the importance of this phase. A temporary cut in resources allocated to concept design phase leads to problems that require more resources in the final design stage, cutting back further on the resources available for the concept design of the next product. The cycle can then repeat across generations of the product, creating a chronic under-investment in concept design and an increase in the overall development costs. Rahmandad and Repenning (2006) document similar dynamics in the allocation of organizational resources between development of software and fixing the bugs reported from the field.

Homer and Hirsch (Homer and Hirsch 2006) hypothesize that the rising costs of healthcare in the united states may result from increasing investment in "complication prevention" activities to the detriment of "Onset prevention" health care efforts. The more salient and urgent complication prevention activities get a bigger share of the limited resources, leading to reduction in preventive activities and therefore further increase the future demand for treatment of complications and acute health problems.

Finally, Morrison (Morrison 2005) shows how the allocation of time between new and old ways of doing work can result in under-performance of new approaches and therefore their premature abandonment before the benefits of learning curves accrue and make the new alternative comparatively attractive.

Despite several contextual differences, the above dynamics share important structural features: In all these cases organizational (or societal) resources are allocated between different activities, e.g. planed vs. reactive maintenance and concept vs. final design; These different activities contribute to one final goal, even though through different (potentially indirect) channels, e.g. production and product development ultimately contribute to output and revenue; The activities have different time delays in their impact, e.g. investment in production yields quick results while process improvement takes much longer to improve (the efficiency of) production; and at least some investment in the long-term activity is justified. The resulting dynamics include persistent mis-allocation of organizational resources in favor of the activity which pays off faster. In most cases a tipping dynamic exists where favoring the short-term policy beyond some threshold will push the system to further increase allocation to that policy leading to the dominance of the poor allocation strategy.

Two assumptions are common in the simulation models used in this stream of research. First, the resources available to the organization are assumed to be exogenous to the dynamics of interest. Second, the unit of analysis is assumed to be a single organization, therefore competitive forces are excluded. Both these assumptions may be consequential. If the payoff from resource allocation activity impacts the available organizational resources, the costs and benefits of different activities should include not only their contribution to performance given a fixed resource pool, but also the contribution to changing the available resource pool. For example, it is conceivable that the benefits of a faster increase in available resources following the myopic strategy can over-ride the under-performance of this strategy in the presence of fixed resources. Moreover, competitive pressures may push down the viability of long-term policies because the adopting firm may lose too much market share before it can benefit from its long-term strategies, and therefore lose its ability to continue with the long-term strategy.

The goal of this article is two fold. First, building on the strategic management literature about organizational capabilities, we construct a generic model of resource allocation between different capabilities. This model captures the structural characteristics common to resource-allocation and learning challenges discussed in the system dynamics literature and generalizes the resulting dynamics to a broader set of organizational phenomena. Next, we examine the impact of endogenous resource availability and competitive pressures on the allocation of resources between different organizational capabilities.

The results suggest that for a large set of problems, the resource allocation between different organizational capabilities can reinforce counter-productive strategies, similar to those discussed in the examples above. Moreover, the endogeneity of organizational resources tips the balance towards justifying more short-term activities. In fact after inclusion of competitive pressures, the optimum strategy may shift towards completely myopic policies.

Modeling Resource Allocation Between Two Capabilities

The resource-based view in strategy highlights the importance of resources and capabilities that allow the firms to perform better than competition (Henderson and Cockburn 1994) or enable them to modify their operational capabilities and build new ones faster in the face of a changing competitive landscape (Teece, Pisano et al. 1997; Eisenhardt and Martin 2000). Maintenance, product development, production, and customer service are different examples of organizational capabilities. The case-based research in system dynamics has shown how dynamics of these capabilities can lead to under-investment in capabilities with long lead-time and therefore lead the majority of organizations away from efficient combinations of capabilities. These results are in line with the general observation that capabilities and resources are only gradually accumulated through time and therefore efficient investment across different resources to develop them in a timely manner is complex (Dierickx and Cool 1989; Henderson 1994).

Organizational capability can be defined as one or a group of routines that provide a firm the option for producing specific outputs or changing other routines (Nelson and Winter 1982; Winter 2000). Winter (2003) distinguishes among different types of capabilities in a framework where zero-level capabilities are defined as those that allow the firm to accomplish its goal and make a living, and first-level ones as those routines that operate to modify and change zero-level ones. Similarly higher-order capabilities can be defined as those that operate on first level ones, etc (Collis 1994). In practice the literature makes a clear distinction between zero and higher levels of capabilities, where the higher-level capabilities are often called dynamic capabilities (Teece, Pisano et al. 1997; Eisenhardt and Martin 2000). In fact the viability of capabilities beyond the first level is questioned in the light of the costs of maintaining these capabilities and the availability of alternative ad-hoc problem solving avenues to address the occasional need for higher level capabilities (Winter 2003).

This framework closely relates to different lags observed between investing in different capabilities and observing the results. While zero-level capabilities directly contribute to performance, the first-level ones only impact the rate of change in zero-level capabilities, and therefore their influence on performance comes with a significant delay. For example investing in production (zero level capability) pays off faster than product development, which only impacts performance through making future investments in *production* more efficient. Therefore the multiple-levels of capability provide a theoretical framework to organize case-based research on dynamics of resource allocation among organizational capabilities. A generic model along these lines can organize similarities across different conditions in which multiple levels of capabilities are at work in an organization and suggest additional empirical conditions when such dynamics could become important. We therefore model two levels of capabilities and the tradeoffs in allocating the resources for investment between these two levels.

As a concrete example consider a firm producing electronic equipments. The capability to produce specific electronic products is the central zero-level capability for this firm. Short-term performance depends directly on the strength of this capability. However, this capability erodes and the profitability of the company decreases as the market for current products saturates, competition bids away the profits, the production equipment wears down, and the human assets are eroded through turnover or change. In response the firm can introduce new products and production processes that distinguish it from the competition and allow higher profits. Successful investment in the production of new products depends on other capabilities of the firm, including the ability to design these new products, which we therefore identify as a first level capability.

The zero level capability (C_0), is driving the performance of the firm. The latter is defined here as firm's profit and depends, beyond zero-level capability, on the productivity (p) of this capability in generating income beyond variable production costs, the fixed cost of production (c), and the cost of investment in zero and first level capabilities (R):

$$\Pi = C_0 . p - R - c \qquad (1)$$

Organizational capabilities are made of routines and assets that change only gradually and through accumulation processes (Dierickx and Cool 1989). Consequently each capability is represented as a stock. We therefore conceptualize two stock variables, C_0 and C_1, to represent the zero and first level capabilities. Each capability then includes an inflow (I) and an outflow (O) variable that regulate the speed of change in that capability (equations 2 and 3).

$$\frac{dC_0}{dt} = I_0 - O_0 \qquad (2)$$

$$\frac{dC_1}{dt} = I_1 - O_1 \qquad (3)$$

The outflow of capability represents the gradual depreciation of the capability as organizational assets erode, skills are lost or outdated, and competition catches up and renders specific routines trivial. In the first approximation, the speed of depreciation is directly related to the size of the stock of capability. The larger the stock of capability, the higher is the amount of routines and assets that are subject to erosion or competitive imitation. A first order draining mechanism is used to formulate capability erosion. The parameters d_0 and d_1 represent the average life of each type of the capability. In dynamic markets (Eisenhardt and Tabrizi 1995) where new ideas continuously challenge the status quo, the life of competitive organizational routines remain short and therefore one would expect d_0 and d_1 to be smaller. Mature markets with relatively stable structures often imply longer average capability life times.

$$O_0 = \frac{C_0}{d_0} \qquad (4)$$

$$O_1 = \frac{C_1}{d_1} \qquad (5)$$

Inflow variables capture the increase in organizational capabilities. Investment in capabilities through investment in hard assets, bringing together the factors of production, training the individuals, and allowing them slack time to form effective routines contributes to gradual development of capabilities. Here organizational resources (e.g. productive time of employees, financial resources, etc. all expressed in thousand dollars/month) invested in development of capabilities are represented as R. We further distinguish investment and efficiency of investment in capabilities. Development of any capability requires some sort of investment. However two firms investing the same amount of resources (e.g. personnel time, money, assets) into building a production capability do not necessarily get to the same levels of this zero level capability. Organizations can vary in their efficiency in transforming investments into organizational capabilities, variables e_1 and e_2 capture these differences.

$$I_0 = R_0 . e_0 \qquad (6)$$

$$I_1 = R_1 . e_1 \qquad (7)$$

Theory defines first level or dynamic capabilities as those capabilities used for change and modification of zero level ones (Eisenhardt and Martin 2000; Winter 2003). Therefore the efficiency in change and creation of zero level capabilities is a function of the first level capabilities. For example a strong product development capability would enable a firm to leverage its investment in new production capacity more effectively and therefore gain higher performance benefits. In other words, the stronger the first level capability, the higher is the efficiency of the organization to transform a dollar of investment in zero level capabilities into operational zero level capabilities. We assume that gains in efficiency come at decreasing returns because efficiency in the creation of new zero order capabilities is bounded by physical constraints limiting the speed of building of the new capability: routines can not form faster than a maximum speed and there are limits to the speed of the installation of physical assets and the development of human capital. On the other hand first level capabilities are not a necessary requirement for development of zero level ones. Zero level capabilities can also be built through ad-hoc problem solving procedures (Winter 2003) that are accomplished by the members of the organization on a per-need basis without the utilization of the first level capabilities. For example, a firm can acquire a start-up with a new product, rather than using its own product development capability. We assume such ad-hoc problem solving processes to have an efficiency of e_{ah} in producing new zero-level capabilities. Therefore the efficiency in transforming organizational resource investment to zero order capabilities can be summarized as:

$$e_0 = Max(e_{ah}, g(C_1)) \text{ where } g(0)=0,\ g'(.)>0, \text{ and } g''(.)<0 \qquad (8)$$

Here the function g(.) represents the efficiency in producing zero level capabilities through the application of first level ones. In the absence of any first level capability such efficiency is zero (g(0)=0). Increase in the first level capability increases the efficiency of using this capability to build the zero level one (g'(.)>0). Finally the diminishing return on first level capabilities is captured through the constraint g"(.)<0.

Since second level capabilities are not considered in this study, e_1 is assumed to represent ah-hoc problem solving processes used to create first level capabilities and therefore is assumed to be constant. Finally, the organization should allocate the resources between the zero and first level capabilities. Fraction f of total resources is assumed to be allocated to first level activities. Therefore f represents the main organizational decision in our analysis:

$$R_0 = R.(1-f) \qquad (9)$$

$$R_1 = R.f \qquad (10)$$

Following the previous studies in system dynamics, in the first part of the analysis the stream of resources invested in different capabilities, R, is kept constant. Later this constraint is removed and endogenous resources are considered.

First level capabilities vs. ad-hoc problem solving

The simulated organization should decide how to allocate its scares investment resources between the zero and first level capabilities. In making this decision, it needs to balance between the direct investment in zero-level capability against the investment in efficiency of increasing this capability. We analyze this tradeoff by finding the firm's performance, Π, in equilibrium, as a function of the firm's decision variable, f. The shape of this function informs how investments in first or zero level capabilities pay off. Dynamics of reaching this equilibrium is discussed next. The system of differential equations describing capability dynamics can be re-written as:

$$\frac{dC_0}{dt} = R.(1-f).Max(e_{ah}, g(C_1)) - \frac{C_0}{d_0} \qquad (11)$$

$$\frac{dC_1}{dt} = R.f.e_1 - \frac{C_1}{d_1} \qquad (12)$$

C_1 is independent of C_0 and linear and first order with respect to C_1. Therefore assuming constant resource and fixed organizational policy in allocation of resources (constant f) the solution for C_1 can be obtained in closed form as:

$$C_1(t) = (C_{1,Initial} - R.f.e_1.d_1).\exp^{-t/d_1} + R.f.e_1.d_1 \qquad (13)$$

While derivation of specific dynamics of C_0 depends on the functional form of g(.), we note that the only feedback loops in the system are the two balancing loops governing the depreciation of capabilities, which are both first order. Therefore the system will ultimately reach equilibrium in the value of both capabilities. We can therefore calculate the steady state value of both capabilities with respect to the organizational investment policy parameter, f, using Little's law (Little 1961). From equation 13, the steady state value of C_1 is $R.f.e_1.d_1$. Replacing this value in equation 11 and solving for steady state value of zero level capability we find:

$$C_{0,eq} = R.(1-f).Max(e_{ah}, g(R.f.e_1.d_1)).d_0 \qquad (14)$$

And therefore steady-state firm performance can be found as a function of firm's strategy for investment in different levels of capability:

$$\Pi_{eq} = \begin{cases} p.R..d_0.e_{ah}.(1-f) - R - c & e_{ah} > g(R.f.d_1) \\ p.R..d_0.g(R.f.e_1.d_1).(1-f) - R - c & e_{ah} \le g(R.f.d_1) \end{cases} \qquad (15)$$

Analyzing the steady-state performance function we can conclude that[1]:

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[1] Call the second expression in equation 15 (when $e_{ah} \le g(R.f.d_1)$) *A*. Note that:

$$\frac{d\Pi_{eq}}{df} = \begin{cases} -p.R..d_0.e_{ah} & e_{ah} > g(R.f.d_1) \\ p.R..d_0.[\frac{dg(R.f.e_1.d_1)}{df}.(1-f) - g(R.f.e_1.d_1)] & e_{ah} \le g(R.f.d_1) \end{cases}$$

1) There is at least one local peak in performance at f=0.
2) There is potentially another peak of performance at the peak of expression A.
3) There are no other performance peaks in this function.

Therefore three potential settings are identified (see Figure 1). The first describes the dominance of a strategy of modest investment in first level capabilities to increase efficiency of investment in zero-level ones. Firms in such markets need to balance their investment in zero and first order capabilities so that the peak performance is achieved.

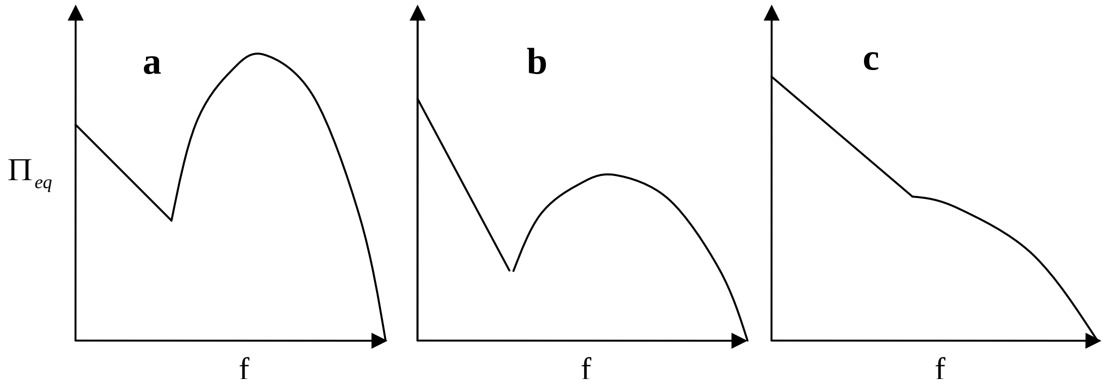

Figure 1- The three general conditions for equilibrium performance of organization in light of the tradeoff between investment in zero and first level capabilities. Horizontal axis represents fraction of resources invested in development of first level capabilities and changes between 0 and 1. Vertical axis denotes organizational performance. a) The maximum performance is attained by investing in both first and zero level capability, however, a local peak exists where no investment in first-level capability is required. b) Maximum performance is attained through the use of ad-hoc problem solving in order to generate zero-order capabilities. However, there is a local peak of performance where modest investment in first level capabilities partially pays off. c) The single peak in performance is achieved without investment in first level capabilities.

A second performance domain appears when the performance peak achieved through investment in first order capabilities is lower than what can be achieved through ad-hoc problem solving. In both these cases incremental adaptation of *f* can lead to one of the suboptimal peaks of performance. In the limiting condition for the second case, it is possible that investment in first level capabilities never results in performances higher than those achieved by ad-hoc problem solving. Organizational adaptation under these conditions is easier because adaptation will find the only peak on the performance landscape.

One of the insights emerging from the previous analysis relates to the stickiness of low investment in first level capabilities. The multiple system dynamics studies on dynamics of resource allocation do not consider the viability of ad-hoc problem solving. They therefore imply a single performance peak, which is often not discovered by the organizations. Many of the documented organizations seem to be on the very low level of investment in first-level capabilities and unable to recover from this equilibrium. By identifying the competition between ad-hoc problem solving processes and first-level capabilities, this analysis offers an additional explanation (beyond the dynamics of learning and individual biases) for the persistence of such sub-optimal policies. Investment in first level capabilities should be large enough to build these

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The first part of derivative (for $e_{ah} > g(R.f.e_1.d_1)$) is a constant negative, while for expression A the slope equals $p.R.d_0.g'(0)$ at f=0 which is positive and becomes negative at f=1. Assuming continuous g(.) function we observe that second derivative of A remains negative for all values of f.

routines to outperform ad-hoc problem solving. Lower levels of investment are going to be counterproductive since they waste resources that otherwise would be used to extend zero-level capabilities. Incremental increase in investment in first-level capabilities, even if persistent, may not payoff and therefore will render such adaptive moves impractical. Ad hoc problem solving therefore helps with understanding the stickiness of potentially inferior policies.

The focus of the proceeding discussion was on the steady state tradeoffs of investing between different levels of capabilities. An important dimension of the capability accumulation processes is the dynamics of performance before reaching equilibrium. These performance dynamics provide the signals that guide management's decision making and adaptation of strategic action. Investment in zero level capabilities pays off relatively fast through accumulation of income-generating routines and resources. First level capabilities take a longer time to pay-off because their impact is indirect and only through increasing the speed of the creation of zero-level capabilities. Therefore adjustment of investment policy to favor the building of dynamic capabilities would typically entail a short-term decline in performance, before any potential gains through increased efficiency in building of zero level capabilities is realized. This is the primary dynamic that has been documented by previous case studies to hinder adoption of efficient policies (Allen 1993; Repenning 2001; Repenning and Sterman 2002; Morrison 2005; Rahmandad and Repenning 2006). These dynamics are strategically consequential when first level capabilities are worth their costs. Therefore, following the previous research in dynamics of allocating resources to organizational capabilities, in the following discussion we focus on firm and market structures in which first level capabilities are potentially beneficial (steady state global peak is not at zero).

To illustrate, consider the comparison between two firms. Firm *a* is spending 15% of its investment resources on first level capabilities while firm *b* is spending 35%. Both firms are achieving similar performances because they are on similar levels on the two sides of the performance peak (see Figure 2-B). Here the maximum equilibrium performance is attained by spending 24% of resources on dynamic capabilities. Now the managers in both firms decide to experiment with changing their investment in first order capabilities (a 10% increase/decrease for a and b respectively) to see if different investments in dynamic capabilities are warranted. Figure 2-A describes the performance observed by the two firms with parameters described in Table 1. Initially the firm a observes a drop in its performance as the investment is diverted from zero level capability and the stock of these capabilities depletes faster than it is recovered through investment. However, the build up of the first level capability gradually increases the efficiency of the investments made in the zero level capability and leads to recovery of performance. The firm gets back to its initial performance after about 20 months and continues to enjoy improvements in performance as it moves towards a new performance equilibrium.

Firm b experiences a sharp increase in performance as a result of increasing the investment in zero level capabilities. The reason is that larger investment in zero level capabilities pays off very well at the beginning, given the initially high level of first level capabilities. After a few months however, the initial sharp increase in performance is followed with a slow decline as first level capabilities are eroded and the return on investment in zero order ones decline. Nevertheless, the experiment results in overall performance improvement. In fact the steady-state results of both experiments are similar (an overall increase in performance of the same magnitude) for the both firms, even though the intervening dynamics are significantly different.

Even though the start and the end points of the experiments are very similar in terms of performance, the lessons learnt may be very different. In firm *a* if managers have a good understanding of delays involved in building the first level capabilities and seeing their benefits, if they have long-enough a planning horizon in their position to by-pass the initial dip in the performance, and if they have the political will and influence to rally the rest of the organization to sustain investment in first level capabilities for long enough a period to observe the benefits, the managers will find this experiment fruitful and will be able to see the final performance improvements. However, it is more likely that the managers under-estimate delays involved in building dynamic capabilities, do not expect to remain in their current position for long enough to benefit from their initial performance sacrifice, or their efforts to sell the idea of sustaining the experiment for long enough does not succeed inside the organization. Under any of these conditions the experiment is abandoned prematurely or worse, the direction of change in policy is reversed.

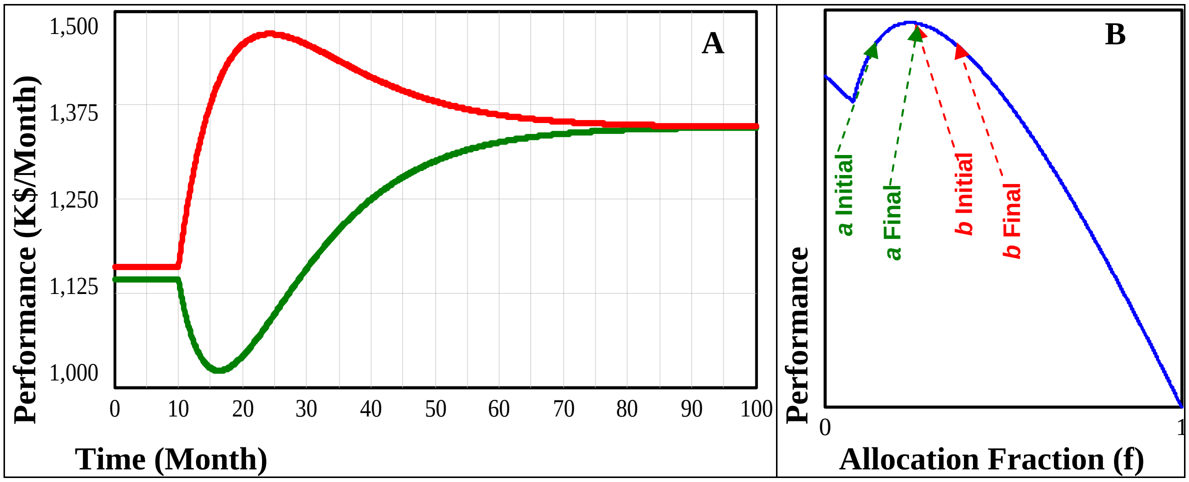

Figure 2- Performance dynamics in shifting investment from zero to first level capabilities. Starting from investment of 15% of resources in first level capabilities, firm a, in green, increases this amount to 25% at time 10 and experiences a temporary drop in performance before experiencing the improvement. Firm b, in red, starts from 35% and moves to 25% at time 10. It experiences a significant improvement before stabilizing at final level. Left: The steady state performance as a function of f. The start point and finish points are highlighted for the two firms.

In contrast, the managers in firm b are likely to be rewarded for significant improvement in the firm performance through cutting unnecessary costs and focusing on the core business processes. The slow decline of performance after the sharp initial increase may get less attention or be associated with other potential reasons which are closer in time than a change over a year ago. As a result of this experiment the policy of cutting down the dynamic capabilities receives a strong reinforcement and is more probable to be pursued further.

These results are in general agreement with the extant literature. Similar dynamics of worse before better are documented in allocation of resources between multiple capabilities. Moreover, if the change in allocation fraction (f) is an endogenous function of the performance, the organization faces the prospects of a tipping point in f. Given that f is the main control parameter at management’s disposal, such endogenous adjustments are common and important. For example under performance pressure managers may cut down on investment in preventive maintenance, concept design, quality, or process improvement. Below a tipping threshold of investment in first level capabilities, as performance shortfall pushes the organization to cut down on first level capabilities, the cut down harms the longer-term performance because the organization has moved away (to the left in Figure 2-A) from the efficient allocation. Despite the short-term performance improvement (as more resources are given to zero-level capability before first-level one degrades significantly) when the ultimate lower outcome is realized later, the organization is further pushed towards lowering the investments in first level capabilities, until it is locked in an inefficient policy of investing very little on first level capabilities. The analysis so far extends the case-specific dynamics to a general class of resource allocation to zero and first level organizational capabilities and shows the generalizability of these results. Next, we consider the impact of endogenous resources and competitive pressures on capability building dynamics.

Table 1- The parameters of the model used in simulation experiments reported in the paper.

Parameter	Value	Units	Definition
c	2000	K$/Month	The costs of firm operations other than the investments in capability building.
d_o	10	Month	The average life of zero level capabilities.
d_1	10	Month	The average life of first level capabilities.
e_{ah}	2.5	ZLC/K$	The efficiency of ad hoc processes for creating zero level capabilities.
e_1	0.01	FLC/K$	The efficiency of ad-hoc processes in creation of first level capabilities.
p	0.15	K$/Month/ZLC	The productivity of zero level capabilities expressed in terms of thousands of dollar per month of performance created by each unit of capability
R	1000	K$/Month	Total investment in development of new capabilities (zero and first level).
g(x)	1.2*LN(x)		The function relating first level capability to efficiency in building zero level capabilities.
τ	1	Month	Time constant for perceiving and measuring the trend in performance

Endogenous Resources

Case studies of capability allocation dynamics have typically assumed a fixed amount of resource to be available for investment across different capabilities. For example the number of maintenance personnel, design engineers, or production and process improvement personnel are assumed to be constant. So far we have used this assumption in our model of resource allocation across multiple capabilities. However, in practice the resources available to an organization largely depend on the organization's performance. For independent organizations and business units this dependence is direct: only a fraction of net revenue is available for investment. Also a weaker relationship exists for the organizational units where performance evaluation of the unit impacts its future allocated budget. In fact such relationship is at the heart of organizational growth. Investments in different organizational capabilities such as sales-force, brand name, product development group, manufacturing capability, and employee skills contribute to the building of organizational capabilities and therefore profitability. Profitability in turn allows for more future investment in such capabilities, closing different reinforcing loops that drive organizational growth (Sterman 2000).

How does the consideration of endogenous resource impact the resource allocation policy? Once we consider the impact of available resources on performance, a positive feedback loop is formed that can lead to growth or demise of the firm. How will the efficient policies for the firm change in the light of this positive feedback loop? To consider these questions we modify the model so that resources available to the firm are a function of its performance. More specifically, we assume a fixed fraction (b) of net organizational revenue (revenue minus non-capability costs) is invested in organizational capabilities, therefore:

$$R = (C_0.p - c).b \qquad (16)$$

The other equations do not change. As an example you can imagine a new firm in an untapped market where little competition exists. The firm can grow by investing in its production and product development capabilities, where one capability contributes to the organizational growth directly (by creating more products that can all be sold in the market) and the other contributes by increasing the number of product lines the firm is active in.

Given the positive loop created through endogenizing the resources allocated to organizational capabilities, depending on the parameter settings, the organization can grow fast and reach very high performance levels. Comparing these performance levels in a single graph is not informative, therefore we devise a new performance metric to measure the average trend in the performance of the organization. The *Average Output Trend* (AOT) metric measures the rate of growth (or decline) in performance[2] using a fractional trend function (Sterman 1987), where:

$$AOT = \frac{1}{T}\int_0^T gr(t).dt \qquad (17)$$

$$gr(t) = \frac{C_0.p - Y_t}{\tau.Y_t} \qquad (18)$$

$$\frac{dY_t}{dt} = \frac{C_0.p - Y_t}{\tau} \qquad (19)$$

The parameter τ represents the time for measurement of the trend.

Similar to the fixed-resource setting, different allocation policies can have different short and long-term performance ramifications. We therefore use the following experimental design to examine the impact of different allocation policies (f) on the rates of growth (or decline) of the firm's output. First, we analyze the long-term impact of different values of f by comparing the AOT measures for different values of f. We start these experiments from equilibrium, where the firm is using f=0.5 and the fraction of resources for investment (b) is chosen to keep the firm in equilibrium. At time zero, the firm changes its allocation policy to different values ranging between 0 and 1. The average output trends across different policies are compared after forty periods[3] of new policy to examine the relative value of different allocation fractions. Figure 3 reports the results of this experiment.

Two qualitative differences emerge in comparison of these results with the performance as a function of fixed resources. First, the peak for performance has shifted to the left, towards policies that prefer higher investment in zero level capabilities. Second, the local peak at f=0 no more exists which suggests at very low values of f there is always some long-term benefit from having some incremental investment in first level capabilities.

Organizational performance is a function of zero level capability (equation 1) and therefore depends on the two factors that dynamically change the level of this capability:

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[2] Trend of output ($C_0.p$) rather than profits is measured to avoid challenges with use of trend function for negative numbers.

[3] A forty-period interval is selected to allow enough time to observe the long-term ordering of different allocation policies, without getting into technical challenges over numerical integration using growingly large outputs that follow the more successful policies.

resources invested to build this capability and the efficiency of the investment in it. Therefore to understand the shift in the peak performance towards the short-term policies, we need to consider not only the effect of different policies on the efficiency of the organization in building zero level capabilities, but also their impact on the growth of the resources available for further investment. Where additional investment in the first level capability increases performance through increasing the efficiency of investment in zero level capabilities, allocating those resources to zero level capability has the double benefit of growing the performance directly, as well as, growing the pool of resources faster. In other words, short-term policy of shifting the investment towards zero-level capability can be beneficial because it bring about a quick opportunity for growth, not available through the "long-term" policy. Such growth will grow the pool of resources available to the organization, and therefore will increase the investment in both capabilities. By reducing the delay in the positive feedback that governs organizational growth, policies that deem short-term become more efficient. The net impact is a shift in optimum policy from investing 24% of organizational resources in first level capability, to investing only about one third of this fraction (9%). While the exact extent of the shift depends on parameter settings used, sensitivity analysis on parameters suggests that the trend is quite general: considering the endogeneity of resources available to the organization reduces the priority of investment in first-level, long-term capabilities. Investments in zero-level capabilities pay-off faster, therefore strengthening the positive loop of Performance➔Investment➔ Capabilities ➔ Performance, and this additional benefit tips the balance towards further investment in zero-level capabilities.

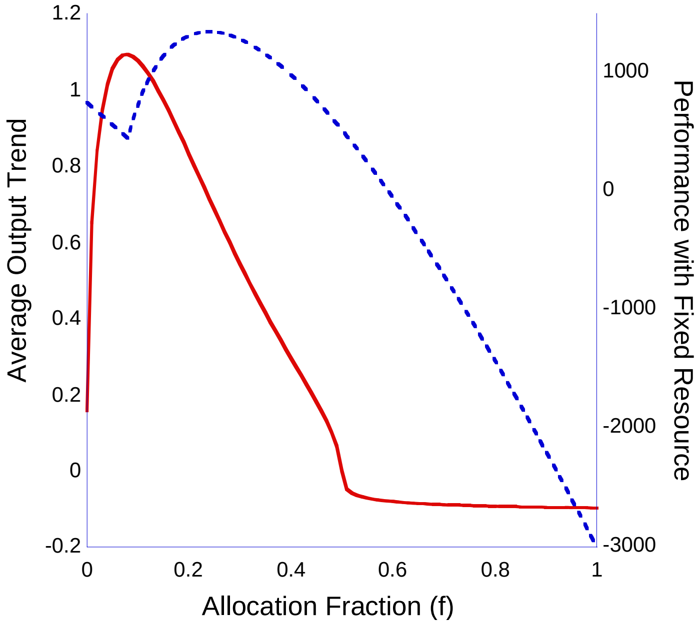

Figure 3- The average output trend (solid red, left scale, in fraction per month) for different allocation policies when investment resources allocated are a function of performance. Peak output growth rate is achieved by allocating 9% of resources to first level capabilities. The performance for different allocation policies with fixed resource (dashed blue, right scale, in K$/Month) is also reported for comparison. Using the same parameters, peak performance is obtained at 24% allocation in this case.

The second impact of the variable resource relates to the peak at f=0. In analyzing the organizations with fixed resource, ad hoc problem solving processes could overshadow the strength of the first level capabilities because the size of first level capabilities were bounded by the fraction of resources allocated to these capabilities. Therefore at small levels of investment, first level capability was inconsequential in terms of contributing to efficiency of developing zero-level capability and only wasted the resources, leading to a region around the f=0 where negative return on f dominated. In contrast, in the case of variable resource, as long as the growth loop dominates (f<0.5 in our setting), the investment in first level capability will continue to grow and eventually will dominate ad-hoc problem solving, therefore over the long-run f=0 is dominated by policies that promise a minimum fraction of investment in the first-level capability.

In the analysis for the fixed resource case we also observed a dynamic tradeoff for managers involved in the resource allocation decisions. Specifically, allocations that favor first level capability look worse in the short-term, because they cut down on the quick payoffs achievable through direct investment in the zero-level capability. This created a potential trap for managers as they experimented with different allocation policies. Allocations beneficial in the short-term could be harmful in the long-run and vise versa. What is the impact of endogenous resources on this dynamic trap?

To examine this question we compare the output trend (gr(t)) for a few different allocation policies. Figure 4 shows the time domain response of allocation policies of f=[0, 0.05, 0.1, 0.15]. At the beginning all the firms grow with increasing rates, and the ordering of different policies, in terms of their growth rate, is consistent with the hypothesis that lower investment in zero-level capabilities is better in the short-term, regardless of its long-term ramifications. The policy of sole investment in zero level capability dominates all the other alternatives in the first 8 month, and it takes another two month before the policy of f=0.1 (which in this setting dominates the others in the long-run) takes its place at the top of the pack. Moreover, f=0 policy leads to a constant growth rate as first level capability is completely ignored and after the depreciation of initial first-level capability, the zero-level ones are built only through the ad hoc problem solving (which has a fixed efficiency). In contrast other policies show a growing rate of growth, as more first level capabilities accumulate and enable increasingly more efficient investment in zero level capabilities.

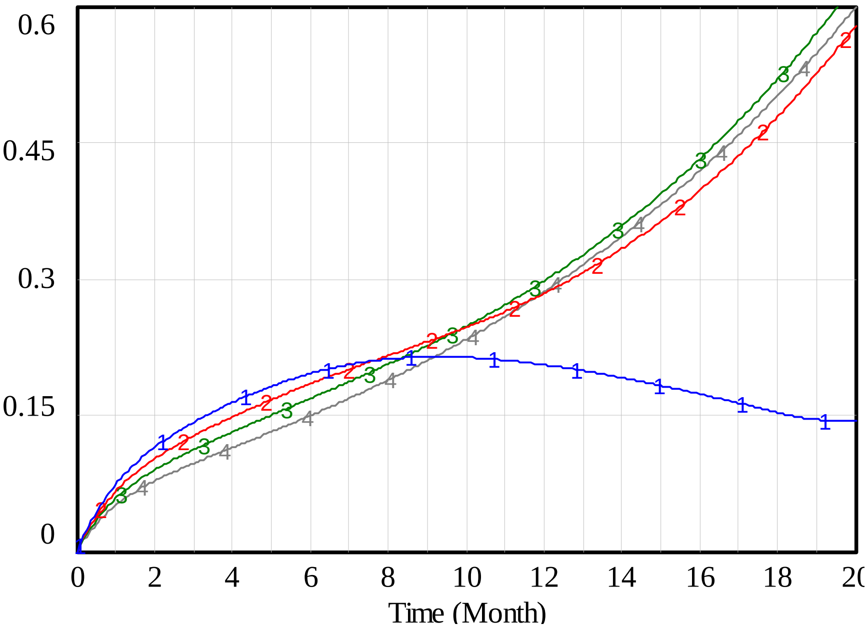

Figure 4- The tradeoff between short-term and long-term growth in allocation of resources between zero and first level capabilities. Different allocation policies in the graph include f=0 (blue, 1), f=5% (red, 2), f=10% (which is the highest payoff; green, 3), and f=15% (gray, 4).

This experiment suggests that some dynamic traps persist for managers, in the form of observing initial higher growth rates for ultimately poorer policies. However, note that these traps are weaker in this case because in the examples above the firm observes a positive growth rate in all allocation policies. The tradeoff that the manager should overcome is between growing slowly at the beginning and very fast later, as compared to growing faster at the beginning and slower later. In contrast, the traps observed in the case of fixed resources include worse before better dynamics, where the manager should undergo a temporary decline in performance to benefit from high leverage policies. Numerical experiments suggest that worse before better dynamics are not observed in the endogenous resource setting: any short-term decline in performance triggers a death cycle of reduced investment, capability, and performance from which the organization can not recover. Given that growth and decline in performance send qualitatively different signals to the managers, one can argue that the temporal traps are less salient when we consider the endogeneity of resources. Under these conditions the name of the game is "who can grow faster?" Smart managers can slow down their short-term growth in order to build their first level capabilities and dominate in the long-run. However, no manager should completely sacrifice growth in order to build first-level capabilities. Such sacrifice can not pay off as the supposedly short-term decline in performance leads to lower levels of resources being available for investment in capabilities, leading to further decline in performance that overshadows the benefits expected from the sacrifice. Of course the strength of impact of performance on resources can be thought of as a continuous characteristic of the organization under study. Therefore below some threshold in the strength of this impact one can expect worse-before-better policies to re-emerge as important.

Competition

In the discussion so far we have used the simplifying assumption that the performance of the firm is independent of other firms in the market and that decisions are made without regard for competitive pressures. Placed in an unlimited market and without any competitor, the only concern for the firm is to grow faster. However, real managers often face their toughest challenges in the competitive dynamics. The benchmark for their performance is not the isolated firm's capability level or growth potential, rather, how their firm fairs in competition. How robust are the policy results regarding resource allocation in absence of competitors, if we consider the reality of competitive pressures? Do competitive pressures push the optimal policy one way or another? What is the impact of this assumption on the strength of dynamic learning traps? To address these questions, we extend the analysis to include competitive dynamics.

We model the competition of N identical firms in a fixed market. Most of the previous equations remain unchanged for this analysis, with the minor modification that all equations will require an index ([j]) to identify different firms among the N active firms in the market. To enable controlled comparisons, similar parameters are used for all the firms, except for the allocation fraction, f, which is the policy parameter of interest. Equations 20-23 describe the market aggregation and competition processes. We assume firm j's zero level capability determines its potential output (PO[j]). The real sales, however, comes from distribution of available market among different firms. If total market size (M) is bigger than the sum of the potential outputs for all the firms, then all firms sell at their potential output level (S[j]=PO[j]). Otherwise, their market-shares are proportional to their potential output[4]. Formally:

$$PO[j] = C_0[j].p \qquad (20)$$

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[4] Market size is selected so that initially the system is in equilibrium and everybody is selling exactly what they produce (that is M= $\sum_{i=1}^{i=N} PO_{Initial}[i]$)

$$S[j] = Min([PO[j], M.\frac{PO[j]}{\sum_{i=1}^{i=N} PO[i]}) \qquad (21)$$

$$R[j] = (S[j] - c).b \qquad (22)$$

$$\Pi[j] = S[j] - c - R[j] \qquad (23)$$

Equations 22 and 23 replace 16 and 1. With this setting, we can now analyze the relative strength of different allocation policies in the presence of competitive pressures. We use a controlled experimental approach in which the N firms are identical, the market starts from equilibrium where total market size is the sum of the output for all the identical firms, and every firm starts with the same allocation policy of f=50%. At time zero the firms switch to new allocation policies, and simulation traces the relative gains and losses of different firms in terms of market share.

In the first experiment, we compare the final sales of N=101 firms, each switching to a policy of f[j]=100.j, j=[0,1,…100] at time zero. We report the sales (S[j]) at different point in time[5] as a function of allocation fraction, f[j] (See Figure 5). The basic mode of behavior in this setting is the transfer of market share between firms with different growth potentials. Starting from the same initial conditions, firms that switch to poor-growth-potential policies lose market share to firms that can aggressively expand their potential output. In fact, if we run the simulation for long enough, a single firm will emerge as dominant and will drive every other firm out of business.

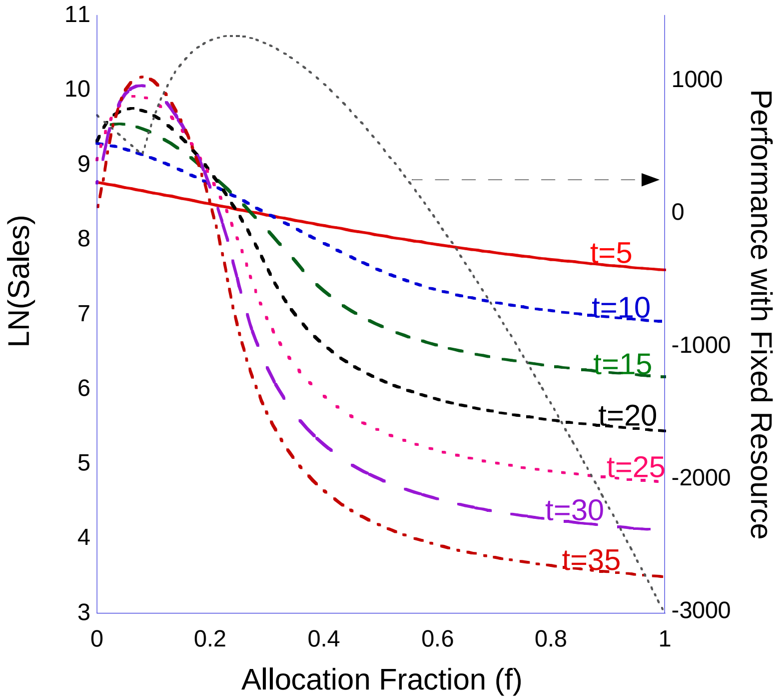

Figure 5-Sales for different firms as a function of their resource allocation policy on Logarithmic scale (left scale). Results based on N=101 competing firms at seven different points in time are shown to highlight the gradual change in the dominant policy as time proceeds. Long-term dominant policy is achieved by allocating 9% of resources to first level capabilities. The performance for different allocation policies with fixed resource (dashed black, right scale, in K$/Month) is also reported for comparison. Using the same parameters, peak performance is obtained at 24% allocation in this case.

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[5] We simulated the model for longer time horizons than shown in the figure however the basic mode of behavior and the peak remain constant, while only the number of surviving firms decline as the market moves towards a single dominant firm at f=0.09.

In this experiment we again observe a significant shift in the optimum allocation policy (from 24% to 9%), which emerges through a process somewhat similar to the endogenous resource case. The firms that can harness the fastest growth rates take market share away from the slow-growing ones, therefore allowing themselves to grow and benefit from the larger resource pool to invest. Again, the growth benefits of short-term policies tip the balance in their favor. In contrast to the case where competition didn't exist, in this case firms with inferior policies lose market share and are quickly driven out of the market. Nevertheless, in the first experimental setting, the strategy that dominates is the same one as in the no-competition case with endogenous resource. The firm that could grow the fastest in that case can take market share away from the other firms in a competitive market, and therefore will take on the market. Therefore the competition and endogenous resource cases share their optimum policy, when a large number of competitors with diverse policies exist at the beginning.

The market dynamics also show a gradual shift in the highest-performing policy through time. Five periods after the start of competition the highest sales goes to the firm that spends nothing on first-level capability. However, in these early periods most policies in the neighborhood of the optimum performance yield growing sales as they take away market share from many inefficient competitors. Among these growth-enabling policies there are those that with modest investments in first level capabilities grow their first-level capabilities and gradually dominate the no-first-level policy. This pattern of shift in dominant policies continues and in about 40 periods the long-term optimum policy (f=0.09) rises to dominance. Firms competing in this market therefore face a temporal trap, as the dominant policy is found among those that do not create the highest initial sales or growth. Nevertheless, we do not observe any value in the worse-before-better policies. Any decline in the short-term yields lower resource availability and a decline in capabilities, while the lost market share benefits the competitors and further reduces the firm's relative position.

When the competitors are dispersed on the strategy space, many inefficient firms exist and they supply the fuel for the initial growth of the few firms that are close to optimum policy. This growth period provides those firms with the opportunity to build their capabilities and compete based on their long-term growth potential. However, the situation can change if the most of the firms are not starting from the largely inefficient policies. For example consider a market with six players with relatively efficient policies of (f=[0,0.03, 0.06, 0.09, 0.12, 0.15]). In this case the firm following the policy of f=0.09 is facing three aggressive competitors who prefer a short-term growth based policy with lower investment in first level capabilities while only two competitors (f=0.12, 0.15) may initially lose market share to this firm. Can the policy of 0.09 remain optimal in this aggressive market?

Figure 6 reports the results of this experiment. Allocating 9% of resources to first level capabilities is no more optimal. In fact the only firm that can defeat the myopic one (f=0) is investing only 3% of its resources in first level capability. Losing market share to more short-term oriented competitors, many of the policies that could in the long-run grow faster than f=0, can not maintain a significant growth rate and therefore their first level capability remains underdeveloped and not competitive. In fact the dominant firm in this case (f=0.03) is the only one that can sustain a growth in the first level capability for long enough (over 40 periods in this case) to surpass the firm with f=0. These results suggests that as we move towards more competitors with highly aggressive policies, the viability of even limited investments in the first level capabilities become questionable. Different levels of optimum policy ranging between f=0 and f=0.09 can be found depending on the number of competitors and their allocation policies.

For example in the competition between only two competitors, always the one with the lower investment in the first level capability wins. Therefore the dominant strategy in a duopoly requires no investment in first level capabilities.

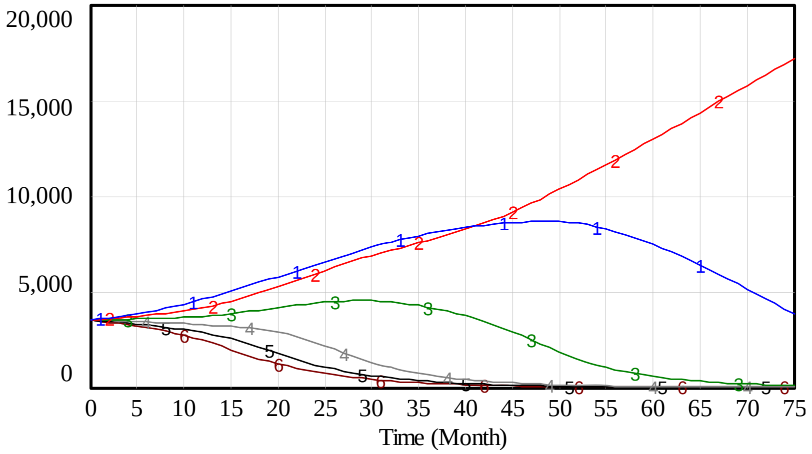

Figure 6- The performance of 6 firms constituting a market. The firm characteristics follow: firm 1: f=0: blue; firm 2: f=0.03: red; firm 3: f=0.06: green; firm 4: f=0.09: gray; firm 5: f=0.12: black; firm 6: f=0.15: brown; after about 50 periods firm 2 dominates and continues to take over the market.

In fact, competition favors short-term policies further when we consider the fact that firms try to choose their allocation policy strategically. They would consider how other firms in the market act and they would adjust their own allocation strategy accordingly. As we observed in the previous example (See Figure 6), in the pack of competing firms, the half with the highest investment on first-level capabilities has the slowest *initial* growth potential and therefore is doomed to lose market share to more aggressive competitors and be driven out of the market[6]. Knowing this, the firms entering the market want to strategically choose allocation policies that are on, or below, the competition-free optimal allocation (f=0.09 in our setting). However, if everybody is on or below f=0.09, then anything above the f=0.045 allocation is going to be a losing strategy, so everybody will seek to lower their allocation strategy further. The structure of this competitive policy selection resembles a simple game in which players chose a number in a range (here between 0 and 0.09) and the player whose number is closest to 1/3 (or any number below half) of the average of all wins. The unique Nash equilibrium for this game is for everybody to select the minimum value on the range (here 0), because being above half of the rest is losing, and the only way for everybody to be below half of the rest, is for everybody to select the minimum. Given the structure of our competitive market, we would expect a similar Nash equilibrium to exist in this setting, driving the firms to select the policy of no investment in first level capabilities. In other words, if we assume the firms are rational and choose their allocation policy strategically, they all should select the policy that allocates all the resources to the short-term, zero-level capabilities.

Nash equilibrium at zero investment in first level capabilities rests on the assumption that the players in the market are all rational and have similar perceptions of the market structure. Moreover, the size of the market is assumed to be fixed, so that every gain for a firm should come at the cost of some other firm. In practice the heterogeneity in firm conditions and information suggest that initially the market will include many firms with suboptimal

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[6] To see this formally, consider the equation 11. The derivative of zero level capability, and therefore output, is directly (and negatively) related to f. Thus the lower the f, the higher is the initial increase in output and thus the market share. Given the zero-sum and symmetric nature of initial competition in our setting, half the firms gain and half lose market share.

investments. Moreover, an initial growth phase in the market size often proceeds the fixed market period. Under such conditions, there is an initial window of opportunity during which it is feasible to spend resources on first level capabilities and sustain growth, albeit lower than completely myopic strategy, while the firm builds its first level capabilities. Once this honey-moon period is over, that is, inefficient firms are driven out and the market size reaches maturity, a successful firm should have built enough first level capabilities that it can overcome the myopic firms through its efficiency gains from the first-level capabilities. This result suggests that if the firm wants to build first level capabilities, the correct time may actually be the initial phases of market formation, when the window of opportunity is open. Curiously, given the lack of slack resources, this period is often not used for investment in long-term capabilities.

Figure 7 summarizes our analysis results in terms of optimum allocation policy following the consideration of endogenous resources and competition. With a fixed resource at hand, the firm is better off spending a considerable level of its resources on building first-level capabilities, which will later allow for efficient use of its resources in investment in zero level capabilities. Once we include endogenous resources in the analysis, the organization faces less incentive to invest in first level capabilities, because the potential for growth in resources coming from the investment in zero level capabilities promote the strategies with significantly less attention to first level ones. Nevertheless, some investment in first level capability is still beneficial for maximizing the growth rate. Competition further tilts the balance against building first level capabilities. In competition firms that do not initially grow, will fail as their resource pool shrinks and they fail to realize the benefits of more long-term investments. The optimal policy in these conditions depends on the number and the placement of competitors on the strategic landscape and can vary between 0 investment to the peak observed for endogenous resource case. In fact, when players in the market are assumed to select their resource allocation policy strategically, a unique Nash equilibrium emerges at zero investment in first level capabilities.

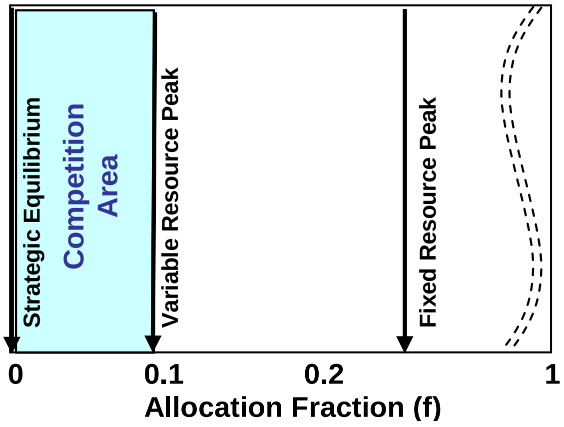

Figure 7- The efficient allocation policy under different assumptions. With fixed resources, the peak performance is observed at f=0.24. The peak is shifted to 0.09 when we consider the endogeneity of resources. Under competition, peak performance can fall anywhere between variable resource peak and 0. However, the strategic selection of allocation policy forces a game theoretic equilibrium at 0 allocation.

Discussion

System dynamics research has a long tradition of finding counter intuitive insights about the dynamics of social systems (Forrester 1971). These studies often reveal how decision makers' poor understanding of dynamics lead them to making bad decisions. A category of problems that is replete with such inefficiencies include the allocation of organizational (or societal) resources among activities that pay-off through different channels and with different time delays. From proactive vs. preventive maintenance, to product development and process improvement vs. production, firms seem to be biased towards investing in short-term capabilities and activities. Why such allocation biases exist?

Previous research hypothesize that the mis-allocation arises from the psychological decision-making processes (Sterman 1994) and the learning biases under these conditions (Rahmandad, Repenning et al. 2002). Psychologically, more salient and tangible activities that payoff in short-run are more often on the radar of managers and receive a higher share of the resources when it comes to resource allocation. Moreover, the experimental feedback that managers receive reinforces myopic strategies. The delay in the long-term activities means that shifting away from them does not create any instantaneous problem, rather, increases performance because resources get diverted to the alternative, short-term activity. In contrast investing in long-term activity requires a worse-before-better dynamic that can be misleading to the managers. In short, both psychological and learning processes can explain the persistence of under-investment in long-term activities.

In the present study we extended these results for a general class of organizational problems, where organizational resources should be allocated between zero and first level capabilities. The results are consistent with the existing literature and suggest that similar learning challenges and psychological biases can pressure organizational decision-makers towards myopic policies. From production to product development, branding, sales channel, customer support, and process improvement, different organizational capabilities can be categorized as zero or first level capabilities depending on whether they directly contribute to performance or their impact is indirect, through modifying the zero level capabilities. The extension of temporal tradeoff traps to this general class of problems helps us better understand the pervasiveness of myopic resource allocation policies in organizations.

Moreover, in this study we explore two new mechanisms that can reinforce myopic allocation policies when different activities have different delays in their payoff. Specifically, our general model of resource allocation between zero and first level organizational capabilities suggest that when resources to be allocated are themselves a function of organizational performance, the tradeoff between zero and first level capabilities is tipped in favor of zero-level capabilities. The quick payoff obtainable from zero level capabilities increases the value of investment in them because the growth fuels the expansion of total resources available for further investment. This process leads to a major shift in optimum allocation policy towards investments that payoff in the short-run. Introduction of competitive pressures further reinforces these results. In the presence of competition, growth for any of the firms comes at the expense of their competitors. Therefore there is additional incentive for the firms to act myopically and get the upper hand in the short-run. Short-term gains can then translate into long-term dominance as these gains expand the resources available to the firm and cut down on competitors' opportunities. In fact assuming that firms select their allocation policy strategically and based on what they expect the other firms to do, it is possible that the policy of allocating *no* resources to first level capabilities dominates all other policies in a game theoretic equilibrium.

Both these results depend on the dynamics of allocation of resources between different activities. Yet they take a somewhat different path from typical system dynamics studies. These dynamics suggest that myopic policies persist not because the decision-makers are unaware of long-term consequences of these policies, but because the policies are more efficient in competition with some of the long-term alternatives. In fact both results are reached by following the unique approach of system dynamics in broadening the boundary of analysis and endogenizing what was assumed constant in the previous research. Curiously, the expansion of model boundary in this case results in justifying a focus on short-term strategies.

Nevertheless these results do no contradict the learning and psychological arguments for persistence of myopic strategies. They simply offer additional reasons that could underlie the failure of firms to allocate resources to activities that can payoff in the long-run. In fact both types of explanations can be at play with different degrees of strength at different organizational settings. In this study we assumed a direct and strong link from performance to available resource. Many organizational settings do not support such strong connection. Moreover, competitive pressures may be less consequential if their impact is not sensed inside the organization in the time-frames needed for development of organizational capabilities. Therefore in practice both these dimensions are continuous and the current results are most relevant when a strong link between performance and resources exist, or when competitive pressures are strong and quick in their feedback.

We used a specific formulation for the capability dynamics that conceptualizes the first level capabilities to contribute to the efficiency of investments in zero level ones. A good example for capabilities that relate to each other in this way is product development and production. Other conceptualizations may be more appropriate for other types of capabilities. Whether the basic insights in this settings will be applicable to other cases is a question for further research, nevertheless, we speculate that the basic arguments are robust for a larger class of capability formulations. The impact of resource endogeneity depends on the faster initial performance growth when we invest in short-term policies. As long as the delays exist for long-term policies (which is true by definition), their long-term benefits should be discounted in the light of additional resource (and therefore investment) we could gain from using the short-term policy. This argument is quite general and does not depend on the functional form of capability formulations. Similarly, the impact of competitive pressures seem to be robust because they are generated by the potential for growth in the presence of endogenous resource combined with the zero-sum nature of competition where growth of a firm comes from the decline of another.

Another boundary condition on our results relates to the growth potential for the firm. In the formulations for this paper we assumed that positive growth loops in the form of Capability➔Performance➔Investment➔ Capability dominate the behavior of the firms in the market. Markets with such structures are common but not universal. The results regarding the endogenous resource case largely depended on this assumption: if growth does not bring more resources, then there is little value in faster growth, and thus endogenous resource does not benefit short-term policies.

Finally, the analysis here raises new questions regarding the viability of dynamic capabilities. Assuming that firms play rationally and face markets dominated with positive feedback loops, the results suggest that firms should avoid investing in first level (dynamic) capabilities. Empirical analysis can test the hypothesis that firms in markets dominated by reinforcing loops are less amenable to investment in dynamic capabilities. Future studies can also analyze the conditions under which a firm can develop first level capabilities and benefit from them. Many assumptions of the model can be violated in the real markets. For example firms do not start from the same equilibrium conditions and performance is often a function of multiple capabilities. It might therefore be possible to accumulate first level capabilities in opportunities provided by those violation, e.g. in multiple steps when performance is growing and some zero-level capabilities do not have the capacity to allow for faster growth.

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