The use of system dynamics to examine the relationship amongst quality, value, price and profitability

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Abstract

This paper argues that the positivist approach adopted by many studies into the relationship between customer satisfaction and revenue is limited; the ontology associated with positivism permits surface relationships only to be determined. What is required is a method grounded in a more realistic ontology that allows for a deeper investigation. The paper proposes that system dynamics is one such method. The differences between the positivist approach and a systems approach are expounded, and, though the positivist approach is not completely rejected (on the contrary, it is defended), its limitations, particularly when applied to a social environment, are apparent. In particular, the paper expands on the differences between studies in the natural sciences and those in the social sciences. It is these contrasts that make extremely suspect an effective translation of the methodology applied so successfully to the natural sciences, across to the social environment, and which demands an alternative methodology. This paper presents one such methodology and posits system dynamics clearly within that methodology.

Introduction

The issue of managing customer satisfaction has been a core of marketing since Drucker (1954) commented that firm revenue is driven by customer need satisfaction; and later that 'to satisfy the customer is the mission and purpose of every business.' (Drucker 1973) Drucker's comments link three customer issues; Firstly the immediate revenue possibilities, secondly the longer term opportunities for revenue and thirdly the question of the interrelationships required for these opportunities to be realised. These aspects are critical if the linkage between revenue activity and profitability are to be realised. It is the purpose of this paper to explore these issues.

The linkage between customer retention and profitability was demonstrated by Reichheld (1996). In a study extending over a period of more than ten years, Reichheld and his colleagues found that what distinguished the unusually successful companies from their competitors was 'a measurable advantage in customer and employee loyalty.' Each company with outstanding loyalty also delivered superior value to its customers

and employees, and generated strong cash flows. Reichheld maintained that increasing customer retention rates was a more effective way of improving profits than a strategy focused on attracting new customers. Whilst this strategy may be questioned for large markets where customers do not have direct links to the firm, for example fast moving consumer goods (Sharp, Riebe et al 2002), its appropriateness is pertinent in business to business and markets with small customer bases.

Development of greater loyalty, or greater customer retention rates, has been claimed to have a significant positive effect on market share (Fornell and Wernerfelt 1988; Rust and Zahorik 1993; McGahan and Ghemawat 1994), on firm profits (Dawkins and Reichheld 1990; Reichheld and Sasser 1990; King and Rickard 1994; Rust, Zahorik et al. 1995; Colgate, Stewart et al. 1996), and therefore to be a significant determinant of a firm's long-term financial performance (Jones and Sasser 1995). In summary, these literatures argue that increasing customer satisfaction and customer retention leads to lower marketing expenditure, positive word-of-mouth, and improved profits (Reichheld 1996; Heskett, Sasser et al. 1997).

A considerable amount of the research literature has focused on service quality as the prime determinant of customer satisfaction (Oliver 1980; Bearden and Teel 1983; LaBarabera and Mazursky 1983; Parasuraman, Berry et al. 1988; Anderson and Sullivan 1993; Taylor and Baker 1994; Johnson 1995). Other possible determinants of customer satisfaction have received less attention: for example, price (Ravald and Gronroos 1996); value (Woodruff 1997; McDougall and Levesque 2000); and equity (Hellier and Geursen 2003). Research effort has been mainly directed towards identifying attributes of service quality that may be improved, resulting, it is hoped, in greater customer satisfaction and firm revenue. The linkages suggested by the literature may be depicted as in Figure 1, which provides a simple diagrammatic representation of the postulated, and often researched, linkage from customer-satisfaction attributes to firm revenue.

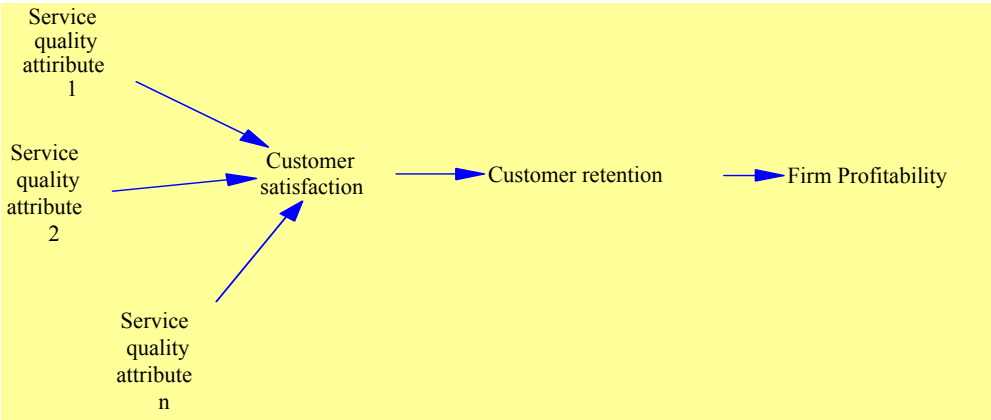


Figure 1: Linkage from customer satisfaction to firm profitability

Much of the literature follows the linear and positivist approach suggested by Figure 1. In assuming linearity, it implicitly accepts the validity of the sequence suggested by the questions raised earlier: certain attributes of satisfaction are manipulated to improve

customer satisfaction; and these improvements translate directly and immediately into increases in customer retention and revenue. In adopting positivism, it implicitly assumes that the resultant model provides a general law-like statement for the customer satisfaction-revenue relationship. But the customer satisfaction/revenue relationship exists within a social world, while positivism was originally applied to investigations of the natural world. Thus, is it appropriate to investigate, for example, the customer satisfaction/profitability linkage as if it was a natural science study? That is, is it legitimate to investigate social objects in the same way as we would natural objects?

Research philosophy

The main premise of the method of science is that the world is characterised by phenomena that are ordered and regular, and that 'laws of nature' can explain these regularities. It is these laws of nature that the research study attempts to discover. In seeking to explain and predict these phenomena, science constructs theories to account for the regularities observed under experimental conditions of closure. The laws explaining these regularities are then subjected to empirical testing, as observation of experimental results is regarded as the sole source of scientific knowledge (empiricism). The basis of the scientific method was thus established as: observation and experimentation, deductive reasoning and, where possible, mathematical representation. One last addition was required before the 'scientific method' was firmly established and this came from an influential contribution by Rene Descartes (1596-1650). In his 'Discourse on Method', Descartes provided four rules for conducting research. His second rule, which introduced the concept of 'reductionism', underpinned much of the intellectual and scientific development over the next two centuries. In it he states (Sutcliffe 1968):

> The second was to divide each of the difficulties that I was examining into as many parts as might be possible and necessary in order best to solve it.

In other words, by decomposing the whole into its component parts; explaining the operation of each part; and viewing the operation of the whole as the sum of its parts, the laws governing any entity, regardless how complex, may be derived.

We thus arrive at a method of science characterised by a trinity of reductionism, repeatability and refutation, and one that still dominates much contemporary scientific practice and pedagogy (Checkland 1999). Reducing complexity permits an investigator to examine what Ree calls 'simple natures' (Ree 1974); results from the investigation can be validated by the repeatability of the investigation; and, knowledge about the particular area of interest is advanced through on-going process of refutation or validation of hypotheses.

Social science is an attempt to explain social phenomena, that is, to find explanations or theories of the social world, within the limits of available evidence (Lewins 1992). The method of science, up until the creation of the new discipline 'sociology', was applied to the natural world, but the founders of social science were in no doubt that it was equally applicable to the social world. Comte's (1798-1857) aim was to create a naturalistic science of society, which would enable the study of society to follow the same scientific approach as that of nature. Thus, the new science adopted the empirical

methods and epistemological underpinnings of the natural sciences, and sought, through its scientific study to improve the society of the new industrial era.

This Naturalist approach accepts the unity of method between the natural and the social sciences, adhering to positivist principles that centre around and are underpinned by the Humean conjunction of empirical regularities with causality. An anti-naturalist view posits that, because of the composition of society—a composition that includes humans, human activities and relations—application of positivist principles to the study of the social sciences is not merely inappropriate, but fundamentally incorrect. Rather, the anti- naturalist approach entails interpretation or elucidation of social events, using ideas originating in classical hermeneutics (Outhwaite 1975).

In recent years, a critical realist philosophical approach to social enquiry, that provides a common approach to the study of the natural and social sciences, has emerged, invigorated by developments in the philosophy of science. While Roy Bhaskar has been particularly influential in the development of this approach (Bhaskar 1978; Bhaskar 1979), it has been applied in many fields: linguistics (Pateman 1987); feminism (Assiter 1996); marketing (Hunt 1991); and economics (Lawson 1989), (see(Outhwaite 1987; Collier 1994).

In the experimental activity associated with the natural sciences, constant conjunctions of events are produced under closed conditions and the laws deduced are then applied in open world systems. There, as in social systems, the object of interest is not the constant conjunction of events, but rather the generative mechanisms underlying the deduced causal laws. In the social world, the unperceivability of the objects of interest is not the impediment to knowledge of those objects. The main epistemological limit to the application of the natural method to the social enquiry is the fact that, in the social world, the object of interest can only be observed in an open system, where invariant empirical regularities cannot be manifest.

In short, social systems cannot ever be experimentally closed. Thus, unlike in natural systems, theories cannot be tested since a closed system is never available for such test purposes. The import of this is that in social science, theories must be explanatory rather than predictive (Bhaskar 1979)

In summary, the type of studies generally undertaken into customer satisfaction, while useful in that they identify correlative relationships that are worthy of further study, do not, and cannot meet the objectives set out earlier: that is, the development of a generic model of customer satisfaction/revenue relationship that permits necessary adjustment in satisfaction attributes to achieve maximum profit/revenue. Rather, what must be recognised is that each situation needs to be investigated anew, guided by the results of quantitative studies indicating likely factors that might be considered as influences on the satisfaction-profitability relationship.

It has been argued that methodologies that rely solely on the manufacture of experimental conditions of closure to identify constant conjunctions of events are limited in their ability to produce realistic explanations about the social world. Furthermore, such *empirical realist* approaches, depending as they do on human

observation of constant conjunctions and metal abstractions of those conjunctions, deny the autonomous existence and operation of causal structures that may not be readily apparent. *Critical realism*, on the other hand, regards the objects of knowledge as 'the structure and mechanisms that generate phenomena' and these objects are 'neither phenomena (empiricism) nor human constructs imposed upon the phenomena (idealism), but real things and structures which endure independently of our knowledge, and the conditions which allow us access to them.' (Bhaskar 1979). Critical realists, recognising that reality exists independently of investigators and their perceptions of it, attempt to become informed about the objects of knowledge through a layered ontology comprising three domains:

1. the empirical, consisting of perceptions and experiences;
2. the actual, consisting of events and behaviour; and
3. the real, consisting of underlying structure and generative mechanisms.

In the first domain, knowledge is obtained only through perception, and since perception will reveal only events and constant patterns, relationships, as causal powers, can be obtained only through logical deduction. An example, associated with customer satisfaction, might be: whenever the value associated with a service increases, customer satisfaction increases. Now, most empiricists will move beyond this limited view of reality to include the domain of the actual, and will admit to hidden casual mechanisms that are revealed through the constant conjunctions of observable events. Such events, however, are observed under specific condition of experimental closure, and knowledge gained from this is inductively applied, as law-like statements, beyond the experimental closure conditions to the outside world. Again, an example associated with customer satisfaction might be: all other things being equal (the *ceteris paribus* assumption), whenever value increases, customer satisfaction increases; or, for this specific group, whenever value increases, customer satisfaction increases. In drawing such conclusions, the investigator identifies events and empirical experience of those events as the underlying mechanisms and structures. The domains of the empirical and actual are 'fused' with the domain of the real. This two-domain approach usually begins with the identification of some empirical phenomena, followed by the establishment of conditions of experimental closure in order to develop an explanation which might account for the phenomena. It is not necessary that the explanation or theory be plausible, only that it is coherent and can predict future regularities. It is, in other words, accepted on the basis of its instrumentality.

In the third or real domain, it is recognised that the constant conjunctions of events that occur under conditions of experimental closure are not necessarily to be found in the open world. Empirical experiences may be out of phase with actual events, which, in turn, may be out of phase with underlying mechanisms and structures; mechanisms may act in tandem or in opposition, or act transfactually across domains without causing events. The power associated with mechanisms and structures, that may be exercised without realising observed events, is referred to as *tendencies* by critical realists. The attribution of tendencies with events and entities provides the realist's statements of law.

In summary, the empirical and actual domains provide what might be referred to as 'surface' accounts of observed phenomena. Underlying such accounts are the deeper and more coherent explanations found in the domain of the real. The domains are said to be stratified, in that surface accounts identified in the empirical provide a guide to the investigation of underlying causal powers and mechanisms within the more complex domains of the actual and the real. When one structure or mechanism is identified, it becomes the entity to be explained.

In the social world, reality is constructed by people, interacting through associated beliefs, values and language. Thus, to investigate a social world, for example an organisation, is to investigate an entity that both socialises the participants and is transformed by the participants. Constant conjunctions of events that might apply to one organisation might not be evident in another, or, if evident, may be attributable to other structures or mechanisms. From this viewpoint, therefore, no one model will suit all organisations; each organisation has its own social world. Each organisation must be investigated as a single entity. The empirical domain, the first layer of investigation, still reveals regularities that then may be explained by human constructs. These accounts then became the object of the next stage of the deepening investigation.

System dynamics allow for this ever-deepening process for advancing knowledge of the objects being investigated. At first glance, SD may look like the 'hard' approach associated with systems engineering, and may not appear to lend itself to a critical realist investigation. Lane explores this criticism, and addresses each of four main interpretations of the criticism from a perspective of social theory and systems science. His conclusion is a firm no: SD is not necessarily a hard approach (Lane 2000). While the system dynamics literature certainly states that a study must have a specific purpose, the purpose is not an optimisation objective, as in OR; rather the purpose of the model is to probe mental models associated with agreed problem situations with a view of improving understanding of the system. Participants are involved with the process, and the model must act not as a 'coercive' process, but as a 'negotiative' process (Eden and Sims 1979). Through use of causal loop diagrams, participants in the SD investigation can probe structures, identifying those that require immediate attention, while allowing for the possibility of probing deeper into the structure at a later time. SD, by examining causal structures and dynamic behaviour, both permits the dynamic response of systems to be more readily viewed and enables various polices to be checked for, what Lane (2000) calls, dynamic coherency.

System dynamics

System Dynamics (SD) was developed in the late 1950s at the Massachusetts Institute of Technology's Sloan School of Management by Jay Forrester (Forrester 1961), initially as a way of explaining industrial behaviour. His method was then called industrial dynamics. Later, the method was applied to social systems; for example, Forrester (1971) developed a SD model of world dynamics, including world population, global economy, natural resources and physical environment. The purpose of his model was 'to investigate effects of population and economic growth as human activity approaches the carrying capacity of earth' (Sterman 2000). Other examples of the application of SD include: energy modelling (Meadows, Behrens III et al. 1974; Sterman, Richardson et al. 1988); heroin imports to U.S. (Gardiner and Shreckengost

1987); community alcohol problems (Holder and Blose 1987); healthcare (Lane, Monefeldt et al. 1999); organisational learning (Senge 1990) and quality improvement (Sterman, Repenning et al. 1997).

A system approach to the relationships between customer satisfaction and revenue

From the literature on customer satisfaction, the following model of the relationship between attributes of customer satisfaction (quality, price, value) and revenue was developed (see Figure 2).

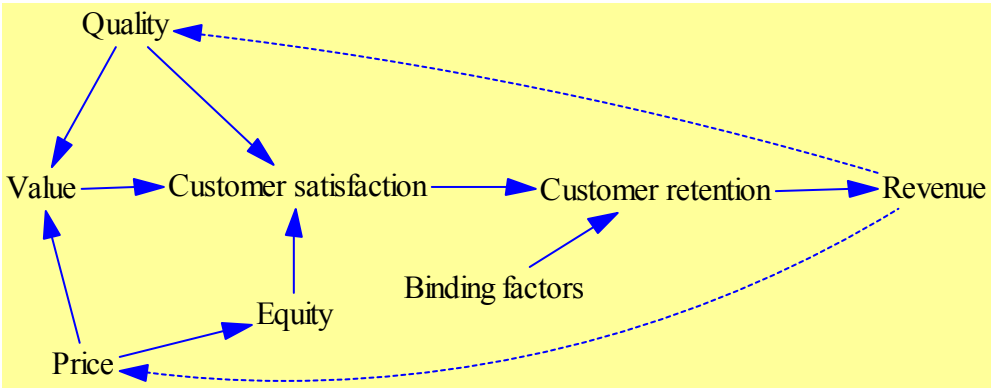


Figure 2 Basic model relating attributes of customer satisfaction and revenue

The following simulations were developed as part of a consultancy with a smallish real estate firm. The firm was quite successful, but felt that performance could be improved, without having any specific changes in mind. This case was chosen as being suitable for a customer satisfaction investigation (relating satisfaction to revenue), as staff at the firm were intuitively aware of the need to satisfy customers, in order to further enhance the good reputation of the firm; to initiate a steady stream of revenue; and to develop additional clients through referrals from satisfied customers. That this was so was clearly evident from discussions in the later workshops. The simulations below were run to demonstrate the difference between taking a positivist approach and a systems approach. Later, a more pertinent simulation was developed for their real estate environment, but this is not reported here.

Simulation 1: the basic simulation

The basic model of Figure 2 is derived from the model outlined in Figure 1. Customer satisfaction is directly and linearly related to customer retention, which in turn is directly and linearly related to revenue. New customers come on board at a steady rate per time period. The simulation tracks the total number of customers and the net value of a single customer (see Figure 3).

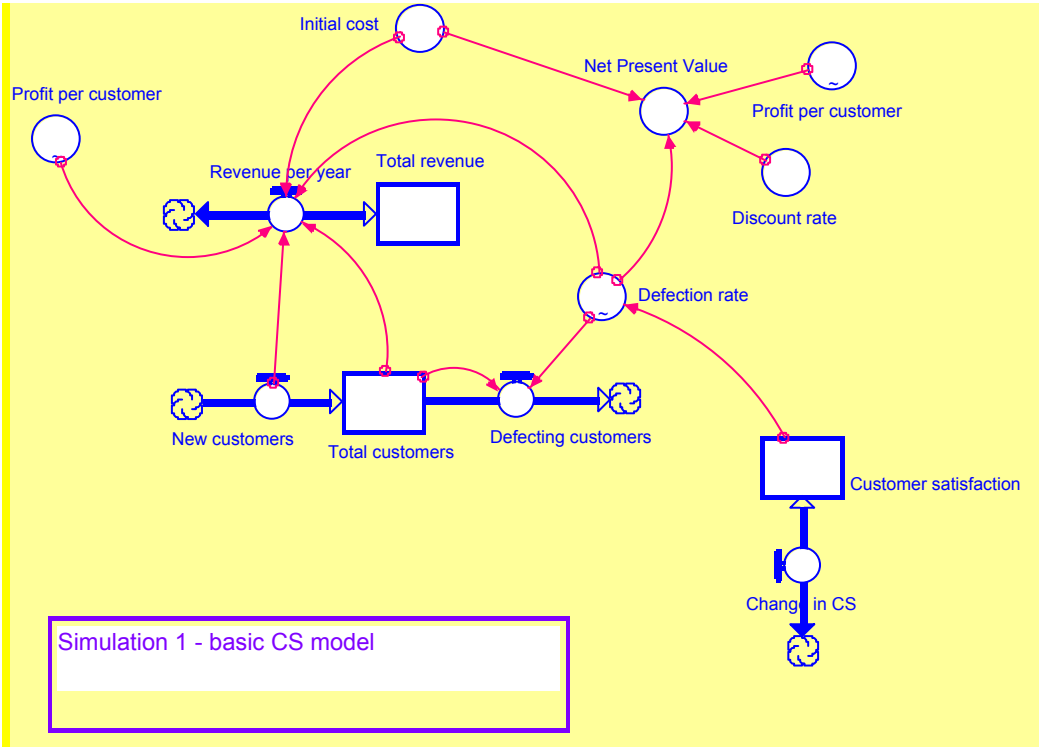


Figure 3 Basic simulation of the customer satisfaction/revenue model

Figure 4 displays the dynamics of Total customers and Revenue per year, for a retention rate (and customer satisfaction) of 0.7. The steady state Total customers equal 333 and the steady state Revenue per year is 4333.

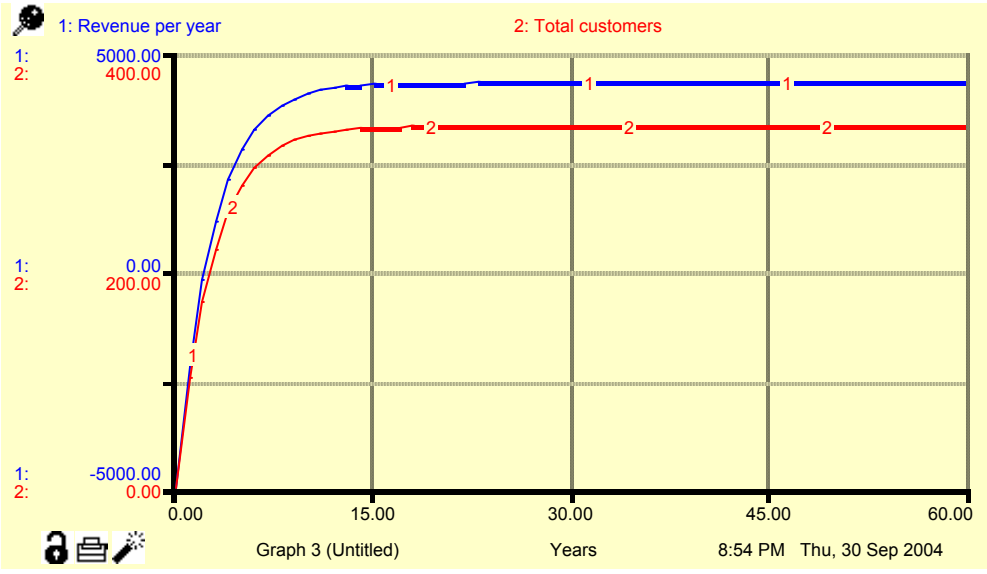


Figure 4 Dynamics of Total customers and Revenue per year from simulation 1

If customer satisfaction (and hence customer retention) are increased, the total number of customers and revenue increase linearly. This is the response assumed by much of the customer satisfaction research.

Simulation 2: simulation 1 plus disconfirmation as a driver of customer satisfaction

The second simulation includes Oliver's (1977) expectancy-disconfirmation paradigm, wherein customer satisfaction is driven by disconfirmation and perceived quality. Disconfirmation is taken here as the difference between perceived quality and expectations; expectations lags perceived quality (implying that customer expectations are based on previous perception of quality); and, perceived quality lags actual quality – customers need some time to track an increase or decrease in quality (they track a decrease in quality quicker than an increase.); actual quality is constant. Figure 5 displays the simulation.

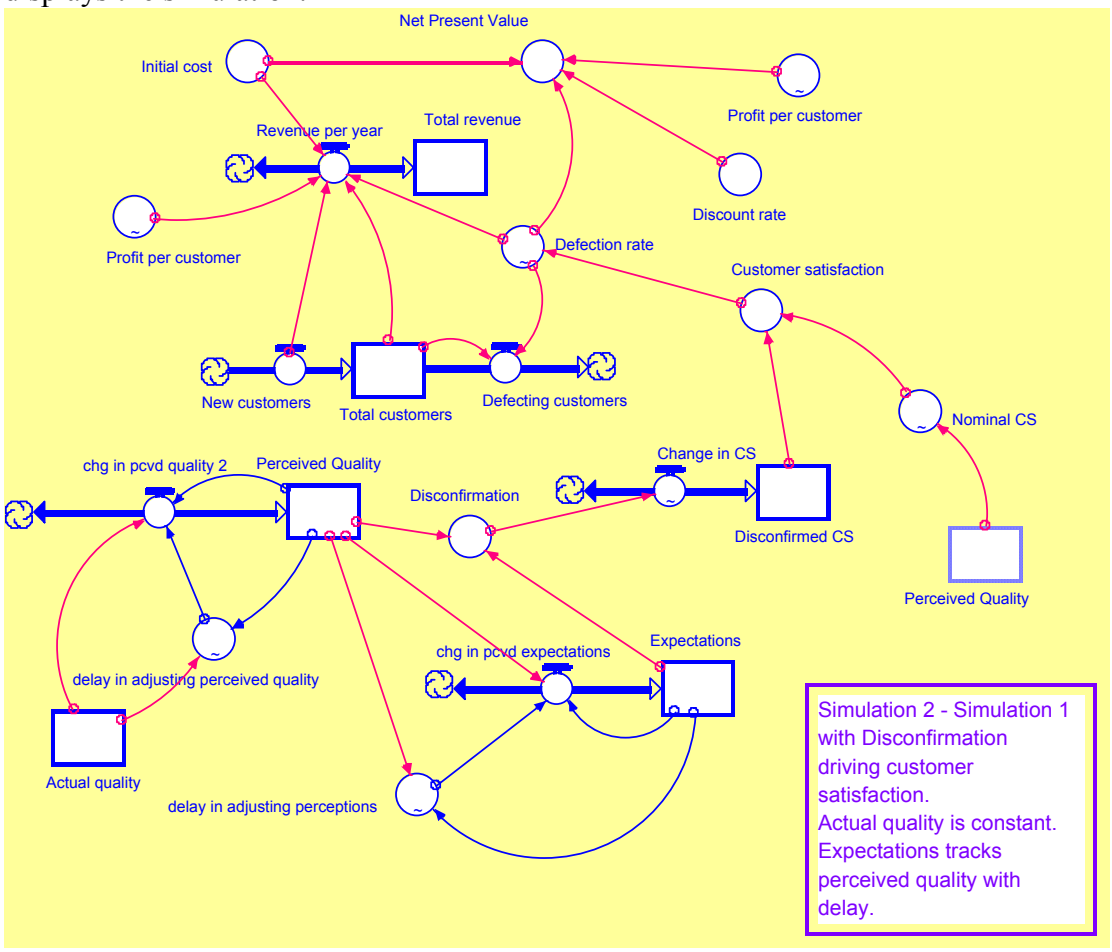


Figure 5 Simulation 2: simulation 1 plus disconfirmation

Expectations can initially be less than or greater than perceived quality, but will adjust to the perceived quality value over time. Customer satisfaction reflects the value of perceived quality, but positive disconfirmation will increase customer satisfaction and negative disconfirmation will decrease customer satisfaction. Also, negative

disconfirmation will decrease customer satisfaction more than the increase from the equivalent value of positive disconfirmation.

If actual quality, perceived quality and expectation are all set equal to 70, customer satisfaction assumes a value of 70 and a dynamic response equal to that in simulation 1 would be obtained. What is more likely is that expectations have been either raised or decreased in response to perceived quality and actual quality.

Case 1

Actual quality = 85; Perceived quality = 70 and Expectation = 70.

Customer satisfaction has an initial value of 70 reflecting the initial value of perceived quality (70); the initial retention rate is 0.7. Figure 6 displays the dynamic output.

Perceived quality and expectations gradually adjust to match actual quality; that is, although people initially have lower expectations, their expectations are gradually increased by their perceptions of the actual quality. Figure 6 displays the constant value of actual quality; shows perceived quality tracking actual quality, and expectations tracking the value of perceived quality. Also customer satisfaction tracks perceived quality, for a final value of 85, but is increased by another 5 points to 90 as a result of the initial positive disconfirmation. The defection rate decreases from its initial value of 0.3 to a final value of 0.1, mirroring the increase in customer satisfaction.

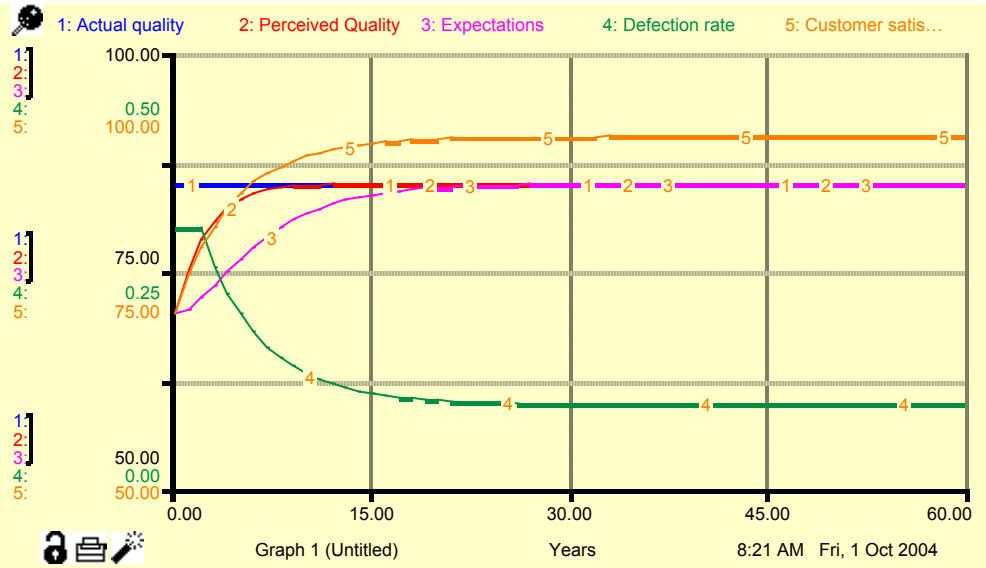


Figure 6 Simulation 2 output for initial actual quality greater than expectations

What happens to customer numbers and revenue? Figure 7 below displays their responses.

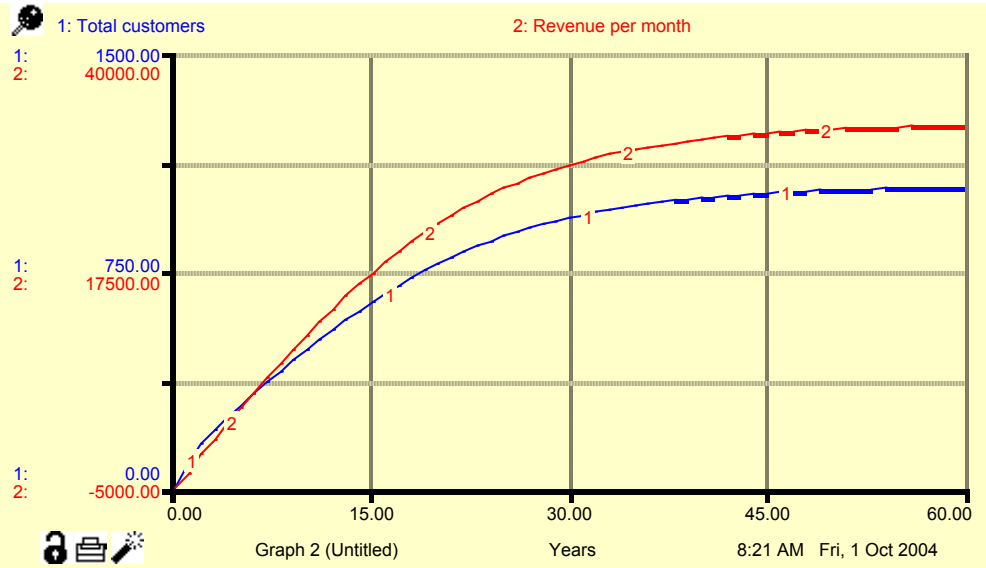


Figure 7 Simulation 2 outputs for Total customers and Revenue per year with initial actual quality greater than expectations

The steady state Total customers are just over 1000 and the steady state revenue per year is about 32500. The steady state values for Total customers and revenue per year are consistent with the result from simulation 1 with a value of just over 90 for customer satisfaction.
This simulation allows examination of various changes in actual quality: a steady increase over time; or, a sudden increase at a particular time.

Case 2

Actual quality = 60; Perceived quality = 70; and Expectation = 70.

Customer satisfaction has an initial value of 70, reflecting the value of perceived quality. The retention rate has an initial value of 0.7. Figure 8 displays the response for actual quality, perceived quality, expectations, customer satisfaction and retention rate.

Expectations gradually adjust to match actual quality; that is, although people initially have higher expectations, their expectations are gradually decreased by their perceptions of the actual quality. The graph below indicates this. The final customer satisfaction value is about 56.6 reflecting both the final perceived quality of 65 and the initial negative disconfirmation.

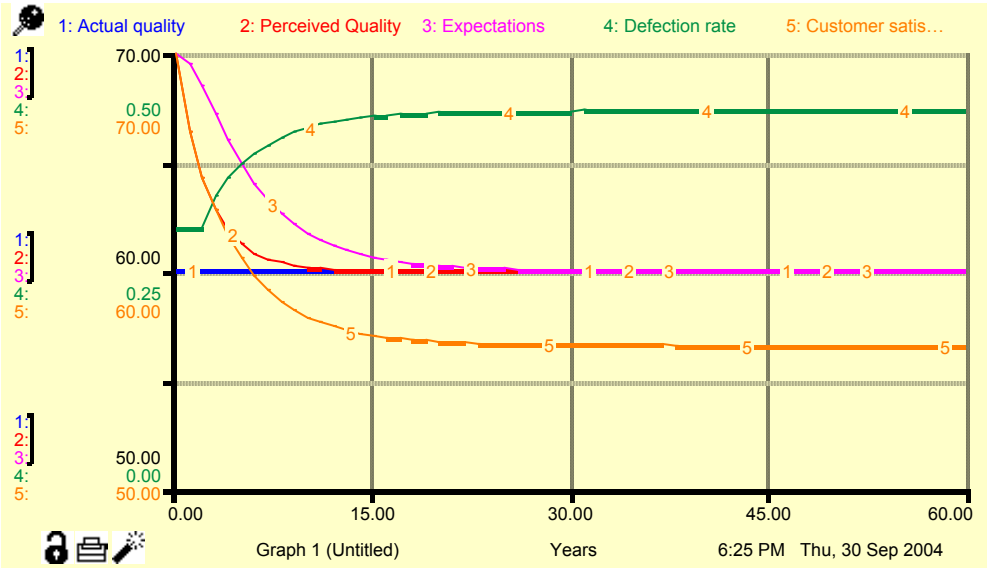


Figure 8 Simulation 2 outputs for initial actual quality less than expectations

Total customers and revenue per year are shown in the Figure 9.

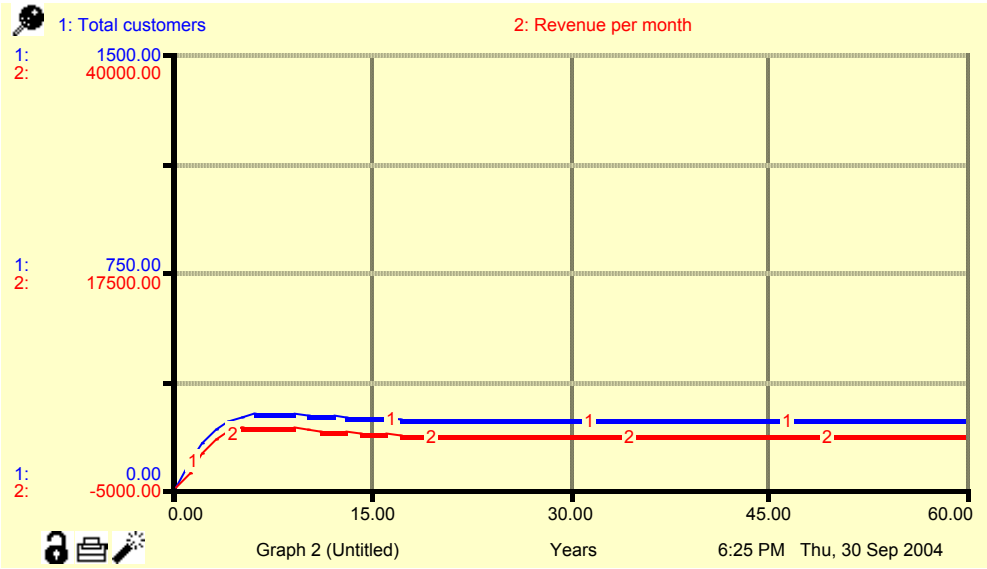


Figure 9 Simulation 2 outputs for Total customer and Revenue per year with initial actual quality less than expectations

The steady state total customers are now about 230 and the steady state Revenue per year is about 207.

While the results from simulation Case 1 and Case 2 are consistent with results from simulation 1 with customer satisfaction values equal to the final value of customer satisfaction for Case 1 and Case 2, these cases differ from the simulation 1 in their transient response; that is, in the values for the years leading to the steady state

condition. The table below shows the growth of Total customers and Revenue per year for the first ten years for the basic simulation and for simulation 2, Case 2 (the same applies to simulation 2, Case 1).

Table 5.2 Total customers and Revenue per year

	Basic Simulation		Amended Simulation	
Month	Total customers	Revenue per year	Total customers	Revenue per year
11	230	-$9,497	244	$3,254
23	230	$2,459	231	$4,499
35	230	$2,472	230	$2,644
47	230	$2,472	230	$2,497
59	230	$2,472	230	$2,484

Simulation 3: simulation 2 with a quality improvement program included

Simulation 3 is the same as simulation 2 with a quality improvement program included. The quality improvement program is driven by revenue directed to it, but with diminishing returns. The simulation is now as shown in Figure 10.

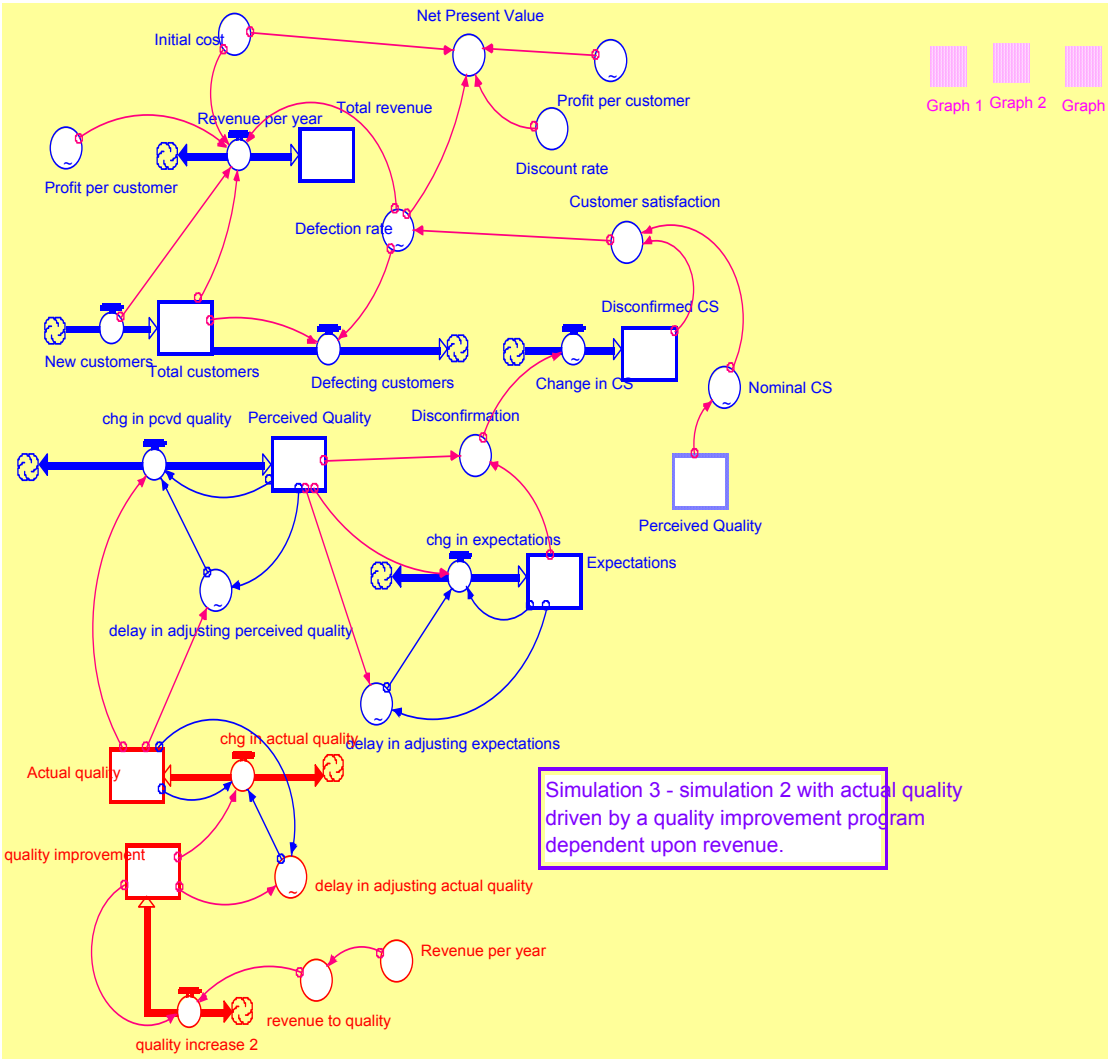


Figure 10 Simulation 3: simulation 2 plus a quality improvement program

The quality improvement program is funded by a constant proportion of revenue per year for five years. Initial values are: actual quality = 65; perceived quality = 60; expectations = 80; quality improvement =65 (quality program just starting).

Because of the initial low value of perceived quality, customer satisfaction starts off at a value of 60. Expectations are initially high (having been raised, say, by marketing associated with the latest release), but they quickly drop, as the actual quality is perceived to be much lower than expectations. Immediately, cash begins to flow into the quality improvement program, increasing the actual quality, and, after a short delay, the perceived quality. As perceived quality increases, expectations again increase. The retention rate is initially only 60% but increases to a steady state value of about 78% as perceived quality and positive disconfirmation both apply. Customer satisfaction is increased from the initial value of 60 to a final value of 78. Figure 11 displays the output for actual quality, perceived quality, expectations and customer satisfaction.

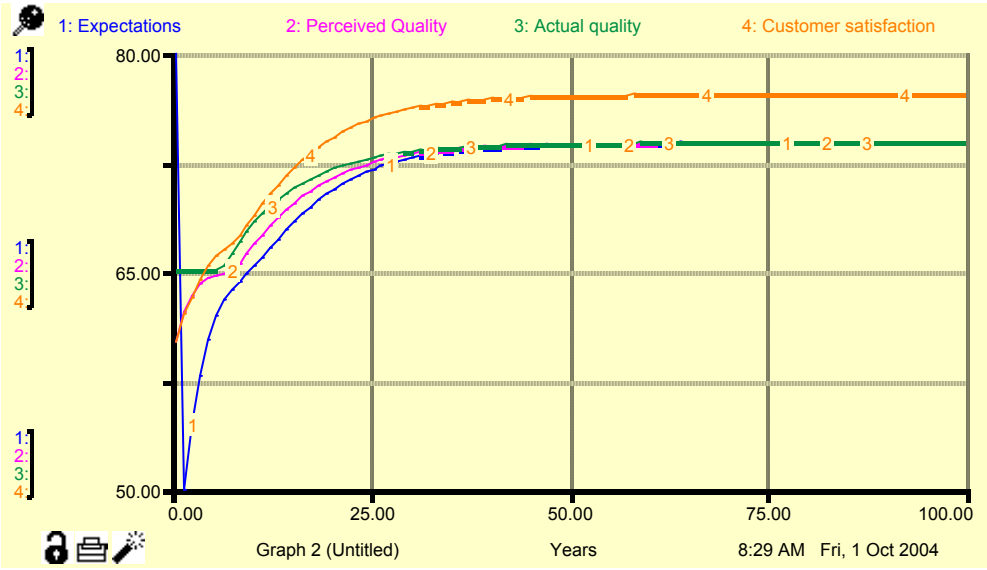


Figure 11 Simulation 3 outputs for actual and perceived quality, expectations and satisfaction

The graph of Total customers and Revenue per year is displayed in Figure 12.

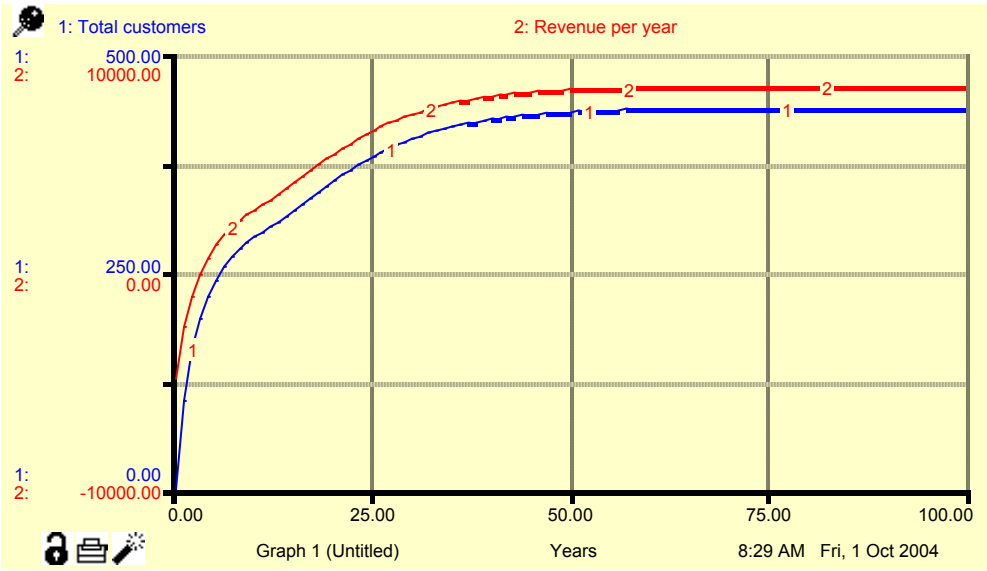


Figure 12 Simulation 3 output for Total customers and Revenue per year

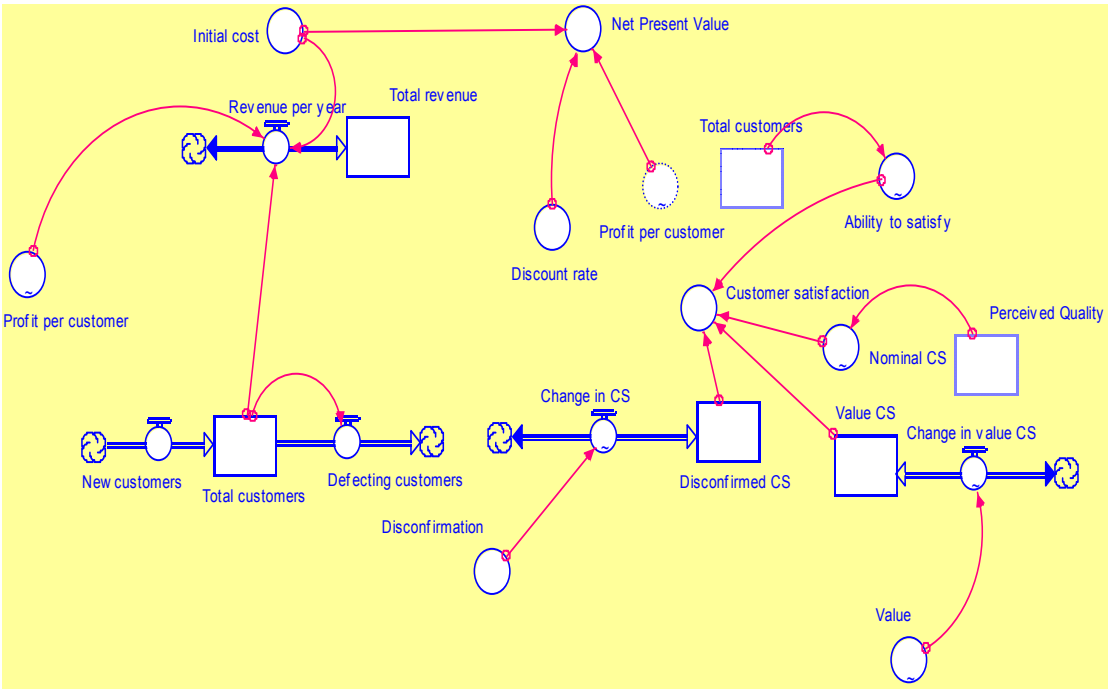
The final value of Total customers is about 440, consistent with a value of 78 for customer satisfaction.

Simulation 4: simulation 3 plus value and ability to satisfy

Simulation 4 expands on simulation 3 by including two additional factors influencing customer satisfaction:

- The first is a measurement of value, included as the difference between price disutility and quality utility. Price disutility is a non-linear function of price, and quality utility is a non-linear function of quality;
- The second is a measure of the firm's ability to continue to satisfy customers as customer number increase.

The simulation is now as displayed in Figure 13.



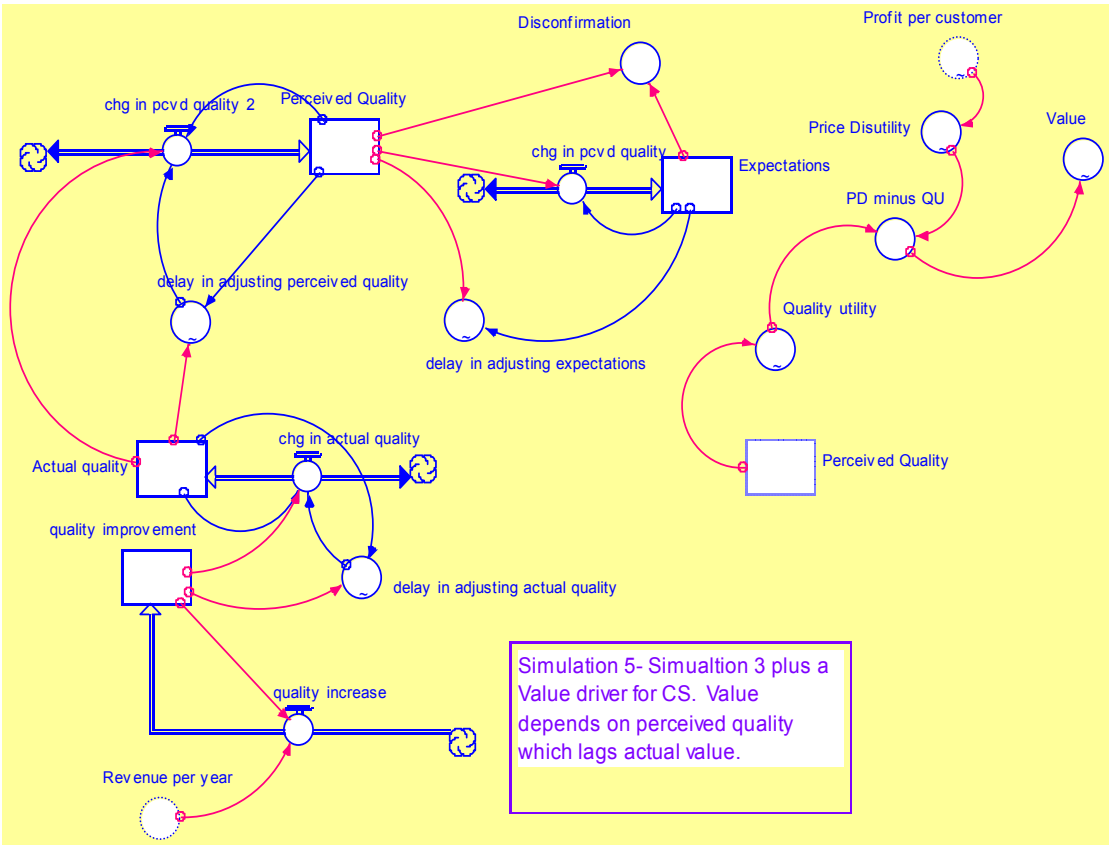


Figure 13 Simulation 4: simulation 3 plus a value variable and an ability to satisfy variable

The initial values are the same as in simulation 3: actual quality = 65; perceived quality = 60; expectation = 80. Again, it is assumed that expectations have been raised by the firm in their public announcements. The usual graph of quality, expectations and customer satisfaction is shown in Figure 14.

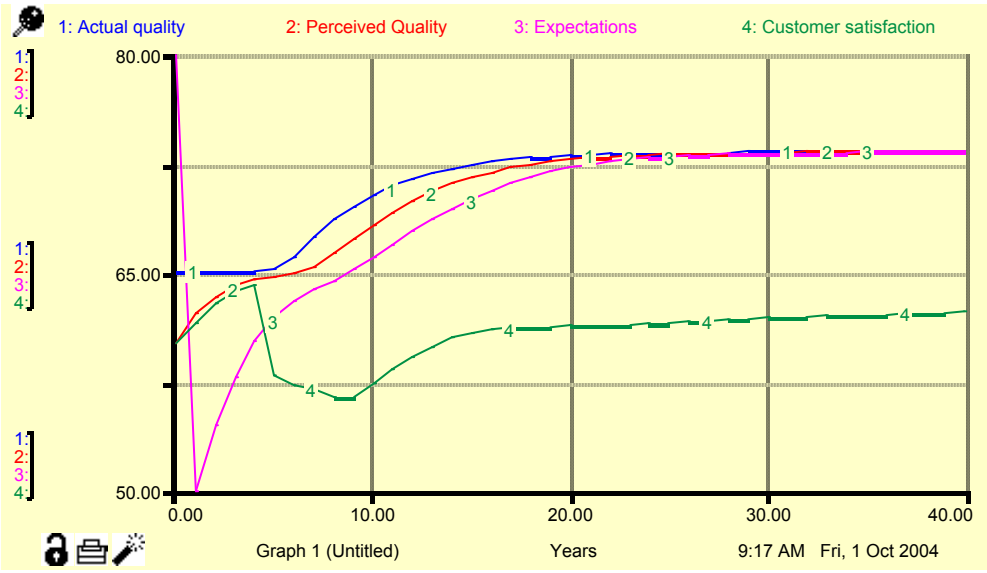


Figure 14 Simulation 4 outputs for actual and perceived quality, expectations and satisfaction.

Actual quality, and in turn, perceived quality, are increased through the quality improvement program. Expectations, initially high, rapidly fall to match the perceived quality, but then increase, tracking the increase in perceived quality. The final value of actual quality and expectations is about 73, as in simulation 3. Customer satisfaction decreases after an early increase, due to the increased influence of the 'ability to satisfy' variable, but as the increase in quality takes effect, customer satisfaction increases, though only to a value of 62, compared with the value of 78 in simulation 3. Total customers and revenue per year are shown in Figure 15.

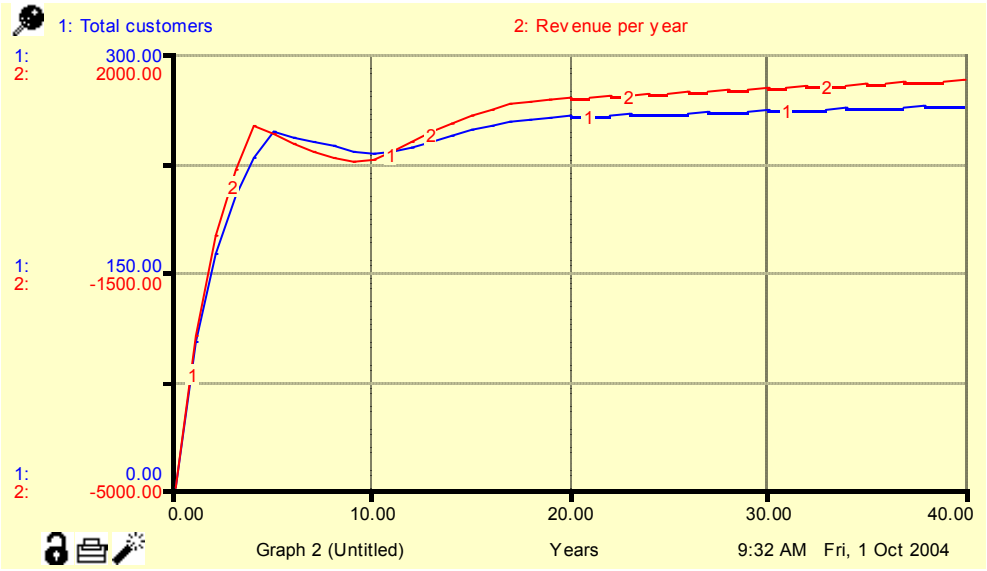


Figure 15 Simulation 4 outputs for Total customers and Revenue per year

Now, consider the following scenario. As the quality improvement program takes effect, thereby increasing actual and perceived quality, management makes the decision to increase their profit margin to compensate for the fall in revenue per year after year 4. Previously, the profit margin was set at $40 per year. Now, it is increased to $60. Quality improves as before, but customer satisfaction goes into a decline after year 12, rather than increase as before, as shown in Figure 16.

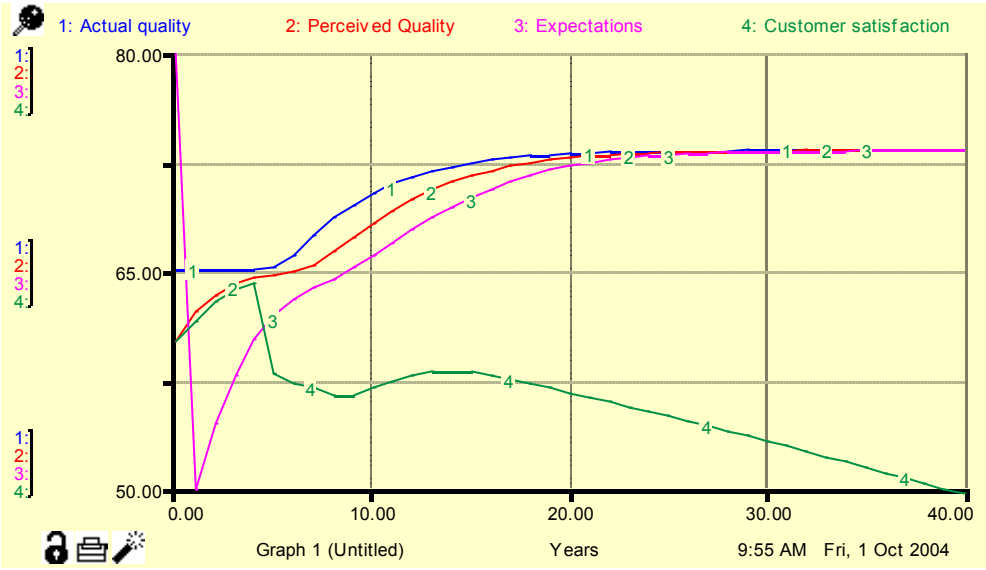


Figure 16 Simulation 4 outputs for actual and perceived quality, expectations and satisfaction with profit margin increase after t=4

Total customers and revenue per year are shown in Figure 17.

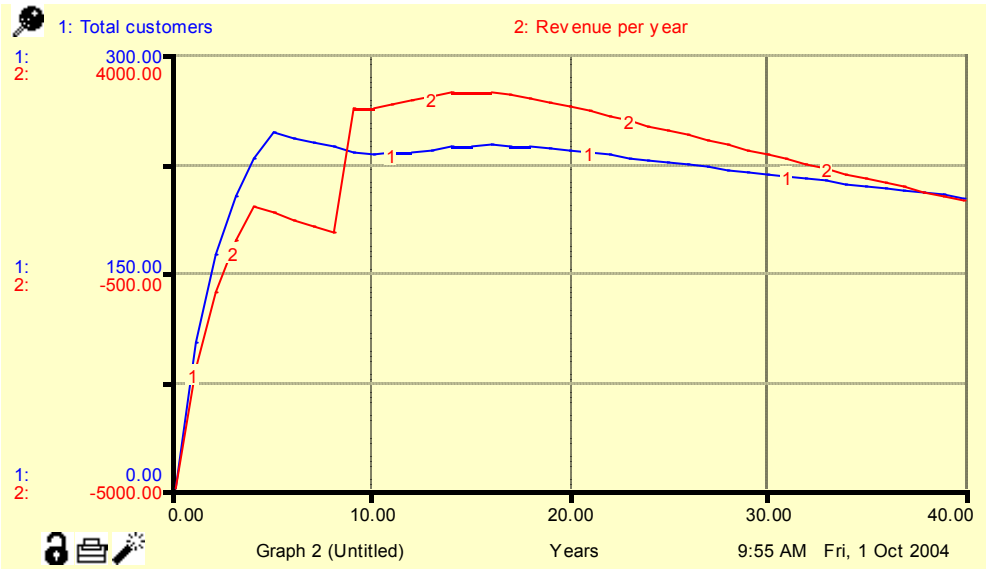


Figure 17 Simulation 4 outputs for Total customer and Revenue per year with a profit margin increase in year 5

Revenue per year initially increases following the profit margin increase, but after a period of time it begins to decrease again. The values of total customers and revenue per year after 20 time periods are shown in Table 3.

Table 3 Total customers and revenue per year for profit margins of $40 and $60

Scenario	Total customers	Revenue per year
Profit margin = $40 per year	264	1570
Profit margin = $60 per year after year 8	200	960

These simulations demonstrate clearly the effect of interactions among variables. The interconnectivities, the nonlinearities and the delays make it impossible for humans to even attempt to estimate the dynamics of such complex structures. SD permits not only the viewing of the dynamics, but also the examination of possible strategies on the operation of the overall system. It allows for the 'digging deeper', consistent with the critical realism methodology. Simulation 4, in particular, reveals the counterintuitive behaviour associated with improvement in actual service quality. The positivist approach suggests that this will result in improved customer satisfaction, customer retention and revenue. Contrary to this projection, customer satisfaction decreases, as does revenue.

Conclusions

The simulations in this paper demonstrate that the relationships amongst quality, value, price and revenue (especially net revenue which is profit) are complex and need to be modelled as such. Here, we have underpinned the need for a systems approach by examining methodological issues; argued that a social environment requires a methodology that permits deeper examination than that offered by the natural sciences method; briefly described one such methodology (critical realism); and, finally, applied system dynamics to the customer satisfaction/revenue relationship. The ability to examine the behaviour and impacts of such links has to the best of our knowledge not been demonstrated using other research means. We argue that this paper indicates that system modelling can become a fundamental tool useful for the examination and modelling of these relationships.

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