

The Dynamics of Strategy

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This article first appeared in Business Strategy Review, Volume 10 (1999), Issue 3, pp 1-16. This revision includes extensive updates and links to working models. Kim was then Teaching Fellow in Strategic and International Management at London Business School. He is indebted to Professor John Morecroft for introducing him to the concepts on which strategy dynamics is built, to Emeritus Professor Jay W Forrester of MIT for creating the underlying science of system dynamics, and to the many other outstanding professionals in the field.

When trying to deliver strong future performance, leaders need to develop strategies that build on a rigorous, quantified understanding of how their business actually works and performs. This article starts by explaining why a dynamic (time-based) approach to formulating strategy is essential, then lays out the core frameworks of a quantitative method that can help executives understand and take control of their organisation's performance.

A ubiquitous feature of the strategy challenge facing managers is how to tackle dynamic (time-related) performance challenges. A typical example is shown at right (Case A: "FundCo").

Whilst management can do much to adjust short-term financial results, there is great uncertainty about medium to long-term outcomes. Yet managers at all levels are expected to commit to confident projections – department heads must promise to deliver results on everything from sales to production costs to service quality; CEOs must gain support for their business plans; entrepreneurs seeking venture capital must offer investors time-path forecasts for future earnings.

This confidence in what will be delivered is assumed to be supported by a clear set of intentions as to what will be done, when, and to what degree across all the major functions of the business in order to bring about the promised performance.

If strategy analysis is to help in such cases, it must answer three basic dynamic questions (see figure 2):

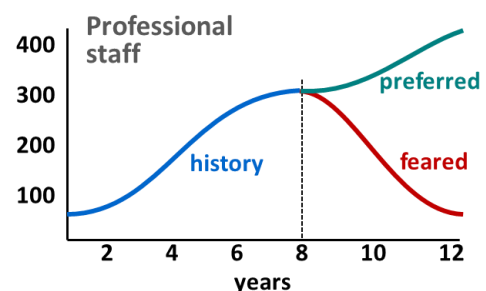
- **Why** has business performance followed the time-path that it has?
- **Where** is performance heading into the future under current policies?
- **How** can we act to alter that future for the better?

These questions are so fundamental to the responsibility of strategic managers that one might expect leading strategy books to tackle them head-on.

Yet charts such as figure 2 and others in this article are remarkably rare, perhaps because we have lacked the methods and tools to answer them.

CASE A: FundCo – The CEO of a major investment firm had reason to worry about its ability to sustain the exceptional growth in earnings that it had maintained for more than a decade. The business depended critically on highly skilled staff, who not only delivered the firm's services, but also maintained strong relationships with clients. This fragile system depended upon good morale and loyalty amongst the staff. The firm's success, built over many years, had attracted the very best recruits. However, the CEO knew that certain rivals had collapsed very rapidly, and wished to avoid that fate itself. Figure 1 indicates the time path of this firm's recent history of staff development, and the alternative futures the CEO felt they might face.

Figure 1: Time-chart for staff numbers at an investment firm

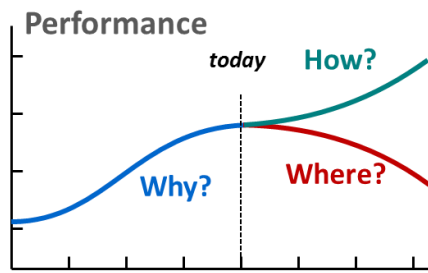


If this time-path for the staff were to arise, it would coincide with a collapse in clients, funds, earnings and, of course, the share price.

There are fundamental structures in any situation that determine how performance evolves over time. These structures can be understood and captured by formal analysis in an approach known as strategy dynamics. The method also allows those structures to be shown in way that is understandable and actionable.

¹ For more information, materials and contact details, see www.strategydynamics.com.

Figure 2: The fundamental dynamic questions in strategy



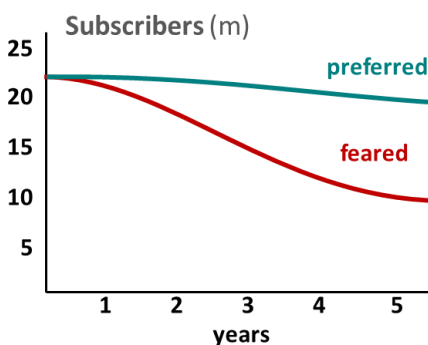
The Time-path of Strategic Performance

Cases B and C, also from work with real companies, illustrate the critical importance of the questions in Figure 2.

Where there is a history to the situation, as in the FundCo case, it is important for two reasons. First, history tells us how ‘the system’ actually works – why we have arrived at the current situation. Secondly, things that happened in the past are *already* determining much of what will happen in future. **History matters!**

CASE B: TelCo – A dominant telecoms firm in a deregulating market fears loss of market share to new entrants. This firm, a formerly nationalised telecoms operator, faces the opening of its market to new competitors. Following the experience of the UK’s BT plc, the firm knows that its financial performance will suffer from losing a proportion of its subscriber-base over a few years, but wishes to minimise those losses, and capture any new subscribers that may emerge. Figure 3 indicates alternative future time-paths for this critical indicator.

Figure 3: Time-chart of competitive intrusion facing a dominant telecoms operator



Telco has no history of competition in this particular market, but if the firm gets to year 3 having seen subscriber numbers fall to 15m, then its prospects from that time will be very different than if that had not happened – and its experience during years 1-3 will tell it a great deal about how competition is working.

Although GameCo is launching a novel product, and therefore has no history for *this* case, this is not the first

such product launch made by the company or its rivals. The history of *those* cases provides highly valuable information about this new episode.

The challenges portrayed in these three examples are not merely descriptive – each has vital **quantitative** features, and understanding what the numbers are doing and why is key to figuring out what to do.

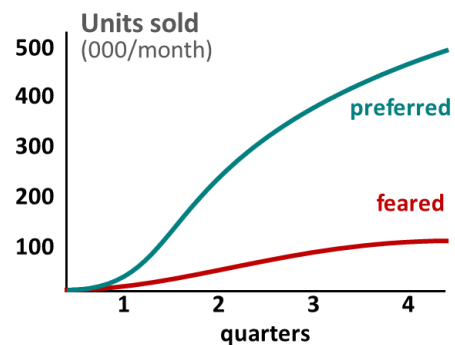
Threats and opportunities have scale

FundCo fears that losing just a fraction of its most critical staff could trigger collapse of a business that is custodian of funds worth over \$75bn. If it can protect and add to that highly-skilled team, however, there remains much opportunity for profitable growth.

CASE C: GameCo – A consumer-technology manufacturer wishes to exploit a rapidly developing market opportunity before rivals do so. This firm, facing a challenge similar to the launch of the Nintendo 64 against Sega and the Sony Playstation, is at an early point in a new phase of the industry’s history, with a consumer electronics product for which there will be a substantial market.

However, it is vital to build sales quickly, to erode the competitors’ increasing strength. It also needs to grow the installed base, in order to drive sales of components and upgrades. And to achieve these things, the firm must quickly win the commitment of suppliers and distributors.

Figure 4: Time-chart for exploiting the potential market for a new consumer-technology product



While this is clearly an episode of strategic importance, notice the time-scale over which this launch success needs to play out – just one year. For the Nintendo launch that preceded this case, the price of both its own and Sony’s product price fell from \$250 to \$99, in just seven months!

TelCo stands to lose millions of subscribers and billions of dollars in revenue. Moreover, loss of this business and the cash flow it generates would threaten its ability to invest in opportunities offered by emerging telecoms technologies.

GameCo expects sales of hundreds of thousands of units, and desperately needs an installed base to

provide the long-term cash flows from sales of upgrades and accessories. Longer-term, pulling off this product launch may determine the entire survival of this multi-billion dollar enterprise.

Strategic issues evolve over a time-scale

Speed will be vital for GameCo, who will win or lose the race against new products from its competitors over just a few months. FundCo could, if it does not act swiftly and correctly, see staff losses accelerate within a few quarters.

Although the competitive threat to TelCo will play out over some years, its immediate decisions on pricing, service, network development and marketing will powerfully affect its later prospects. If competitors get a strong foothold in its market, they will be able to build on that foundation and pose a more serious threat.

Annual business plans are quite inadequate in any of these cases!

Performance follows a time-path

Performance does not just start and end at specific points, but evolves at a varying rate as the future unfolds.

TelCo may at first lose few subscribers, then suffer increasingly rapid losses as its rivals build their capability.

GameCo may see little absolute growth in early weeks, until word-of-mouth accelerates and the rate of sales takes off, before slowing again as the opportunity is used up.

FundCo has so far experienced only a slow-down in growth of its professional staff, but if disillusioned individuals start to leave, attrition could accelerate catastrophically.

Today's performance depends on today's strategic resources

While continuing uncertainties do not permit precise forecasts, strategy analysis should at least give us *some* indication of the time-path for future performance. So how might a management team start to tackle such challenges?

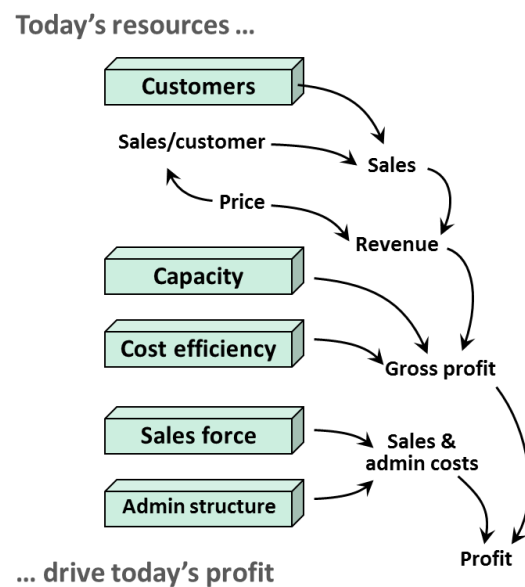
Most managers understand the importance of building and sustaining the resources of their business. These may be 'hard', tangible resources (*cash, equipment, customers, products and so on*) or 'soft', intangible factors (*product quality, staff morale, service levels ...*).

Furthermore, managers know that resources are interdependent – consistent product quality can help build reputation with customers, and strong customer growth may signal that this is a great organisation to work for, helping attract the best new hires. 'Ranking' resources by importance misses the point – it is *the*

system that delivers performance, so if any key resource is in bad shape, the whole business is endangered.

Writers on strategy have long recognised the importance of strategic resources (Wernerfelt 1984, Peteraf 1993, Collis and Montgomery 1995, Grant 2016). But there is a puzzle in this 'resource-based' view of strategy. If we work back from the performance we are getting right now, through the causal relationships that drive that result, it appears that today's performance can be *precisely* calculated from just a few, tangible resources (figure 5). Today's revenue depends on today's customer-base and price, through the sales volume they generate; staff and capacity drive costs.

Figure 5: The simple, immediate connection from resources to profits



If these few tangible resources explain precisely the profits we make *this period*, then their scale at *previous times* explained our profits then, and their *future* scale will also explain precisely our future profits (figure 6).

Word-and-arrow diagrams

'Word-and-arrow' diagrams are common in management books and articles, but often feature abstract items and connections with ambiguous meanings. In contrast, each element in the figures in this article has a precise meaning.

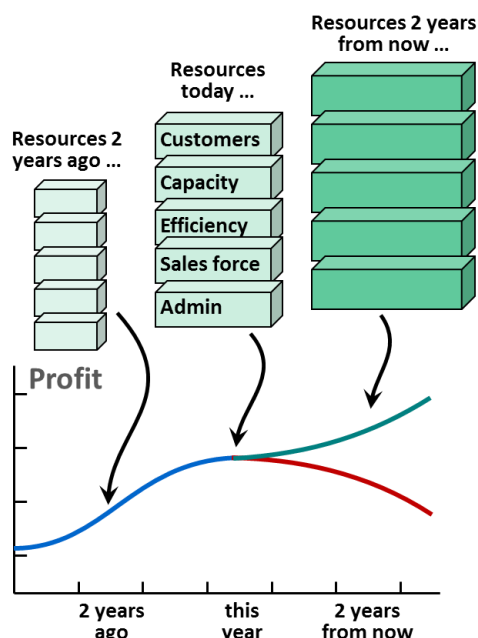
The boxes simply denote containers holding a certain quantity of some resource. The arrows indicate that one item can be immediately calculated from others, just like a formula in a spreadsheet cell.

The missing element in a rigorous understanding of performance dynamics is therefore an explanation of how and why the level of each resource *changes over*

time. Strategy academics have long known of the importance of building and maintaining resources and of the challenges this raises (Dierickx and Cool 1989). The process takes *time*, it costs money and effort, and each such task relies on the existence of other resources in the system. But while these points are simple enough to state, we need the tools to *operationalise* them so we can actually solve the strategic management problem.

Any enterprise is a designed system, and like any such system, it can be simulated. Until recently, such simulation was technically complex, costly and slow. But recent advances in both method and software now make the task very do-able – indeed it is easier, faster and more reliable to model businesses this way than to use spreadsheets that will in any case lead to less useful models.

Figure 6: Resource-levels drive performance at all times – past, present and future



An example: BrandCo

The approach to using this insight in practice can be shown with a further example – Case D: BrandCo – again drawn from case-work (Desmet et al 1998).

Like any performance for any enterprise or department, the profits from this brand-launch in each period depends on the quantities of resources the firm has at that time. We will focus on just three key resources for this business – consumers, stores, and sales force (see table 1).

Early on, the product will have few consumers and few stores, so the sales revenue will be limited and more than outweighed by the costs of its salesforce and advertising expenditure. Later, consumers and stores will be sufficient in number to generate revenues that

exceed the brand’s costs, and the product will be into profit.

To understand whether the profit growth in figure 7 will be possible, we need to understand the mechanisms by which consumers’ desire for the product will be grown and sustained; we need to understand how quickly we can persuade stores to stock the brand – and continue to do so; and we need to work out how consumer numbers and product availability will drive sales and revenue, costs and profit.

Resources build and deplete over time

The essential mechanism we need to capture and quantify concerns how resources ‘accumulate’. This occurs as new resource ‘flows’ into the current ‘stock’ of what we already hold – winning customers (for any business) adds to the level of a customer-base, and losing customers depletes that stock.

CASE D: BrandCo – A consumer-products firm has developed a new drink product and hopes to build a powerful brand. A sound strategy for this product launch needs a clear view of profit growth that might be achievable, and a clear understanding of how the necessary resources will be grown and sustained.

From experience with similar products, the firm believes that about three million consumers might want the product, and about 10,000 stores may be willing to stock it. Typical consumption is about 2-3 units/month per person, at a retail price of about \$11/unit. The product should command a wholesale price of approximately \$9/unit, and direct product costs are \$7/unit.

Figure 7: Expected time-path for profits from launching a new consumer brand

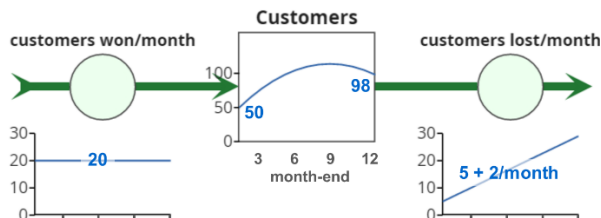


In figure 8, known as the stock-and-flow framework, customers are being won at a constant rate at left. Initially, the customer loss-rate is slower than the win-rate, so the stock of customers is rising. But that loss-rate is accelerating, and by month 8 has overtaken the win-rate, so the customer base starts to fall.

While figure 8 may be unfamiliar, the process it describes is very common and well understood. If you start the month with \$2,000 in your bank account, pay in \$5,000 during the month, and pay out \$4,000, it is no

surprise that you end the month with a balance of \$3,000. However, the relationship between the shapes of the three time-charts in the figure is not intuitively obvious. Even simple changes to gains and losses of resources can lead to a quite complex trajectory for the quantity of any resource-level over time².

Figure 8: Winning and losing customers.



All stocks obey this mechanism – the hiring and loss of staff, development and de-listing of products or services, the addition or closure of capacity, and the receipt and expenditure of cash. Indeed, all we are doing with figure 8 is applying the same discipline to the resource of customers that we take for granted when accounting for changes in levels of cash.

A frequently used analogy to help with understanding these processes is to think of the resource as being like water in a tank, with flows of water filling and draining that tank. Managers usually want more resources (*fill the tank*), so try to raise the inflow to the stock and minimise the outflow. We will also see that feedback mechanisms arise between these accumulating resources. Capturing accumulation and feedback enables us to model a system’s performance through the rigorous method known as system dynamics. (Forrester 1961)

Of course, competitors are also struggling to grow and sustain their resources. And since some of these resources – notably customers and staff – are ‘contested’ or fought over, the way in which

success with these efforts. (*This is explained in the second article in this series: The Dynamics of Rivalry*³).

Accumulation and depletion also apply to intangible factors – training raises staff skills while staff turnover depletes those skills, and a product’s reputation rises or falls as customers have good or poor experiences. (*This is explained in the third article in this series; The Softer Side of Strategy Dynamics*⁴)

The stock-and-flow framework helps explain why changes in strategic performance may be slow to arise – even substantial changes to the in-flows and out-flows take time to change the levels of each resource. In figure 8, for example, *doubling* the win-rate in month 13 would add less than 10% to the customer-base – we would add 40 customers, but lose 31.

Points in time, and periods of time

Stocks of resources are measured at *points in time* (customers at the start and end of each month, for example), whereas most performance measures relate to what happened during *periods of time* such as sales per month. Since the current quantity of stocks determines performance at any instant in time, the total performance during a reporting period reflects the *average* quantities of resources that have existed during that period.

Note also that the units of in-and out-flow are **always** the units of the resource ‘per time-period’, so the time-slope of the resource at any moment is the net difference between in- and out-flows.

Limitations to static analysis

The simple process illustrated in figure 8 has profound implications for explaining firms’ performance.

If a resource accumulates and depletes over time, then its quantity today is *precisely* explained by the history of its own flow-rates. The cash in your bank account

Table 1: Resources needed to build a brand

Resource	Units	In-flows and out-flows	Units	Drivers
Consumers interested	People	New consumers aware	People/month	Advertising, availability
		Consumers losing interest		Interest in other products
Stores stocking the brand	Stores	New stores stocking the brand	Stores/month	Consumer demand, sales force
		Stores de-listing the brand		More profitable use of shelf space
Sales force	People	Hiring, switching from other products	People/month	Salaries, hiring effort, allocation decisions
		Resignations, switching to other products		Poor sales commissions, pressure of work

competition plays out depends on our respective

right now is precisely – to the cent – the sum of every

² Try the examples at sdl.re/StockFlowQuiz1

³ See Free Resources at www.strategydynamics.com.

amount you ever paid in, minus every amount you have ever taken out. Similarly, the number of customers or staff you have today is precisely the sum of all those you ever won or hired, minus all those you ever lost.

This is not an opinion, theory or statistical finding – it is absolutely true, with no error, for all stocks at all times. And if the current resource quantity is totally explained by its own historical flow-rates, then it cannot possibly be explained by correlations with other ‘causes’. Current marketing spend, for example, may strongly affect the current customer win-rate, but cannot possibly explain the current **number** of customers.

... and if we cannot explain current resources by seeking correlation with likely drivers, then neither can we explain anything that *depends on* those resources, such as sales and profits! This means that efforts to explain current performance by looking for correlations with likely ‘causes’ are doomed to failure. Even if we find statistically significant causal relationships, these cannot be true.

Characteristics of strategically valuable resources

The characteristics that resources must possess if they are to provide sustainable advantage are set out in strategy textbooks, and widely accepted (see previous references). Resources must be **durable** – unlike assets that quickly wear out, such as IT equipment or a fashion-store’s product range. They should not be **mobile** – unlike staff with transferable skills who can easily switch to other employers.

Tradeable resources that can be simply purchased cannot, it is said, contribute to competitive advantage. Neither can resources that competitors can simply **replicate**, like a restaurant’s new menu item or a basic insurance product. Resources that can be **substituted** with alternatives are also vulnerable, as many retailers have found with online channels that destroyed their sales.

These may seem reasonable tests of whether any resource will offer competitive advantage⁴, but they suffer two problems. First, none of the criteria is black-and-white – each applies *to some degree*. Few resources are totally durable, absolutely non-tradeable, never replicable or impossible to substitute. Second, whether a resource is durable, mobile, replicable and substitutable is fundamentally a *dynamic* question: firms always face the problem of the rate at which they, or rivals, may be able to change resource-levels.

These established but static criteria for resource advantages limit the usefulness of another common

idea in strategy, namely that owning resources creates ‘barriers to entry’ against rivals. Firms frequently participate in an industry to some extent with a little of each strategic resource, compete more strongly with more of each resource, and build competitive advantage by building up these resources.

These considerations call into question the validity of most of the conditions above that are said to be essential for resources to provide competitive advantage. Many highly successful companies have systems of resources that are entirely transparent and that competitors would appear to be easily able to buy or copy – think of the numerous low-fare airlines, for example. Yet even in that sector, certain competitors, such as Ryanair (Europe), Southwest (USA), and AirAsia have been able to sustain competitive advantage over *very* long periods.

The paradox that firms can build sustained superior cash flow growth from simple, transparent resources that others should be able to copy, buy or substitute is resolved by appreciating that the accumulation of strategic resources can take a *very* long time and be *very* costly – the airports and route-network for an airline, or the skilled staff of a law-firm, for example.

Complementary Resources

There is, however, one final criterion in the ‘resource-based view’ of strategy that remains valid – that resources can provide advantage only if they are **complementary**. In simple terms, this means they must work well together. For example, a great new product is not much use if production capacity is inadequate, if we have no dealers or other channels to reach end-customers, or if we have too little service support.

The phenomenon of complementarity has not been well-specified in academic research, but we can shed light on how complementarity actually works by understanding that managers use resources they already *have* to develop others they *need*.

This is not a choice on the part of managers – it is unavoidable. There is no way to build any resource, in any situation, without making use of others that already exist. Marketing staff need a credible product to build a customer base, sales people cannot sell a product unless cost-effective production capacity enables a competitive price, recruiters need a good reputation in the employment market if they are to hire the necessary staff, and so on.

Even for a start-up, the entrepreneur brings some vital resources, such as relevant experience, a product idea, or credibility with investors. If, together, these resources are just strong enough, then the start-up can

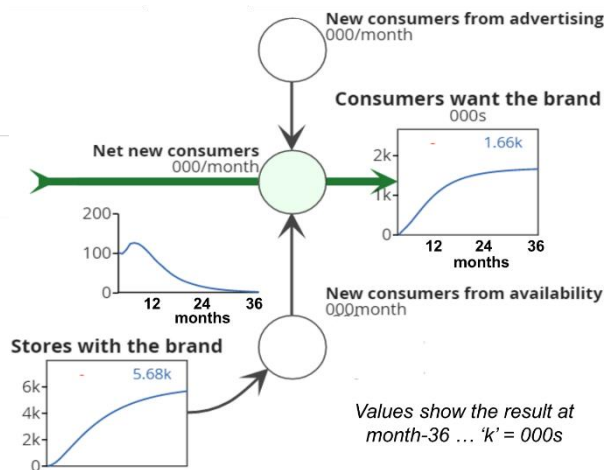
⁴ These tests are known as the ‘VRIO’ criteria – resources should be Valuable, Rare, hard to Imitate, and embedded in Organisational processes.

raise cash, hire staff, win customers, and start to function.

We can show how complementarity actually works by formulating the interdependence between resources for BrandCo. The brand will need to build two vital resources – consumers and stores.

Consumer interest in the product is stimulated by advertising expenditures, but also by the brand’s visibility in stores. In figure 9, advertising starts winning new consumers, but rising store numbers at lower left quickly add to that win-rate. Since the biggest stores that reach most consumers are won first, the early impact is quite substantial. The win-rate soon starts to decline, however, simply because the number of remaining potential consumers declines.

Figure 9: Advertising and product visibility win consumers to the brand

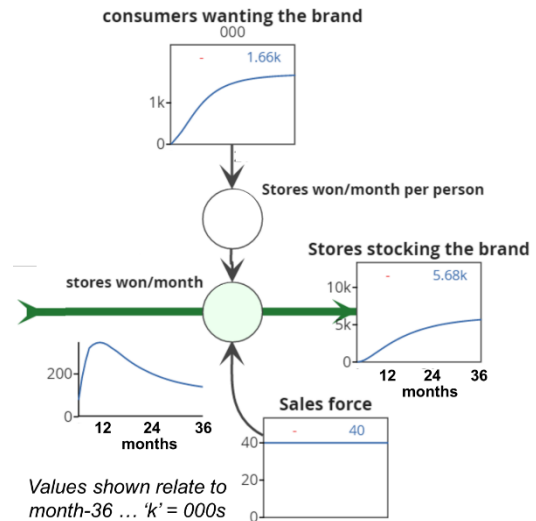


At the same time as brand visibility in stores is helping to grow the number of interested consumers, the rate at which new stores are won depends upon the number of consumers interested in the brand – sales calls alone will not win stores if no-one wants the product! In figure 10, a large sales force wins stores more quickly as consumer numbers rise, but this rate too slows down as the remaining potential stores decline in number.

The sales force devoted to this product can be reallocated quickly, so unlike the other two resources, its level can be adjusted immediately.

Figure 11 combines these interdependencies into a composite ‘system’ for the business, and puts real precision on the notion of ‘complementary’ resources. It shows how the rate of growth for each resource depends in a quantifiable manner on the current quantities of other resources in the system, and on some key decisions. (Exactly how the numbers work in the full model requires some additional structures, explained below).

Figure 10: The rate at which new stores are won reflects sales effort and consumer interest



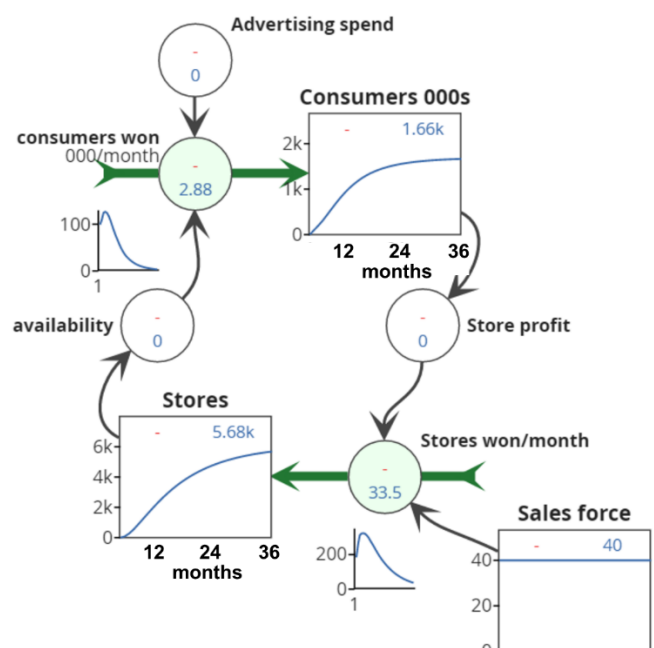
Interdependence causes feedback

Such complementary resource-systems have a further powerful characteristic to add to the stock-accumulation and depletion mechanism – they generate **feedback**.

Reinforcing feedback between resources – and for a single resource

Since the growth of both consumers and stores in figure 11 is enhanced by the existence of the other, the system is capable of reinforcing its own growth. In that case, resource growth rates are driven by the levels of other resources.

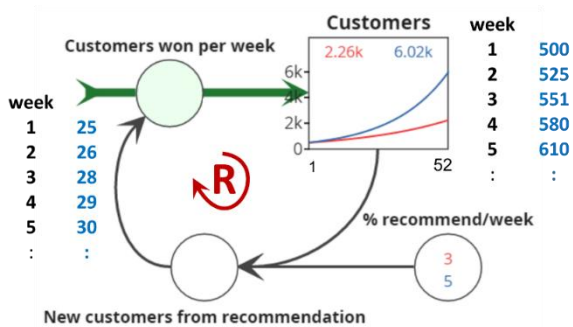
Figure 11: Interdependence between resources in building a brand



However, it is also possible for a resource to drive *its own* growth. We can show this with the customer-base for a new restaurant, where (as for many other businesses!) new customers are won by ‘word of mouth’ recommendations from existing customers.

Figure 12 lays out this reinforcing feedback, and shows how its dynamics are quantified. Each week, the number of *new* customers is calculated from the *current* stock of customers, multiplied by the proportion who recommend the restaurant to others – either 3% (red) or 5% (blue) per week. These may seem small numbers, but only a fraction of customers will recommend the restaurant, and only a fraction of those they tell will actually try it.

Figure 12: Reinforcing feedback grows the customer base of a restaurant



The model demonstrating this mechanism and others that follow is at sdl.re/BSRrestaurant. A more complete model of such a case is at sdl.re/restaurantstartup.

The values on the right of figure 12 record how the stock accumulates over the first few weeks by simply adding these new customers to those already in place – the chart shows the result of continuing this growth for a whole year. The ‘R’ inside the loop denotes that it is Reinforcing feedback.

Notice that the impact of just slightly stronger feedback has a disproportionate impact on the outcome – raising the word-of-mouth fraction from 3% to 5% more than doubles the result. Raising it further to 10%/week would produce over 70,000 customers by the end of the year! While this result may seem spectacular, it is not exactly unknown – think of the early growth of businesses such as Facebook or Uber. It is not, of course, plausible for our restaurant, which will run out of local customers to win, or reach a limit to the number of customers it can serve.

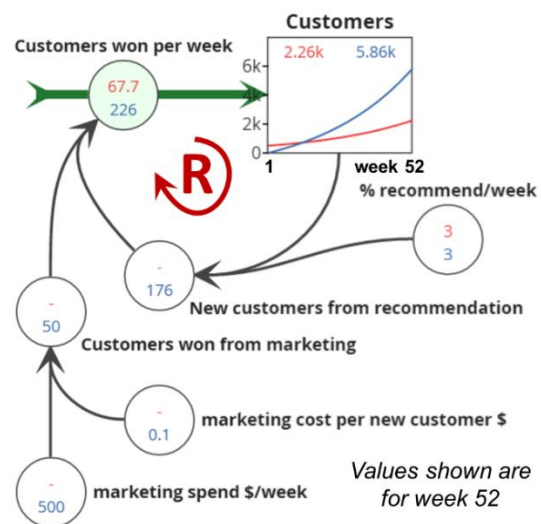
Figure 12 begs the question, though, of where those initial 500 customers came from in the first place – perhaps the owner did some early marketing? Figure 13 shows how this customer-base grows from zero if the owner spends on marketing *and* gains some recommendations. (The red time-path matches Figure 12, for comparison).

You will see in figures 12 and 13 that an *increase* in customers leads through feedback to a further *increase* in that same number. This is characteristic of reinforcing feedback, where a change in one direction for a variable or stock leads to further changes in the *same* direction for the same item.

In this case, reinforcing feedback is driving growth, but reinforcing feedback can also drive *decline*. Too-few customer-service staff, for example, may cause work-pressure that drives more staff to leave, resulting in still-more work pressure, more staff losses, and so on⁵.

Note, however, that any single reinforcing loop can only drive growth *or* decline – not both – for the simple reason that growth concerns the in-flow to the stock, while decline concerns the out-flow.

Figure 13: How marketing adds to reinforcing customer-growth for the restaurant



Balancing feedback between resources

While the existence of certain resources can enable others to grow, a second type of complementarity arises when one resource *constrains* the growth of others. The restaurant, for example, will at some point struggle to win more customers, either because its staff cannot cope with the demand or because the tables are too often full.

Figure 14 shows how limited staff numbers at the restaurant can slow down – and ultimately stop – marketing-driven customer growth. Seven staff (the blue case) can clearly serve more meals than can five staff (red), so the customer-base continues growing to reach a higher level. In each case, the number of customers is ‘brought into balance’ with the capacity of the staff, so the mechanism is said to be balancing feedback.

⁵ See for example the case of a small IT support company at sdl.re/ITsupport.

In both cases, customers visit on average every 3 weeks, so the 1,870 customers (red case) generate sales of $1870/3 = 623$ meals/week. The 5 staff can each serve 100 meals/week or 500 in total. This suggests we would struggle to serve more than 1,500 customers if each visits every 3 weeks – so why do customer numbers grow to 1,870?

A spreadsheet view of dynamic models

The figures in this article may be an unfamiliar way of looking at business performance, but are easily understood by relating them to the spreadsheets we know so well.

Think of each object as a spreadsheet column, with its name in the top cell and all 36 months' values running down the cells below the heading. The thin links between items are like cell references – in figure 12, “I can work out how many customers will be won each week due to recommendations if I know the current number of customers and the percentage who recommend my restaurant to others”.

Inside each item is the formula to calculate its value in each period from those on which it depends ... *new customers from recommendations = Customers * % recommend per week* (rather clearer than something like $C52 = B52 * A\$3!$).

The thicker arrow shows the special relationship between a stock and its flows – the quantity now is the quantity at the previous point in time (*the cell above*) plus and minus anything added or lost ... $Customers(\text{this week}) = Customers(\text{last week}) + Customers\ won\ per\ week$.

Well, for balancing feedback to actually hold down growth, some factor must *cause* that reduction – in this case, that factor is waiting time. If customers tolerated **no** waiting time at all, then customer-number 1,501 would not be won, and the total would indeed stop at 1,500.

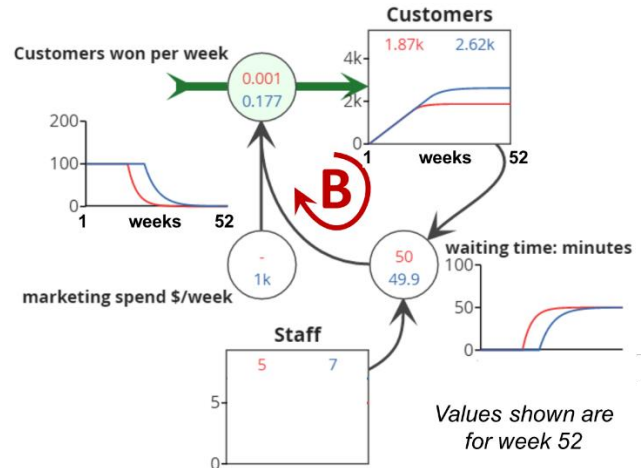
This tendency to over-shoot what can comfortably be managed is characteristic of many businesses that constantly operate above the level where their resources – staff or physical capacity – can cope with demand. A focus on controlling costs, rather than enabling demand to be served, is a common reason for this situation to arise, and can lead to a business destroying its own growth.

Similar limiting mechanisms constrain many resources, from tangible items like customers, qualified staff, or distributors, to intangible factors such as staff skills, business data and product quality.

Tracing around the causality in figure 14, we can see that an *increase* in customers causes an *increase* in waiting time, which leads to a *decrease* in the rate of new customers. Feedback in which an initial change in one direction causes a change in the *opposite* direction

is characteristic of balancing feedback. As for reinforcing feedback, however, any single balancing loop can only cause *either* limits to growth *or* limits to decline – again because growth concerns the stock's in-flow, while decline works through the out-flow.

Figure 14: Balancing feedback limits growth of the restaurant's customers

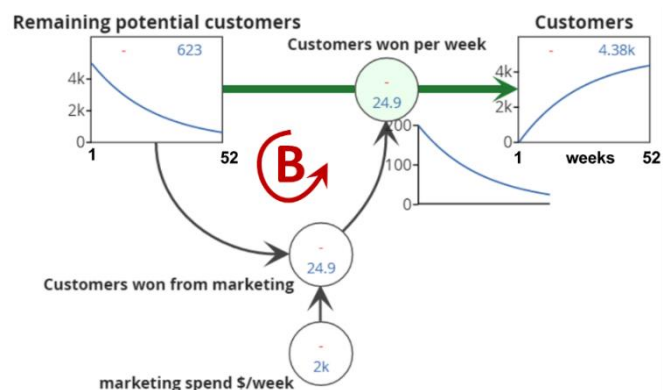


Self-limiting resources – when limited potential slows growth

Like reinforcing feedback, balancing feedback too can apply to a single resource. This occurs when the resource constrains its own growth. The restaurant has a limited local population of *potential* customers, so the more customers that are won, the fewer remain to be won.

Figure 15 shows how balancing feedback slows the number of customers that can be won by each \$ of marketing spend. (*The service capacity limit has been removed in this case.*) This self-limiting feedback also slows growth from word-of-mouth – as the potential population falls, there are simply fewer people left to hear recommendations from the rising number of customers.

Figure 15 Balancing feedback limits marketing-driven growth of restaurant customers



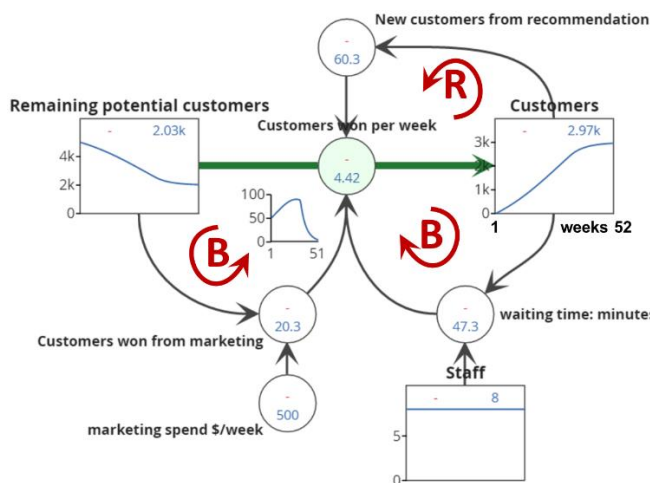
Examining figure 15 closely might suggest that there is actually no feedback at all – the connections go from *Remaining potential customers* to *Customers won per*

week, but no further. The only connection from *Customers won per week* to *Remaining potential customers* is the flow-arrow, but this is going the wrong way! In fact, though, the causality implied by the flow-arrow **does** go in the correct direction (towards the left), since the outflow causes a decrease in the stock.

Combining marketing-driven growth with the reinforcing feedback from word-of-mouth and the balancing feedback from a falling potential population is very common. Known as the ‘Bass diffusion model’ (Bass 1969), this structure forms a reliable basis for modelling the ‘diffusion’ of many products and services into their markets⁶. It also captures well the uptake of new procedures or practices, from the acceptance of a new process by a business department up to industry-wide adoption of novel methods, such as in farming or medicine.

Figure 16 shows the results from combining all of the reinforcing and balancing feedback effects above concerning growth of the restaurant’s customers.

Figure 16: Combined impact of reinforcing and balancing feedback on a restaurant’s customer growth



Resources are *lost* as well as won

Companies cannot, of course, simply stop their costly marketing and sales activities once they have captured most of the potential market, because customers are continually *lost* as well as gained. BrandCo’s consumers forget the product, or are attracted to competing brands (figure 17). Stores, too, may be lost if they find more valuable uses for the shelf space devoted to this brand.

Adding attrition to resource-building time-paths has two implications. First, the larger the stock of the resource, the greater in absolute terms is the back-flow – 10% of consumers lost each month means losing

100,000 from a consumer-base of 1 million but 500,000 from a consumer-base of 5 million. Secondly, the faster such ‘forgetting’ takes place, the more effort and cost must go into replenishment. And this applies to other resources than customers. For example, staff training consumes continuing, high costs in sectors such as fast-food, where staff attrition is high.

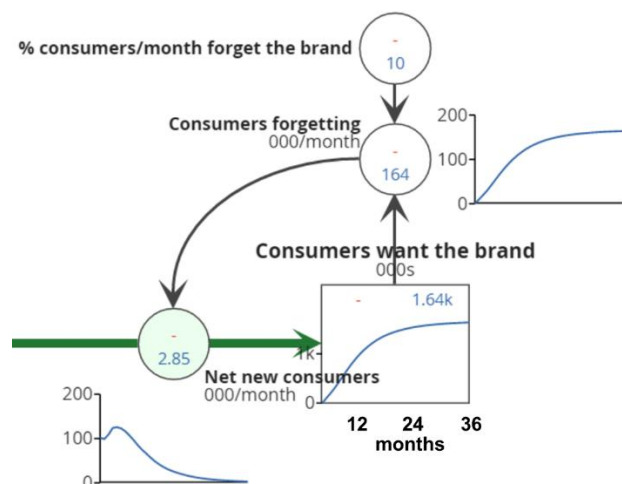
Performance of the resource-system

Figure 11 is more than just a picture of causality in the strategic architecture for the brand – it is a working, quantified simulation; a true “business model”. The full model also includes additional effects discussed above, notably:

- diminishing returns to advertising as more consumers are won
- diminishing returns to sales efforts as the largest stores are captured first by the sales force, so only smaller stores remain to be won
- consumers losing interest in the brand

... plus a simplified calculation of sales revenue, costs and brand profit.

Figure 17: Consumers forgetting BrandCo’s product



Sources of consumer growth are omitted from this figure.

The model quantifies every item and includes arithmetical relationships between its elements. This model allows us to simulate strategy – testing alternative assumptions, sensitivities and decision-choices. Its complete structure is shown in Attachment 1 and the model can be explored at sdl.re/BSRbrand.

Exploring a brand-launch strategy

Figure 18 quantifies a specific strategy for the brand launch. In the base case (blue), both advertising spend (\$1m/month) and the sales force (25) are constant. But

⁶ See the competition model for a consumer-technology product at sdl.re/tec2product, which includes an experience-curve mechanism causing unit costs to fall.

the green time-charts and value show the results of the strategy story summarised in table 2.

Table 2: An advertising and sales force strategy for the brand

Time-period Months ...	Advertising \$000/month	Sales force people
1-6	1,000	25
7-12	2,000	25
13-24	2,000	50
25-36	1,000	25

At first, the firm is cautious, investing only \$1m/month in advertising, and allocating a small salesforce. Then:

- Encouraged by consumers' response to the advertising, spending is doubled from month 7 and the consumer growth rate rises sharply.
- This is costly, so losses on the brand increase.
- By month 12, consumer interest is strong, but only 50% of those consumers can find the brand in their local stores, so from month 13, the sales force is doubled to 50.
- This leads to a jump in the rate at which stores are won. However this win-rate slows as sales people spend more time looking after existing stores than finding new ones.
- For the next 12 months, consumer numbers continue to grow, and increasing availability leads to strong sales growth. By month 24, the company is satisfied that the brand is well-established and wishes to release cash flow to spend on other products. It therefore halves both the advertising and sales support for the brand.
- Stores start to be lost from month 25, as the reduced sales force cannot defend the product against competitors. However, these are smaller stores, so availability falls more slowly.
- This loss of stores, plus the reduced advertising, cause the consumer win-rate to fall to about zero as the number losing interest overtakes the new consumers being won.
- The reduced costs of advertising and sales force do indeed lead to a jump in the brand's profitability, although consumers and stores continue to be lost and profits slowly decline.

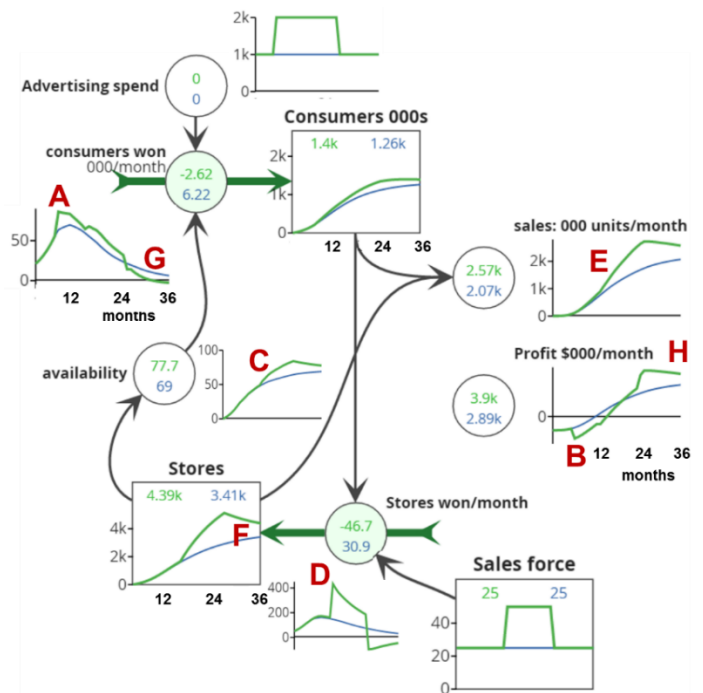
Connecting financials to the system

Notice that in the brand launch model (as well as in other models referenced in this article) the financials are fully integrated into the model. We do not have the problem of a descriptive strategy or business plan from which we somehow have to guess the resulting financial performance!

In these examples, those financials rather 'hang off the side' of the model and simply adjust up or down in response to the behaviour of the tangible resource-

system. More extensive models, however, can go further and capture the additional feedback from the cash generated back into the accumulation of those resources.

Figure 18: Testing a strategy for growing the brand's sales and profits



Generally, this recycling of cash flow can have three levels of impact:

- If little cash is recycled, immediate profits are high, but the resources generating those profits deteriorate, so that profits fall over time.
- If just enough cash is recycled, each resource is replenished at about the same rate as it deteriorates, and profits – although initially lower – remain stable. Marketing spend and sales effort replace lost customers, hiring and training replace lost staff and skills, product development just keeps the product range competitive, and just-adequate investment maintains productive capacity (physical or IS-related).
- Lastly, if management and investors want profits to *grow*, they have to accept lower *current* profits and recycle more cash flow so that all of the resources are added-to faster than they are lost.

The failure by investors and management to recognise these basic truths explains the widespread existence of 'zombie' businesses, which hover somewhere between states (1) and (2), and the rarity of type-3 cases that *fully* exploit the opportunity for sustainably strong growth in cash flows.

The blame for this state of affairs probably lies in the assumption, both among executives and academics, that management's task is to 'maximise profitability'. This flies in the face of basic Finance theory where it has

long been axiomatic that business value reflects growth in free cash flow, rather than profit margins or return on capital ratios (Koller et al 2010).

Practical implications of strategy dynamics

Experience in applying the strategy dynamics method to solve real challenges, both in corporate and non-business cases, has exposed a number of common issues.

“It’s all about the flow-rates!”

Since current quantities of resources directly drive current performance (other things being equal), it follows that the only way strategic performance can change is if the quantities of those resource-stocks change ... and the only way *that* can happen is through the flow-rates that add to, or deplete, those stocks. It therefore follows that management attention should focus, fiercely and continually, on how fast those flow-rates are running – win- and loss-rates for customers (*and the ‘quality’ associated with those customers, such as their purchase-rate*); hiring, promotion and attrition rates for staff (*split by function and seniority*); development and retirement of products and services; changes to physical and IS-related capacity, and so on.

Unfortunately, the importance of these flow-rates is rarely fully recognised, so few firms have good information on these rates of gain and loss, not just over history, but even *currently*. Management reporting systems – if they go beyond the financials at all! – have typically collected what is easy to measure, rather than the flow-rates that really matter.

Track the numbers

Note that knowing the *net* rate of change (in-flow minus out-flow) is quite inadequate. Not only do different factors influence the in- and out-flows, but the management levers on each can be quite separate – sales effort, for example, may win customers, but service support ensures they are retained.

Firms in some sectors are so harshly confronted with this reality (*customer growth and churn in telecoms, and online services, for example*) that they have had no choice but to focus on this flow-rate data. But that is not so in other sectors. Even global brand leaders in consumer goods and pharmaceuticals rarely track these numbers properly. Sure, they know how sales and market share have changed, and can estimate how many customers or end-consumers take their product. They may know these data in considerable detail – by every conceivable market and geographic segment.

Yet they typically do not know *win- and loss-rates* for these resources and can be shocked to appreciate the importance of these flow-rates and to discover what

has been happening to them and why. It should now be clear that without this intelligence they are in no position to make well-reasoned choices to build these resources and improve results over time.

The super-tanker problem

The slow but sustained impact of changed flow-rates on resource-growth explains why managers cannot quickly alter *underlying* performance. Sure, boosting short-term profits is easy enough – raise prices, cut marketing, hiring, training, R&D and maintenance. But this will usually *harm* underlying performance and damage future profit growth, if not reverse it.

It is difficult, costly and time-consuming to make substantial changes to the levels of strategic resources, but without a sustained commitment to make this happen, performance improvements will be slow .

Upgrade your business models, KPIs and balanced scorecards

Executives and entrepreneurs are constantly urged by consultants and investors to “*be clear about your business model*” or “*you have to change your business model*”. Unfortunately, few sources make clear just what a business model actually is, and none show how to quantify such models, let alone get them working to mimic real-world performance⁷.

Attachment 1 displays a true business model (albeit a limited one), and every business would benefit from having such a model. This is not ‘more work’ – we already noted that these models are easier to create and maintain than the less-useful, disconnected spreadsheets on which most businesses rely.

We can similarly be much more precise and holistic in choosing our Key Performance Indicators and designing Balanced Scorecards. Indeed, these models *are* rigorous, integrated scorecards and KPI-sets. There is nothing more to track for the brand, for example, than the items shown in figure 19 (Attachment 1).

Aggregate and disaggregate

Of course, a complete, real-world brand *would* have additional factors to consider, such as the brand’s reputation, the skill and experience of the sales force, or the differing impacts of various types of marketing. But these are merely extensions of the same principles we already discussed, and can readily be added.

You may also have been wondering about the different segments of consumers and types of stores. This too is easily handled by replicating the relevant part of the structure for each group and aggregating the result. And if this company is managing many different brands, perhaps in many different markets, then each can be aggregated to generate a model for the whole business.

⁷ See sdl.re/dynamicbusinessmodels.

Replicable structures, but not replicable answers

While every number reported in the BrandCo model reflects the quantified relationships that apply to that specific case, the underlying system structure applies to every consumer brand sold through stores. However, just because the structure is the same does not mean the *answers* are also the same. This should not be surprising, since the non-intuitive behaviour caused by the many sources of ‘dynamic complexity’ will inevitably lead to highly divergent outcomes.

Sources of “dynamic complexity” – how things change over time

Four common, powerful mechanisms make it hard to work out why organisations or issues perform as they do, and to figure out how to improve performance sustainably:

Stock accumulation causes time delays and non-linear relationships between changes that occur and performance. Results can continue to reflect flow-rate events years or decades after that original event occurred – launching a great product, for example, or failing to hire enough young, skilled staff. And we have not even looked at the consequences of *chains* of stocks, such as those involved when staff develop through levels of seniority, when customers are won and products are developed through a pipeline of stages, or when assets age⁸.

Feedback (which itself can only occur through flows causing stock levels to change) can, as we have seen, cause accelerating growth or decline. Add this to the delays arising from stock-accumulation and we have the potential to generate over-shoot and collapse, or cyclicity (remember the sub-prime mortgages fiasco from the 2000’s?).

Thresholds occur when trajectories cross – service quality is fine, up to the point that service capacity cannot cope, at which point it collapses: product uptake is slow until functionality or price reach a critical level, at which point demand takes off⁹.

Intangible factors such as data, state-of-mind and quality-related issues (skills, morale, reputation, annoyance ...) are ubiquitous, powerfully influence the tangible system, and are in turn affected by that system.

There may be some *rough* general principles – it is probably to be expected that early marketing and sales efforts will lead to losses while the brand builds, but these may be reduced later to allow a higher profit-rate – but we can’t say for certain what the choices need to

⁸ See for example [sdl.com/HR3level](https://www.sdl.com/HR3level) and [sdl.com/assetpipeline](https://www.sdl.com/assetpipeline).

⁹ Thresholds of each type arise in the models at [sdl.com/ITsupport](https://www.sdl.com/ITsupport) and [sdl.com/techproduct](https://www.sdl.com/techproduct), respectively.

be for any case without implementing the numbers and relationships specific to that situation.

This may seem dispiriting, since check-lists of best practice, drawn from high-profile case-stories, are so often offered to demonstrate standard solutions to widespread problems. But there is also a liberating message – if every firm’s situation is unique, and the performance differences between good and not-so-good strategies are considerable, opportunities for radically-improved performance may be found from mastering the strategy model and using it to seek better strategies for the future.

How to apply this approach

The principles illustrated in this article can be applied to any type of profit or not-for-profit enterprise, and to any part or function of an organisation. They can be used both to tackle one-off problems or opportunities and to create and maintain continuing plans.

Such models can be built by following an ‘agile’ development process (Warren 2015)¹⁰. The steps in the Agile process are as follows:

1. Specify clearly the time-path of the strategic challenge confronting the firm, whether an opportunity to be taken or a problem to be confronted (see figures 1-4 above).
2. Trace back the causal relationships explaining this performance for any period until you reach [a] one or more accumulating stocks, [b] one or more decision-variables and [c] influential exogenous factors.
3. For each resource, specify and quantify how the inflows and outflows have been changing over time, and how they might change in future.
4. For each resource, identify the *existing* resources (plus decisions and exogenous factors) driving or limiting its gains or losses (as in figures 9 to 16).

In the first iteration of step 4, additional resources may be identified as drivers of other flow-rates. The product range, for example, may not significantly show up as a driver of current profits, but *is* key to driving the customer win-rate. Skill-levels, too, do not show up in the Income Statement, but are again key to winning new customers or developing new products. This means it may be necessary to repeat steps 2 to 4 for such additional resources.

Extensive experience of applying this approach has found that a limited set of tangible resources arise in most case (see table 2).

Customers nearly always feature in driving demand, of course. In many sectors, *intermediaries* may need to be

¹⁰ The term ‘agile’ is taken from the information-systems world, where simple, working solutions are built quickly with users, after which extensions and improvements are progressively added in small steps and checked to work.

included (stores for BrandCo; resellers or dealers in other situations). But this is often not the case – our restaurant example has no intermediaries, and many online businesses work well precisely because they deal directly with end-customers.

The range of *products or services* is usually needed to explain customer growth and sales. Physical or IS *capacity* of some kind is necessary to enable demand to be fulfilled, and *staff* of various types are needed to win, sustain or operate the other resources in the system. Finally, *cash* usually needs to be dealt with.

Certain industries may feature additional unique resources – natural resources in mining, oil/gas, and agriculture; the order-book in ship-building or aircraft production; contracts in B2B service cases.

Estimating missing items and relationships

The entire Agile process should be followed through *with numbers and time-charts*. We noted above that many businesses do not have all the numbers required, but this must not be allowed to stop the process – *estimate* missing values and commit to finding better data.

Similarly, some of the relationships between items will need to be estimated. Many are simple arithmetic – *revenue = sales * price* for example – but others are more subtle and complex. To some degree this estimation process is self-validating. If we make sure at each stage that the known causal factors can explain, through the arithmetical relationships, the observed performance outcomes, then we can have some confidence in the estimated values and relationships.

If those involved protest that they cannot make such estimates, the response is simple – every time someone makes a decision about pricing, marketing, hiring, product development and so on, they are making *implicit* assumptions about exactly such relationships. So all we are doing here is getting those assumptions out in the open. This may be a novel experience for

everyone, so no-one should feel embarrassed at having no instant answers to such questions.

It is vital throughout this process that the team continues to focus on the *scale and timing* of this emerging story, both for the decisions that will be taken and the consequences of the plan. By this we mean: who will do what, when, and how much, watching out for which indicators that their part of the plan is on track, and with what resulting time-path of performance results?

Conclusions

This article has explained the core concepts of the strategy dynamics method, using some simple cases. Nevertheless, the potential power and reliability of this rigorous, fact-based approach to developing strategy should be apparent. We have explained two critical features of business reality:

- that performance depends upon strategic resources, whose long-term development depends on rates of gain and loss that should be the focus of management attention, and
- that performance of the entire system reflects what can be a complex web of interdependencies between these resources, in a manner specific to each case.

Strategic plans and reports often fail to capture either of these fundamentals. That many companies do, somehow, manage to perform reasonably well is a tribute more to the intuition of experienced managers than to the value of commonly used strategy tools.

Indeed, the strategy field is lagging way behind others in its adoption of modelling and simulation. We no longer allow bridges to be built, aircraft to fly in our skies, or drugs to be used on our bodies without simulating how they will likely perform. We no longer rely on management judgement to manage supply-chains, to control manufacturing processes, set airline pricing or approve bank loans – we expect computer models to help make better decisions.

Table 2: Common resource-types found in most cases

	Manufacturer	Airline	Retailer	Car-maker	Law firm	Pharmaceuticals firm
DEMAND						
Customers	Customers	Travellers	Consumers	Car buyers	Clients	Pharmacies + hospitals
SUPPLY						
Capacity	Machines	Aircraft seats	Stores, space	Production lines	Lawyers	Production lines
Staff	Staff	Pilots, crew, ground staff	Store staff + other staff	Production + other staff	Lawyers	R&D, production and sales staff
Products	Product range	Routes	Product range (SKUs)	Model range	Services	Drugs
Cash	Cash	Cash	Cash	Cash	Cash	Cash

So senior executives now need to adopt the strategy dynamics perspective and related models for their three key strategy tasks:

- designing the business system so it is *capable* of performing well
- managing the business system continually so that it *does* perform well

- *fixing* the business system when it encounters problems.

This should raise their capability and confidence to guide the enterprises on which not just investors' finances, but also people's livelihoods and careers depend.

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Attachment 1: The Brand's Strategic Architecture

The diagram on the next page shows the entire structure of the dynamic model implementing the brand's strategic architecture. Although this may be unfamiliar and apparently complex, this is not an especially large model – analysts commonly work with spreadsheets of *considerably* greater size! – and the logic of its causal structure can be easily followed.

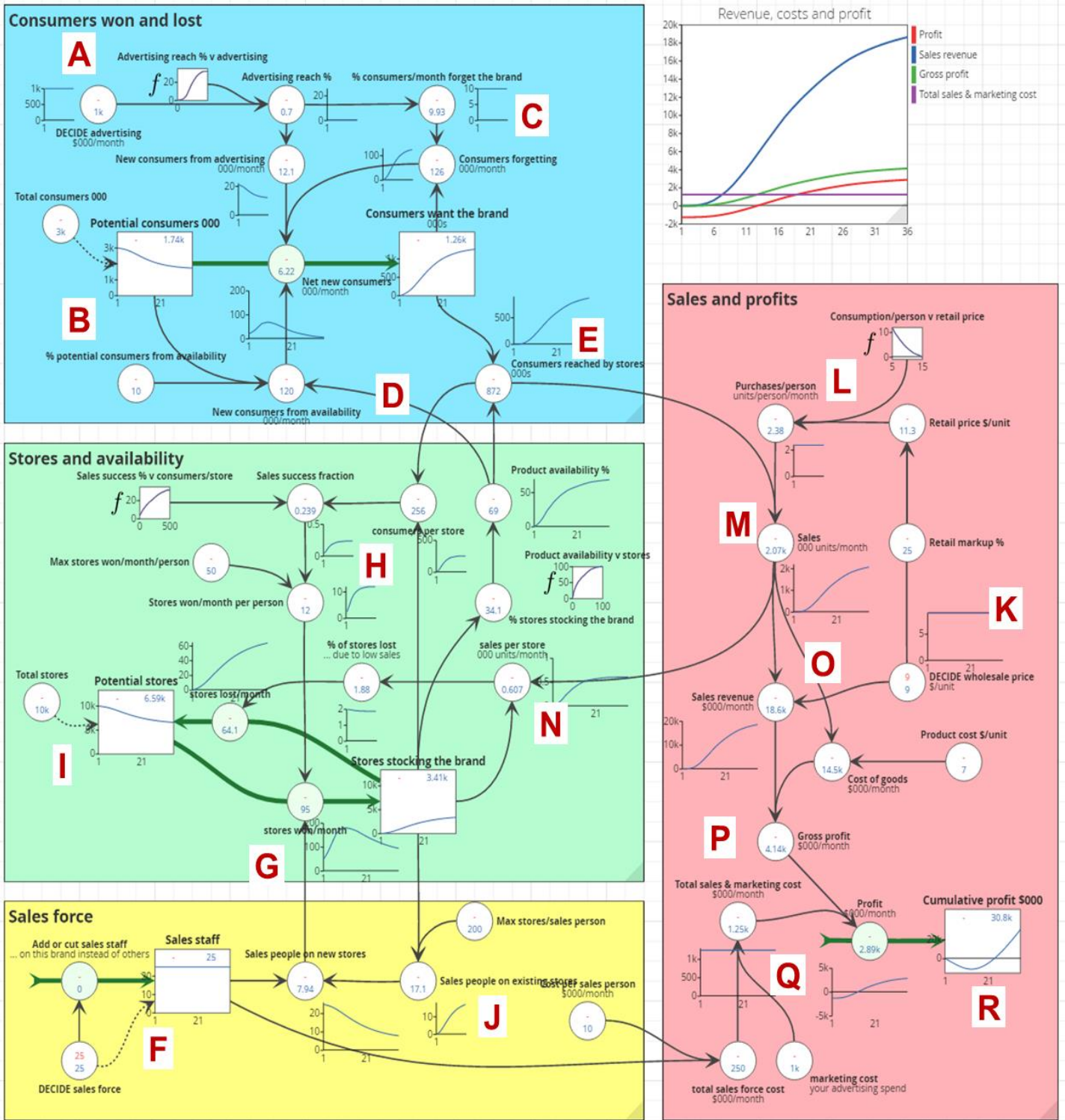
Simply think of each object as equivalent to a column in a spreadsheet, with its name in the top cell and all 36 months' values running down the cells below. The thinner links are like cell references, and inside each item is the formula to calculate its value in each period from those on which it depends.

In figure 19 (next page) ...

- A. The advertising decision drives some new consumers to want the brand
- B. ... but increasingly slowly as the remaining potential is used up.
- C. A fraction of consumers are lost each month, and need to be re-won.
- D. More new consumers are won from seeing the brand available in stores.
- E. Only those consumers whose local stores stock the brand can buy it.
- F. We decide how many sales staff to allocate to this brand
- G. ... which drives the rate at which new stores stock the product
- H. ... which happens faster if there are more consumers per store.
- I. Like consumers, the store win-rate slows as potential stores are captured.
- J. Stores already stocking the brand need sales-staff support, reducing the sales effort available to win more stores.
- K. We decide the wholesale price, to which stores add a markup setting the retail price to consumers.
- L. Higher (lower) prices reduce (or increase) consumers' average purchase rate
- M. ... which, with the number of consumers who can find the brand in their local store, drives total sales volume.
- N. Lower sales per store leads to stores de-listing the brand more quickly.
- O. Wholesale price multiplied by sales gives the brand's revenue
- P. ... from which product cost (*production and distribution*) is deducted to give the gross profit on the brand's sales.
- Q. Deducting the marketing cost (*our advertising decision*) and sales force cost gives the brand's profit contribution
- R. ... which is accumulated to track whether the brand made back the early investment in advertising and sales cost. (*It is simple enough to add a discount factor to calculate the net present value of the brand's strategy*)

The model is available at sdl.re/BSRbrand.

Figure 19: The Strategic Architecture in the Consumer Brand Model



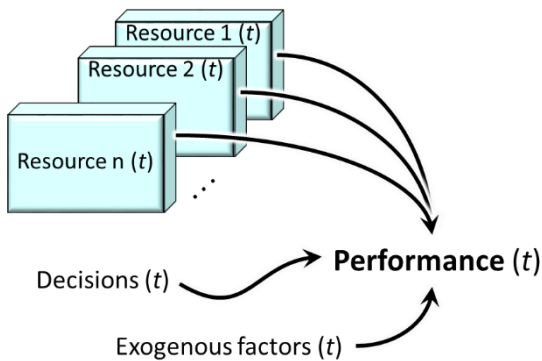
Attachment 2: Technical details

The principles outlined in this article can be formalised mathematically, as follows:

1. 'Profitability P at time t depends on the levels of strategic resources R_1 to R_n to which the firm has access at that time, plus current decisions D and exogenous factors E .'

$$\text{Eq 1 ... } P(t) = f [R_1(t), \dots, R_n(t), D(t), E(t)]$$

Diagrammatically:



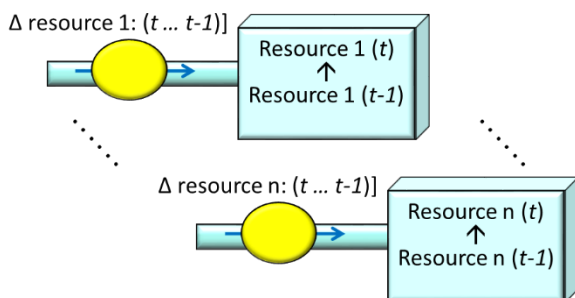
2. 'The current quantity of any resource R at time t is the sum of its historic rates of accumulation r since $t=0$ '.

$$\text{Eq 2a ... } R_i(t) = \int_0^t r_i(t)dt + R_i(0)$$

... or ...

$$\text{Eq 2b ... } R_i(t) = R_i(t-1) + r_i(t-1..t)$$

Diagrammatically:

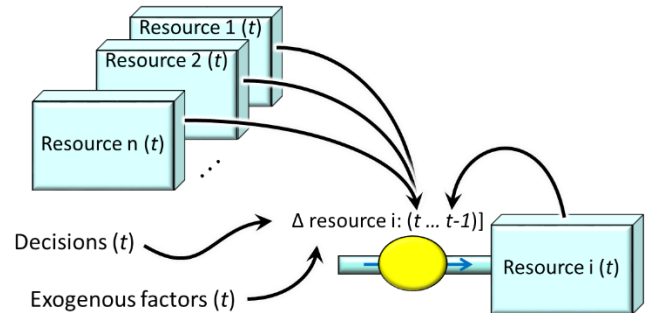


Note that, when the time-path of the resource-flows are plotted on time-charts, the quantity of resource R at time t is equal to the *total area* under the curve of its net inflow since time 0, since *total Resource = Resource-per-period * time-periods*.

3. 'The rate of accumulation r_i of resource R_i at time t is a function of all resources R_1 to R_n to which the firm has access at that time, including R_i itself, plus current decisions D and exogenous factors E .'

$$\text{Eq 3 ... } r_i(t) = f [R_1(t), \dots, R_n(t), D(t), E(t)]$$

Diagrammatically:



These three equations taken together specify the simplest representation of the firm as a dynamic resource-system. The values of the variables at the points where curved connecting arrows meet is given by the single composite function for that variable (equations 1 and 3). For ease of estimation, these functions may be broken down into further sub-functions, such as ...

$$\text{earnings} = \text{revenue} - \text{costs}$$

where ...

$$\text{revenue} = \text{a function of certain resources}$$

and ...

$$\text{costs} = \text{some function of other resources}$$

This build-up of the functions determining resource-flows is captured diagrammatically by intermediate variables in the structure, such as 'potential store profit' in Figure 11.

A more complete representation of an organisation and its business environment requires additional formulations to capture rivalry and capabilities. With those additions, these relationships constitute a complete and parsimonious theory of firm performance. Like any worthwhile theory, it is 'general, useful, and true' (the GUT criteria) and amenable to falsification through the search for any case in which these relationships fail to explain performance.