

System Dynamics, RBV and Behavioural Theories of Firm Performance: Lessons from People Express¹

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Abstract

In recent years several scholars and practitioners have proposed that a combination of system dynamics and the resource-based view of the firm (RBV) can help to explain anomalies in firms' competitive performance over time. For example why do some firms, despite initial success, subsequently falter and even fail spectacularly. This article provides a practical example based on the well-known rise and fall of People Express in the highly competitive US airline industry of the mid-1980s. The contribution of RBV and system dynamics to understanding the changing fortunes of the firm is discussed and also critiqued.

Keywords: dynamics of strategy, resource-based view RBV, firm performance, behavioural decisionmaking

Introduction

In recent years strategy researchers have become increasingly interested in the *dynamic* processes that give rise to performance differences among competing firms. Indeed the editors of a recent special issue in *Management Science* note that “the challenge of fully incorporating dynamics into how we think about strategy is a major one, perhaps the biggest one that the field faces going forward” (Ghemawat and Cassiman 2007).

System dynamics is well positioned to make important contributions to behavioural theories of strategy dynamics. Firms and industries are highly dynamic, complex systems managed by boundedly-rational actors. What better way to understand firms and firm performance than with a ‘theory of structure’ capturing causal relationships and decision making processes that drive the dynamic behaviour of firms and industries over time? Here, drawing on a variety of model-supported strategy work, I argue that a combination of system dynamics and contemporary ideas from the strategy field (particularly the resource-based view of the firm RBV) can yield compelling and credible theories.

The People Express Case – A Vivid Example of Puzzling Firm Performance

I adopt a well-known business case - the rise and fall of People Express – to demonstrate the complementary use of RBV and system dynamics for understanding firm performance. So my topic, theory building in strategy, is approached in a pragmatic and inductive way by examining, and then reflecting on, the intention and outcome of real-world strategy. The

¹ I am grateful to Shayne Gary, Martin Kunc and Scott Rockart for their input to this paper which is a spin-off from our joint review of system dynamics and strategy. I am also grateful to John Sterman for perceptive comments on theories to explain the rise and fall of People Express.

A fundamental proposition (and partial explanation) is that underinvestment in staff was very difficult for managers at People Express to discern at the time the company's spectacular growth was taking place. According to Senge, investment in service capacity was driven by a 'perceived need to improve service quality'. This criterion for investment sounds plausible yet it led to an organization that was chronically short of staff. But why? Senge hints at two reasons (each informed by feedback systems thinking and the chosen archetype): 1. experienced staff (controlled by a balancing loop) did not keep pace with the growth of the fleet (controlled by a powerful reinforcing loop); and 2. implicitly this imbalance was masked by tremendous growth in headcount which did not fully translate into corresponding growth in service capacity. Nevertheless one is left wondering why the company persisted in its aggressive fleet expansion and why in its hiring policy the company did not appreciate that headcount and service capacity are fundamentally different.

Using Ideas from the Strategy Literature to Interpret the People Express Case

To examine these anomalies we turn to two sets of ideas from the strategy literature². The first is the resource based view (RBV) of the firm which explains differences in firms' performance and competitive position in terms of endowments of critical productive assets or resources (Barney 1991; Foss, Knudsen, and Montgomery 1995). In particular we draw on a dynamic view of resource accumulation developed by Dierickx and Cool (1989) which makes the same distinction between stocks and flows (or levels and rates) as found in system dynamics, and which has been extensively developed in Warren (2002 and 2007) and in doctoral theses by Mollona (1999), Gary (2000), Mandal (2003) and Kunc (2005). The second idea is the notion of dominant logic which provides a cognitive/behavioural explanation for different managerial styles of resource management (Prahalad and Bettis 1986). Senior managers' dominant logic is their belief system or overall logic for firm success. Dominant logic captures information filtering and selective managerial attention typical of real-world decision-making and explained academically in terms of bounded rationality and the 'Baker' criterion (Sterman 2000, chapter 13; Morecroft 2007, chapter 7).

The first step in a dynamic resource-based study is to classify resources into tangible or intangible (Warren 2002, 2007; Morecroft 2002) and those that are overtly managed or unmanaged. For People Express the relevant information is in the case and it is a matter of modelling judgment which of the many listed resources to include. Obvious tangibles are planes, staff and passengers. Intangibles include service reputation and staff motivation. The classification into overtly managed and unmanaged resources is quite subtle yet vital because it is often drifting and unmonitored resources (invisible at the operating level, and usually intangible) that are the undoing of an otherwise successful strategy of resource accumulation. Figure 2 provides some clues of what to look for in making this managed-unmanaged classification. For a typical managed resource there is usually a clear desired condition or goal. The apparent condition of the resource is readily measurable. As a result the gap that drives corrective action is objective and the managerial feedback control process is purposive and goal-directed. A simple and familiar example would be a production policy that manages factory inventory to a strict goal. If all resources in a firm were managed with such ideal clarity (and if all underlying goals were not only clear but also internally consistent) then an effective resource

² This interpretation of the People Express Case is an excerpt from my article 'Resource Management Under Dynamic Complexity' (Morecroft 2002). Here I use the example to review the synthesis of strategy concepts and system dynamics and then to critically examine what new insights arise from such a synthesis that are not available from system dynamics alone.

strategy should emerge. However, in many cases key resources are inadequately managed, or not managed at all. There are many small hints and clues to isolating unmanaged resources in practical situations. Often the resources are intangible or soft, so that it is difficult to discern the apparent resource condition. The desired condition or goal may itself not be clear or appropriate. The resource in development may be invisible. In the case of People Express unmanaged resources include potential passengers, service reputation and staff motivation.

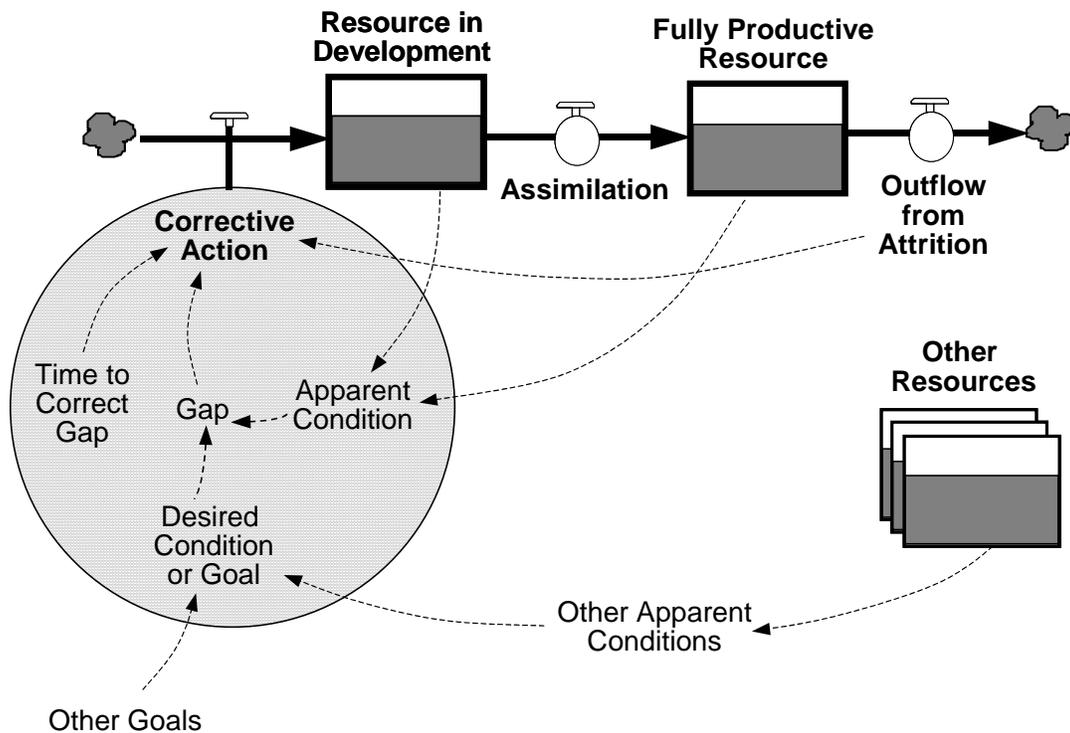


Figure 2: Operating Policy for Resource Management

A rough classification of resources leads next to a study of dominant logic. This phase of modelling work (spanning conceptual aspects of formulation) reveals the managerial rationale for the firm's continuing resource accumulation strategy. Let's start with the tangible resources at People Express. What is the dominant logic of fleet expansion? Such strategic investment could be governed by funding, market share goals, return criteria, demand forecasts, or staffing constraints. The dominant logic at People Express however appears to be (reading between the lines of the case and video) CEO Don Burr's ambitious personal growth target, stemming from his vision of industry revolution embodied in the precepts of the company. Clearly such logic is both powerful and persistent. The imposition of Burr's dominant logic leads to reinforcing feedback (R1 in figure 3) in the resource stock of planes; growth is desirable.

The dominant logic of staff expansion is quite different. From the case one gathers the impression of a Human Resource VP insistent on high-quality recruits, carefully selected by the top management team and trained on the job. The imposition of this dominant logic leads to reinforcing feedback in which the resource stock of experienced staff is the principal determinant of hiring and acts as a constraint on the growth rate (R2 in figure 3).

The dominant logic of passenger growth is also noteworthy at People Express. Customers are a vital resource stock for all companies. Some companies explicitly manage customers by setting sales targets, tracking customers in databases, and implementing marketing programs to eliminate any gaps relative to goal. Other companies do not actively manage the customer base, but instead allow it to evolve from advertising, word-of-mouth and churn. People Express seems to have adopted an ambitious but essentially unmanaged approach to growth of customers. Deep price discounts coupled with targeted advertising unleashed a powerful word-of-mouth effect that caused a very rapid build-up of potential passengers (those fliers willing to try People Express should the opportunity arise). The imposition of this dominant logic embodies reinforcing feedback characteristic of word-of-mouth (R3 in figure 3).

The resulting tangible resource system contains three reinforcing feedback loops (R1, R2 and R3), each a compelling engine of growth, but each operating independently to produce autonomous expansion of planes, staff and passengers. Partial model simulations reveal the power of these growth engines to underpin the kind of spectacular growth achieved by People Express in reality.

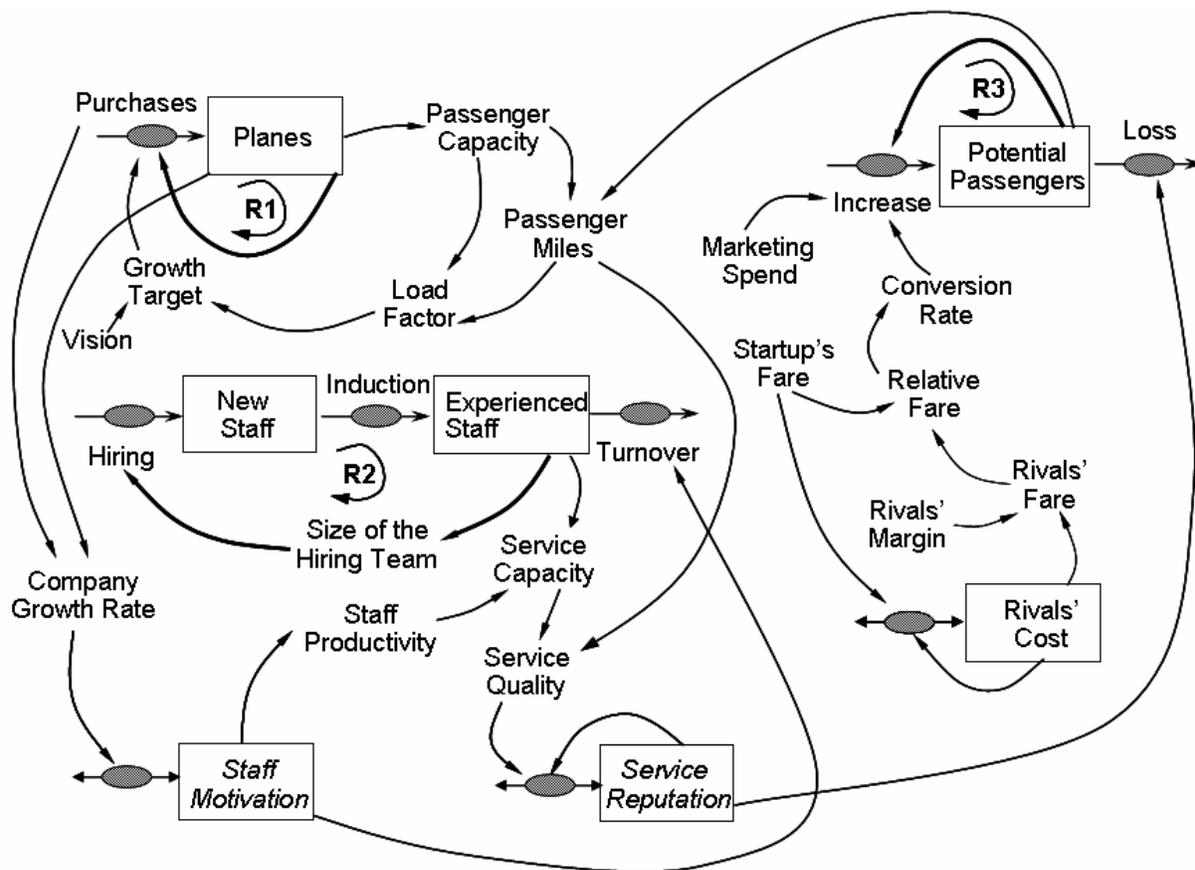


Figure 3 Resources (Asset Stocks) and Feedback Loops in People Express

The third step of a dynamic resource-based analysis looks to the behaviour of the intangibles (service reputation and staff motivation) to explain the demise of People Express and more importantly the invisibility of the company's mounting resource problems. From the case it appears that neither service reputation nor staff motivation is overtly managed. This observation

is no surprise when one considers that almost all the requirements for active resource management (in Figure 2) are absent. Operating goals are not clearly defined and the apparent condition of the resource stocks is unknown. It is difficult to read the minds of customers and measure service reputation, or register the emotions of staff to discern motivation. So reputation and motivation just evolve from operating conditions. Motivation responds to a range of dynamic factors such as company growth rate, share price and profitability (for visual simplicity only company growth rate is shown in figure 3). Motivation influences staff productivity which, in combination with experienced staff, determine service capacity³. Reputation responds with a time lag to the balance of passenger miles and service capacity.

When the three reinforcing feedback loops driving growth in the firm's tangible resources differ in strength (and it would only be an accident if the gain of all three were identical, since their dominant logic is so different), then problems begin to accumulate in the intangibles. No management action is taken to fix these problems because: 1. the unmanaged intangibles provide only weak signals to the rest of the organization of latent growth stresses; and 2. the powerful dominant logic governing tangibles is insensitive to such weak signals. Indeed the case and video suggest that, according to Don Burr, any problems with employee motivation or customer service reputation were best remedied through further growth.

A simulation of People Express' growth strategy reveals the mounting strategic problem. As Figure 4 shows, service reputation declines steadily for six years between 1980 and 1986 when the airline was growing rapidly. The apparent recovery of reputation in the last two years results from an unintended abundance of staff as disillusioned passengers switch to competing airlines. Motivation, though invisible and beyond direct management, remains both steady and high for the first six years, underpinning People's competitive cost advantage. But as the customer base saturates and then collapses, the excitement and profit-lure of a fast-growth enterprise evaporates. Employees are demoralized. Planes fly half-empty. The company dies with a configuration of resources both tangible and intangible that is markedly inferior to its major competitors. There is no commercially viable route of recovery from this resource trap.

³ Strictly speaking service capacity depends on experienced and new staff as well as staff productivity. For visual simplicity the link from new staff to service capacity is omitted in figure 4.

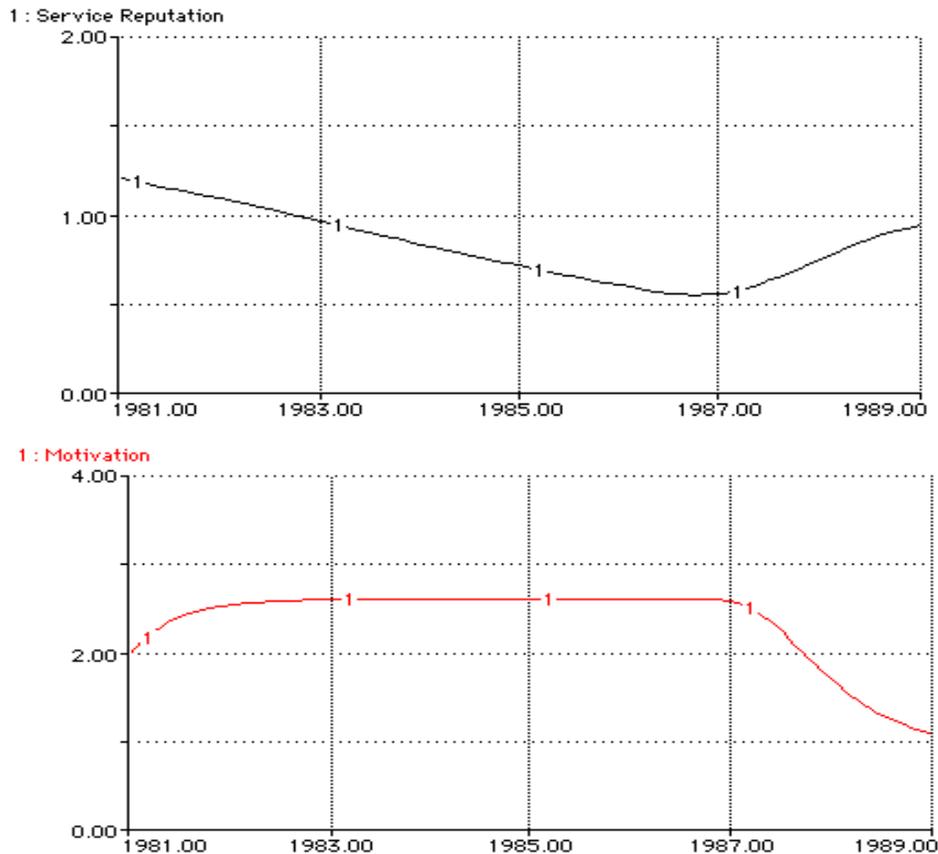


Figure 4: Simulated Time Charts of Intangible Resources from a System Dynamics Model of People Express: Service Reputation and Staff Motivation

What's New in the RBV-Dominant Logic Analysis of People Express?

Scholars and experts in system dynamics may argue there is nothing new in the above analysis of People Express and its failure to sustain growth. Indeed the principal and original contribution to understanding the unfolding drama at People Express came from system dynamics alone and one might therefore think that any later claim of insight is an argument in reverse. In other words, since a system dynamics model of the airline's rise and fall came first, then a subsequent interpretation of this boom-and-bust phenomenon from an RBV-dominant logic point of view cannot be more than icing on the cake of the original model-based theory. This criticism merits close investigation as it goes to the very heart of the challenges facing those who conduct cross-discipline research in system dynamics and strategy.

First we review the facts from a system dynamics viewpoint. The People Express simulator was developed by Sterman in the mid-1980s and first used with students at MIT Sloan in September 1988 as a one-day module in a week-long orientation programme for incoming master's students (this history and more information on the case and model are reported in Graham et al 1994). The simulator constitutes a precisely defined theory of the demise of People Express, with a clear dynamic hypothesis instantiated and quantified in the simulation model. The model-based argument goes beyond Senge's brief account of growth and underinvestment to reveal the feedback effects determining the destiny of People Express. For example the

company's equity-based compensation scheme was able to sustain employee motivation during the rapid growth phase, as stock price rose sharply, even though employees were overworked and verging on burnout. The model contains a rich feedback theory of growth and underinvestment, constructed entirely from concepts fundamental to system dynamics analysis including stock accumulation, time delays, information feedback and bounded rationality. Many of these dynamical system concepts are as old as the field itself. For a contemporary overview see the special issue of the *System Dynamics Review* celebrating the 50th anniversary of the field (Sterman, editor 2007).

So we can correctly conclude that all of the creative work on the People Express simulator, and the resulting explanation of the company's rise and fall, was completed without the need for concepts from the strategy field. Chronologically the development and first-use of the People Express simulator overlaps the arrival of dominant logic in the strategy literature (Prahalad and Bettis 1986) and even precedes Dierickx and Cool's 1989 paper on asset stock accumulation and competitive advantage.

So why is it helpful to re-interpret this rich model-based theory with concepts from the mainstream strategy literature? Part of the answer is improved communication with strategy colleagues. System dynamics theories of firm behaviour are more accessible to strategy professionals if couched in strategy-specific jargon such as RBV and dominant logic. Indeed Repenning (2003) argues convincingly that a vital part of 'selling' system dynamics to other professionals is to ground the work in the language and literature of the field one is trying to enter. So 'asset stock accumulation' is a phrase that many RBV strategists understand and corresponds *precisely* to system dynamicists' levels and rates. Similarly, dominant logic is easily recognised by academic strategists and is closely connected to notions of policy and information flow in system dynamics. Dominant logic is another way of saying that top management policies (in key activities such as capital investment, recruitment, pricing and so on) are boundedly rational and that the effect of dominant logic is to focus organisational attention and collective effort on feedback information that coincides with deeply-held beliefs and aspirations of those with the power to act.

But there is more on offer from the strategy literature than palatable phrases. Widely-cited and influential concepts borrowed from academic colleagues often illuminate one's own field in unexpected ways. So although asset stock accumulation is nothing more than levels and rates, the *linkage* of asset stock accumulation to the sustainability of competitive advantage (as Dierickx and Cool originally proposed) bridges the gap from firm-level behaviour to industry-level competition and rivalry. The dynamical puzzle of the rise and fall of People Express becomes transformed into the equally enigmatic puzzle of the apparent overnight switch in the company's competitive advantage (sustained for five years in a highly competitive industry) to competitive disadvantage. This rapid change of fortune can be interpreted as an unexpected shift in the balance of tangible and intangible resources that underpin Burr's radical 'business model' for a low-cost airline. Normally it takes a long time for firms to re-configure their asset stocks (which is Dierickx and Cool's main point about sustainability of competitive advantage and the reason why full-service rivals found it difficult to copy People Express). But sometimes, due to dynamic complexity and causal ambiguity in the feedback processes linking asset stocks, a seemingly superior configuration of asset stocks can prove fragile, as the true condition of 'hidden' intangibles becomes fully apparent. Is this interpretation of events just another way to present growth and underinvestment? I think it is much more than that because the new interpretation explains an important dynamic phenomenon – the collapse of competitive

advantage. It is the combination of system dynamics *and* RBV that provides this extra explanatory power.

The distinction of tangible and intangible resources deserves close scrutiny too. The idea that stocks are not restricted to tangibles but also include intangibles such as perceptions, reputation, norms and values goes back a long way in system dynamics – at least to Forrester’s (1964) corporate growth model and his widely-cited market growth model (where the delivery delay goal is an intangible stock representing a norm in the organization, Forrester 1968). So RBV, with its broad view of strategically important resources, both tangible and intangible, adds nothing new to system dynamics. But arguably the synthesis of RBV and system dynamics has led to greater clarity in the use of tangibles and intangibles, as evidenced by a complete chapter in Warren’s (2002) *Competitive Strategy Dynamics* devoted to ‘the power of intangible resources’ and his argument (as a system dynamicist) that even soft factors have a hard face (i.e. they can be quantified and dimensionally specified with a degree of rigour that would surprise most strategy practitioners and scholars).

Our analysis of the rise and fall of People Express also made use of a crucial distinction between managed and unmanaged resources. This idea does not arise directly from the RBV or dominant logic literature but is in fact a central part of information feedback control theory. However, it is (once again) the *synthesis* of RBV, dominant logic and system dynamics that lends power to the analysis. RBV says that resource configurations determine firm performance and competitive advantage. Dominant logic reveals the source of firms’ overarching goals – what really matters to management and needs to be achieved by the organisation. And then, as the capstone, control theory and system dynamics say that stock accumulations are managed through stock adjustment. Purposive corrective action, based on the gap between desired and actual system condition, adjusts the stock toward its corresponding goal. From this standard feedback representation of purposive action, there follow two important corollaries about controllability. First, if (for a given resource) there is no clearly defined goal (in the minds of the management team, as expressed in their dominant logic) then there can be no meaningful corrective action. Second, if the condition of a stock cannot be adequately measured or monitored, then again there can be no meaningful corrective action.

RBV neatly overlays and complements this feedback view. If, as RBV says, the overall performance of the firm depends on it maintaining a configuration of resources that confers competitive advantage over rivals, then the functioning and coordination of asset stock adjustment processes in the modelled firm are of central interest in a well-informed dynamic analysis of strategy.

From this synthesis, the competitive significance of intangible resources is made clear. Intangibles like motivation are inherently difficult to monitor. As a result they are often unmanaged and can, as in People Express, drift to extreme values that, after a time delay, are perceived by customers (or other stakeholders) to be totally incompatible with the firm’s intended strategy (even though many other resources are ‘correctly’ configured). To say that such resources are unmanaged is simply to say that they are not subject to timely purposive corrective action and are therefore potentially capable of wreaking havoc with an otherwise successful resource building strategy. In People Express, motivation could not be actively managed, particularly on the downside (even though the firm clearly had ways of boosting the upside motivation of its employees through stock options, job rotation and the sheer excitement of rapid growth). Low and unmanaged motivation translated into service degradation which then fed back through the market to undermine the firm’s growth and success.

There is one more point to add about managed and unmanaged resources. For those who take stocks and stock adjustment seriously it may seem that this particular distinction is already captured in the concept of ‘overt’ and ‘implicit’ decisions, dating back to the origins of system dynamics in chapter 10 of *Industrial Dynamics* and repeated in Forrester (1994). In this classic archival work, overt decisions are described as the ‘conscious decisions made by people as part of management and economic processes’. They involve purposive corrective action predicated on selected information about the goals and current state of the business. By contrast implicit decisions are ‘the unavoidable result of the state of the system such as present ability to deliver, depending on the present state of inventories’. Under this special lexicon from *Industrial Dynamics*, both managed resources *and* unmanaged resources belong with overt decisions. Managed resources are easy to categorize in this way: they are simply resources controlled by overt decisions through normal asset stock adjustment. Unmanaged resources are trickier to classify, but there is no doubt they belong with overt rather than implicit decisions. Unmanaged resources reside within faulty (non-functioning or even non-existent) overt decisions, where normal asset stock adjustment fails to happen. The example most familiar to system dynamicists is the stock of ‘undiscovered rework’ found in project management models (Lyneis and Ford 2007). By definition, undiscovered rework cannot be measured. It is an unobservable state variable and therefore cannot be used as the basis for goal-seeking corrective action, even though such feedback control would be highly beneficial in the elusive quest for on-time and on-budget projects.

In conclusion our review of the conceptual apparatus behind the earlier People Express analysis has shown that it is really the synthesis of system dynamics, RBV and dominant logic that offers something new to would-be strategy modellers, and to scholars and practitioners of strategy. An explanation took shape to explain the rise and fall of People Express. This dynamic resource-based theory provides novel traction on the rapid change in the competitive fortunes of People Express – from highly successful five-year growth wonder (with a seemingly sustainable competitive advantage), to burned-out and bought-out corporate carcass in only six months. Arguably this theory-from-synthesised-concepts is no more insightful, dynamically speaking, than the pure system dynamics theory embedded in Sterman’s original People Express Management Flight Simulator. But it’s conceptual vocabulary is richer. The theory is expressed in terms that are understood by colleagues from the strategy field, and addresses their central concerns about the sustainability of competitive advantage without departing from or diluting the core feedback concepts of system dynamics. These synthesised concepts, when brought to life with simulation, can greatly enhance interpretation of the often-puzzling dynamics of strategy.

Moreover, and this is significant, the ‘theory-from-synthesised-concepts’ is subtly different from the pure system dynamics theory, even in terms of its main explanatory feedback loops. Recall from figure 1 the dual reinforcing loops and dual balancing loops in Senge’s feedback theory of the rise and fall of People Express. Although this picture is much simplified by comparison with the feedback structure of Sterman’s simulator it nevertheless captures the archetypal loops of growth and underinvestment (which are widely used in the field). The key growth-inhibiting structure in Senge’s analysis is to be found in the two lower loops which portray investment in service capacity and a floating goal for service capacity. As the service quality goal erodes due to fast growth, management pressure for expansion of service capacity gradually relaxes and inadvertently leads to underinvestment. A similarly simplified picture (figure 3) for the RBV/dominant logic model contains three semi-autonomous reinforcing loops controlling the growth rate of planes, staff and passengers. Due to the company’s highly

selective and time-consuming recruitment policy the natural growth rate of staff is slower than the growth rate of either planes or passengers, leading (covertly) to staff overload and service degradation that also eventually feeds back to undermine growth of passengers. The same problem of underinvestment in staff happens as in Senge's theory, but for entirely different operational reasons. A more detailed presentation of this alternative model and an accompanying simulator can be found in Morecroft 2007 (CD materials for Chapter 6).

In principle it is possible, in a well-grounded single sample account (or field study), to distinguish which of these two feedback structures best fits the real-world business situation. The resulting simulation model can then be used to generate new testable hypotheses about competitive strategy, growth management and policy design. However the original Harvard case alone is not sufficient for this task of theory selection. Both models are broadly consistent with the limited evidence presented in the case, but they are different and were derived independently by experienced system dynamics modellers. Both model-based theories 'explain' growth and collapse in terms of hidden failure to coordinate investment in planes and seat-miles with growth in service capacity. The essential difference between the two feedback theories lies in the assumed degree of mis-coordination among the functional areas of the firm. The SD-RBV-dominant-logic analysis assumes *extreme* lack of coordination between staff and planes, so that declining-and-*unmanaged* service quality halts new passenger growth, accelerates loss of passengers and leads eventually to the company's demise. The alternative interpretation (characterised in Senge's loops) implies that management is collectively conscious of service quality but fails to implement high standards. The result is a gradual drift to low service quality that again halts new passenger growth, accelerates loss of passengers and leads to demise.

The Promise and Challenges Raised by the People Express Example

I have sketched a dynamic resource-based view of the rise and fall of People Express combining system dynamics and two influential sets of ideas from the strategy field: 1. resource accumulation as a way of understanding firms' resource endowments and enduring differences in firms' strategy and performance; and 2. dominant logic guiding firm-specific decision-making as a way of understanding resource management and firm performance. System dynamics is a natural way to unite these ideas as amply illustrated in Warren 2002, 2007 and in Gary 2005. Stocks and flows portray resource accumulation, while information feedback and policies embody dominant logic and decision-making processes. The stock/flow and policy framework provides a versatile means of visualizing firms' resource systems and formal strategic simulation models enable us to reliably analyse the dynamic consequences arising from the underlying resource management policies. However, there is still some way to go in bridging the gap between this dynamic resource-based view and the mainstream RBV strategy literature. A growing body of contemporary research in this important inter-disciplinary area is reviewed in Gary et al (2008), which describes recent accomplishments and identifies future challenges.

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