Applying Systems Thinking to a Strategic Simulation of Service Quality

Chee-Leong Chong
Jacob Lee
Lye Poh Tan
National University Of Singapore
10 Kent Ridge Crescent, Singapore 119260
65-874-3161/ 65-776-5641 (Fax)
fbaccl@nus.edu.sg ; fbaleelh@nus.edu.sg ; fbatanlp@nus.edu.sg

While service quality is important, it remains an abstract construct that is difficult to define and measure. In this paper, we propose that service quality be viewed as the final outcome of intertwined service delivery processes that involve the interactions of complex non-linear service sub-systems. Various sub-systems were first identified and a simulation model was subsequently developed to allow a detailed examination of the effects of their interactions.

The model shows that the systems thinking methodology is effective for capturing and understanding the complex nature of service quality. Many of the criticisms of the prevalent service quality measure, SERVQUAL, are due to the inherent delays and feedback loops. Because of an embedded reinforcing loop, the only equilibrium state for the service delivery system is when the customer's expectation equals to perception. This has interesting implications since much of the literature advocate the need for service providers to outperform their customers' expectations.

In spite of the growing importance of service quality (Qualls & Rosa, 1995), it remains an abstract and elusive construct that is difficult to define and measure. Its intangible nature also makes it difficult to be precisely captured and systematically managed by traditional quality management tools.

Among the new tools developed, the *Service Gap Model* (Parasuraman et. al, 1985) is now one of the most frequently used. The model was further developed into the *SERVQUAL measure* of service quality (Parasuraman, et. al) in 1988. Despite its popularity, many researchers like Carman (1990) and subsequently Nanakus and Boller (1992), and Brown, Churchill and Peter (1993) have criticized the measure for its conceptual and methodological limitations, in particular, the simplistic notion of service quality as the difference between customer's perception and expectation.

Rather than continue to debate on the merits and shortfalls of alternative service quality models, this paper adopts a different approach. In recent years, the system thinking methodology is increasing used for the understanding of complex causality problems by modeling the complexity and simulating the outcome behaviors. Service quality is first viewed as the final outcome of intertwined service delivery processes that involve the interaction of complex non-linear service systems. Based on the service quality literature, various systems were first identified and a simulation model was subsequently developed to allow a detailed examination of these interactions.

Literature Review of Service Quality

"The Gap Model" (Parasuraman, et al, 1985) argues that the difference between customer's expectations and actual service provided can only be managed through other "gaps" or differences between expectations and performance that occur in the service delivery and creation system. Excellent service quality is achieved by closing these service "gaps" between the customer's desires and the service firm's creation of the desired service. Only then, will the service firm perform to the expectation of the customers and lead to an increase in customer satisfaction.

Parasuraman et al. (1988) further developed this Service Quality Gap Model into a 22 paired items SERVQUAL measure that comprises the dimensions of Tangibles, Reliability, Responsiveness, Assurance and Empathy (see Figure 1).

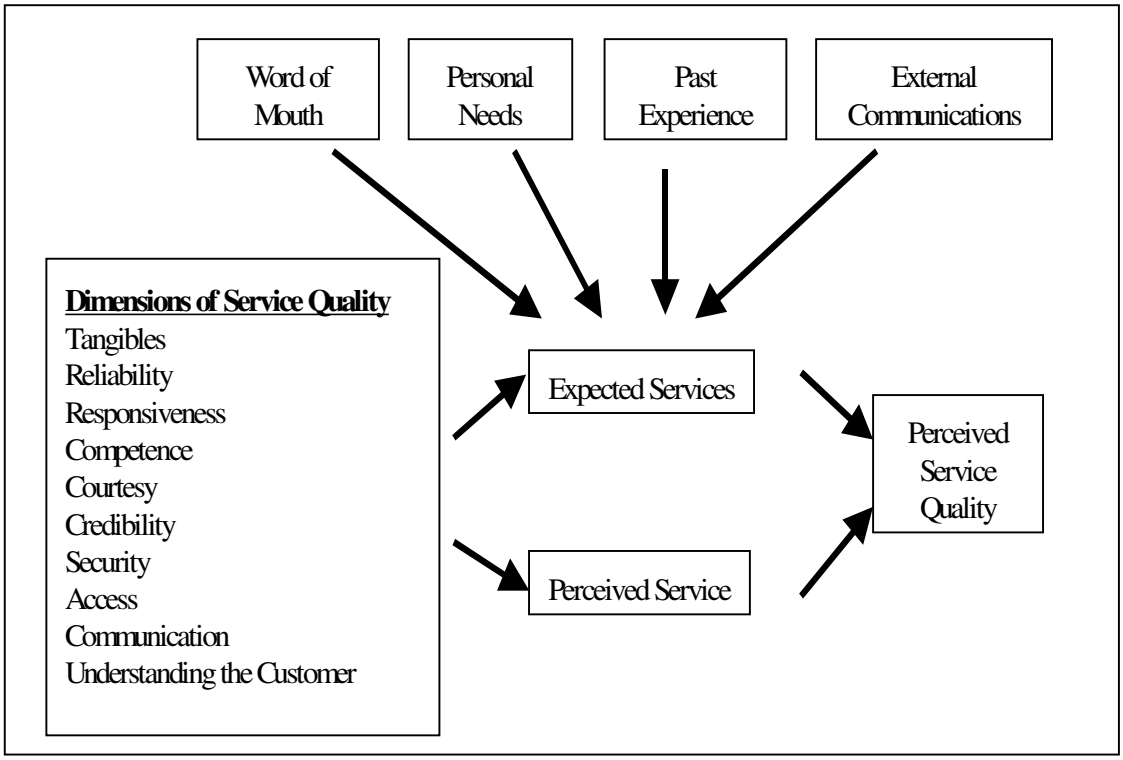

Figure 1. SERVQUAL Measure

The SERVQUAL measure is commonly used as its generic nature allows its application across a broad spectrum of industries. Yet, it has been criticized for its conceptual foundation and methodological limitations (Brown, Churchill and Peter, 1993; Texs, 1993,1994). Being operationalized as performance minus expectation (P-E) made it difficult to reconcile service quality with the general attitudinal models (Carmen 1990). In addition, the implicit assumption that subtraction accurately portrayed service quality is overly simplistic (Thomas, 1997). Some research also demonstrated that expectations influence only perceptions and that perception alone directly influences overall service quality (Boulding et al. 1993). Carmen (1990) questioned the value of measuring ex-post expectation as customers who had a negative experience with the service tended to overstate their expectation, creating a larger gap and customers who had a positive experience tended to understate their expectations, resulting in smaller gaps.

In a study across four different industries, it was found necessary to add as many as 13 additional items to the service quality construct in various settings, while at the same time dropping as many as 14 terms from the original instrument based on results of factor analysis (Carman, 1990). This indicated that considerable customization was required to accommodate differences in service setting across industries.

Key Issues Identification

The SERVQUAL measure (Parasuraman et. al, 1988) is often criticized for its unstable nature. Systems thinking suggests that the instability of the SERVQUAL measure may lie in the delays and feedback inherent in the service delivery system and not in the measure itself.

> *Proposition 1*
> *The instability of the SERVQUAL measure results from delays and feedback inherent in the service delivery system.*

Researchers suggested that the issue with the SERVQUAL measure is its inherently unstable expectation construct. While they recommended its replacement with a more stable construct, Parasuraman (1994) argued that the construct is important as it captures the basic needs and desires of the customer. In fact, the instability arises from the changing desires of the customers and the key challenge to service quality is meeting customer's changing needs.

> *Proposition 2*
> *The expectation construct is unstable because it reflects changing customer's needs in the dynamic service delivery system.*

There have been many arguments about whether SERVQUAL should be replaced by SERVPERF (an expectation only measure). SERVQUAL may be a better driver for service quality goals when the expectation of the customer is higher than the perception as it gives the firm a clear objective to work towards. However, when the firm outperforms the customer's expectation, the performance of the firm will now drive customer's expectation. In such cases, the SERVPERF measure becomes a more suitable driver.

> *Proposition 3*
> *A SERVPERF score that is greater than customer's expectation will cause customer's expectation to increase to the equilibrium whereby SERVPERF equals customer's expectation.*

Currently, there is no research on how often service quality should be assessed. Often, firms are solely driven by their budgets. It is apparent that the frequency is critical for its ability to capture the changing needs of its customers. Although it might be costly to measure frequently, but doing it infrequently may be detrimental to the firm's goals towards meeting customer's expectation. In this case, the model assumes that the SERVQUAL scores are acted upon once they are measured.

Proposition 4

The frequency of assessing the SERVQUAL measure affects the firm's ability to react positively to the changing customer's expectation.

Model Development

First, the key variables in the dynamic model were identified from three sources, "The Service Gap Model" (Parasuraman et. al, 1985), "The SERVQUAL Model" (Parasuraman et. al., 1988, 1991) and "A Dynamic Theory to Service Delivery" (Oliva, 1996). Next, the relationships between the variables were postulated and examined. Delays and feedback were assigned appropriately, with the initial values drawn from current literature.

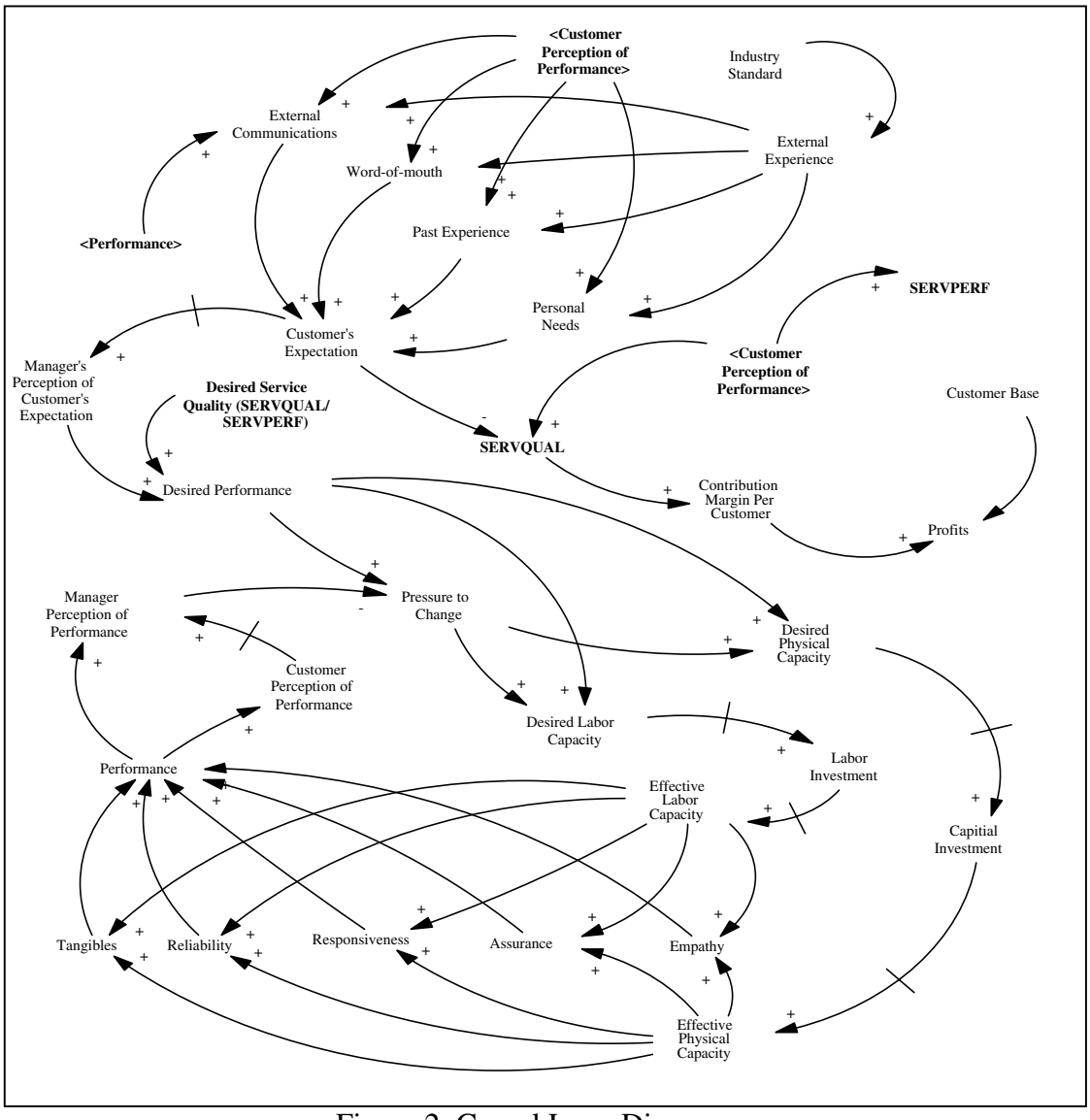

Figure 2: Casual Loop Diagram

Thereafter, a stock and flow diagram was created based on the links and relationships suggested in the causal loop. At this stage, each variable was examined in detail and equations were assigned to each linkage to model the desired relationship. In short, the stock and flow diagram attempted to replicate the dynamics of the service delivery

system in a “microworld.” Once the model was completed, key variables and assumptions in the model were assigned values to simulate different scenarios in the service delivery system. The four propositions were then tested in the system delivery “microworld”.

Results

SIMULATION RUN 0 (Equilibrium State)

In Run 0, the model was in its equilibrium state. The SERVQUAL index was set to zero and both the customer’s expectation and perception of performance were set to four.

Industry Multiplier = 1;Service Quality Index = 1

SIMULATION RUN 1

Industry Multiplier = 1 + STEP (0.1,4) +STEP (0.1,8)

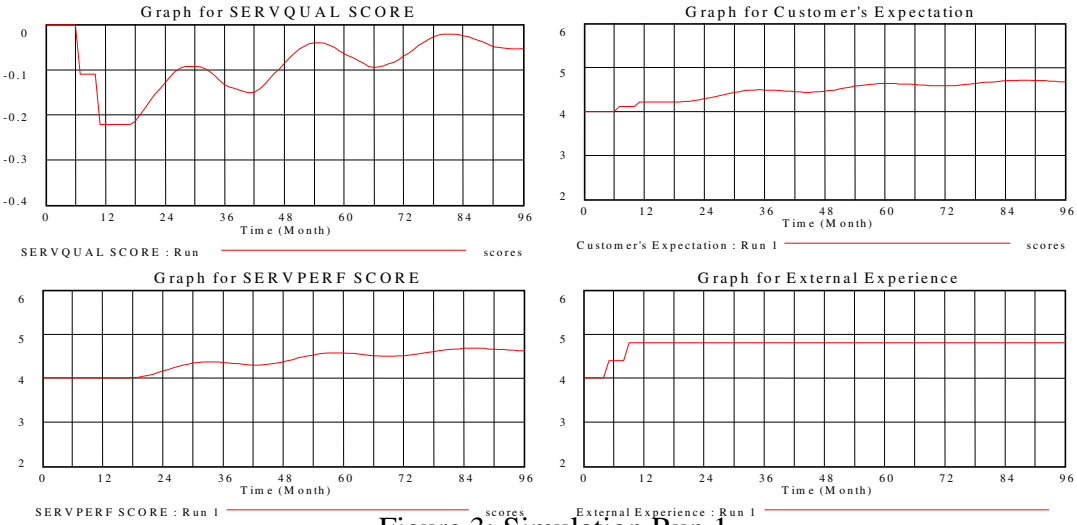

Figure 3: Simulation Run 1

In Run 1, disturbances were introduced into the system. These disturbances could be an announcement by an external agent that raises the standards for comparison. The disturbances were simulated by using a step-up function in the “industry multiplier” variable at time 4 and time 8, to reflect changes in industry standard in these two periods. The other variables in the model were held constant. By simplifying the model with just two step-ups, the effects between consecutive disturbances and that when the disturbances have stabilized can be analyzed effectively. The model also assumed that there was no delay between external experiences and the change in industry standard. This was reasonable, as ignoring this delay had no effect on the overall results of Run 1. The delay pushed back the time when the disturbances affect the system.

Run 1 showed that when disturbances are introduced, the SERVQUAL score became very unstable over time. This was most prominent in the short run as illustrated by the huge deviation from the equilibrium score of zero. The graph of expectation showed two sharp increases, reflecting the two steps up on the industry multiplier introduced. However, these “sharp” increases did not appear in the SERVFERF construct. This suggested that the expectation construct is more sensitive to changes in the

environment, i.e., increases in external experiences (industry standard) is better captured by the expectation. The SERVPERF score, which is primarily driven by the performance of the service firm, was less sensitive due to delays inherent in the system. This is especially true for service industries that experience long time lag to improve their capacity for higher performance. For such firms, the SERVPERF score is quite stable in the short run and gradually increases after some time.

Hence, Run 1 showed results similar to what many researchers have found. The SERVQUAL score is very unstable and is primarily due to the expectation construct (Texs, 1993). The SERVPERF score, a measure of customer's perception of performance, is more stable, with no sharp increase. As the ability to react to changing customer's needs is the key to meeting customer's expectation, the SERVQUAL measure is better than the SERVPERF measure in this aspect. The more stable SERVPERF measure for service quality may not be a timely reflection of the relative performance of the firm to customer's expectation. In a situation where the service firm is performing below customer's expectation, the firm may misperceive that it is doing well and does not improve its performance accordingly to meet customer's expectation. In such cases, the SERVQUAL seem a better measure as it tells the firm that it is performing below customer's expectation and need to improve.

SIMULATION RUN 2

The environmental conditions remained stable but the firm changed its goals towards service quality. Instead of the strategy of meeting customer's expectation in the base model, the firm attempted to pursue a strategy of outperforming customer's expectation. This seemed to be a strategy that many service firms are currently pursuing and the dynamic model seek to understand the implications of such a strategy.

Service Quality Index = 1.1
*Desired Performance = Service Quality Index * Customer's Expectation*

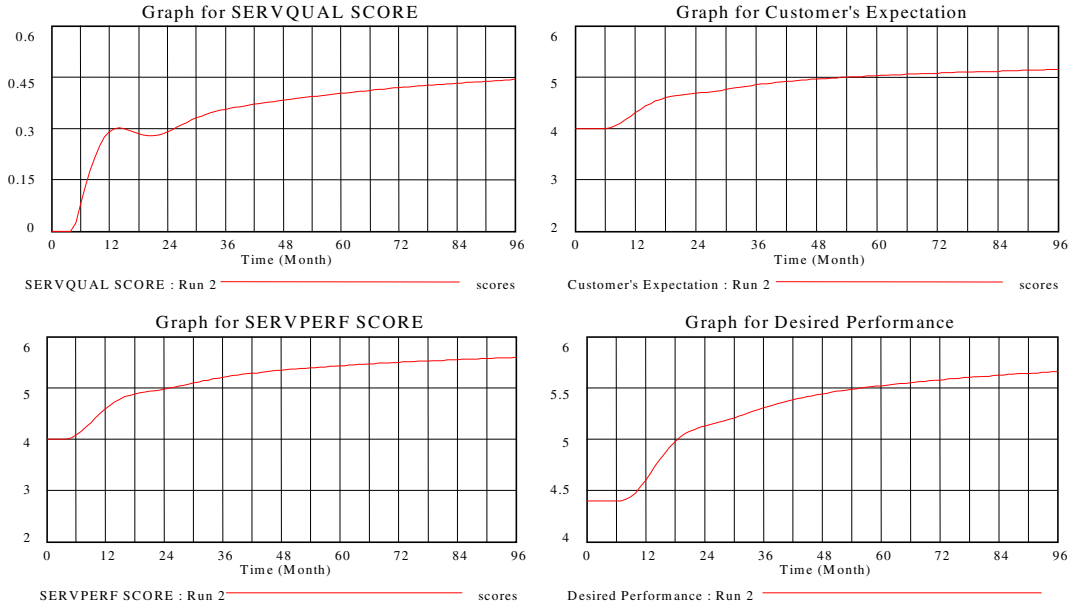

Figure 4: Simulation Run 2

The SERVQUAL score increased over time as the firm outperformed the customer's expectation and increased customer's satisfaction. It was observed that the SERVQUAL score only increased after time = 4 although the firm started to pursue their new strategy from the very beginning. This further demonstrated the existence of inherent delays, and actions by the managers will only be effective after some delay.

More importantly, Run 2 illustrated that although the manager had no intention of increasing the customer's expectation, it increases after some time. The only change in the micro-world was a shift of strategy towards higher service quality (outperform customer's expectation) but this caused the initial customer's expectation to increase.

To pursue a strategy of outperforming customer's expectation, the firm increased its investments, which drove up the firm performance above the customer's expectation after some delay. The increase in customer's perception of performance will give the customer a higher expectation in future encounter with the service firm. This increased expectation drove the firm to further increase its capacities in order to cater to the rising customer's expectation. This developed into a vicious cycle.

As illustrated by the graphs, an increase in the SERVPERF score will eventually lead to an increase in customer's expectation. This will cause the firm to increase its capacities further in order to maintain its goal of outperforming customer's expectation. This reinforcing archetype imbedded in the service delivery system will create an ever-increasing trend in both the customer's expectation and the firm's performance. As the only stable state in this microworld occurs when customer's expectation equals to customer's perception of performance. The firm cannot pursue a strategy of outperforming customer's expectation unless they are committed to increasing their service capacities continuously.

SIMULATION RUN 3

Industry Multiplier = 1 + STEP (0.1,4) + STEP (0.1,8)
*Desired Change in Capacity (3a)=0.5*Desired Change in Capacity (1)*
*Desired Change in Labor (3a)=0.5 *Desired Change in Labor (1)*
*Desired Change in Capacity (3b)=1.5*Desired Change in Capacity (1)*
*Desired Change in Labor (3b) = 1.5*Desired Change in Labor (1)*

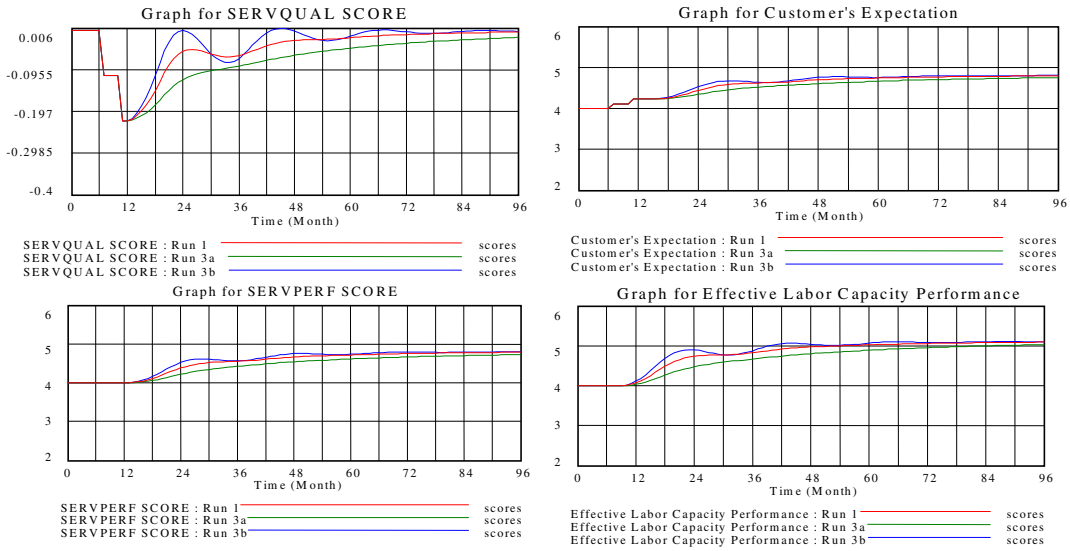

Figure 5: Simulation Run 3 Results

As seen in RUN 1, the instability in the SERVQUAL score was mainly due to the delays inherent in the system. With this embedded reinforcing archetype, for managers who do not account for these delays when they make their decisions, the SERVQUAL score may become worse. In reacting to the changing customer's expectation, an impatient manager causes the SERVQUAL score to fluctuate more than necessary, further reinforcing the idea of an unstable customer's expectation.

The inputs to Run 3 were similar to those in Run 1 except for the tolerance for pressure to change. In Run 3a, it was assumed that the managers had a higher tolerance for pressure, i.e., less capital and labor investments are made for the same pressure to change and performance gap. Run 3b depicted the managers with a lower tolerance for pressure, i.e., they were more impatient in their investments.

Run 3a and 3b showed the tolerance to changing its capacities to meet changing customer's expectation affected the stability of the SERVQUAL score. The higher the tolerance, the more stable will be the SERVQUAL score as illustrated by Run 3a. When the tolerance was reduced as in the case of Run 3b, the SERVQUAL score became extremely unstable and fluctuates drastically.

A check with the Graph of Effective Labor Capacity showed that in Run 3b, effective labor capacity increased to meet rising expectation and then fell when the managers realized that they made too much investments. This could be due to their impatience in waiting for the effects of their investments to surface. When the managers' tolerance to changing customer expectation was low, they tend to change their capacity to meet changing customer's expectation easily. Any discrepancy in between their actual and desired performance will cause them to adjust investment accordingly.

In addition, they did not consider the effects of delays in the service delivery system in their decisions. Before the effects of their previous additional investment are apparent, they have invested more as they did not see the expected increase in performance. They have failed to realize the rationale of "Taking two aspirin and wait". Before the effects of the aspirin are felt, they have taken too much and inevitably suffer from an overdose in the end.

SIMULATION RUN 4

In SERVQUAL literature, it is not clearly stated how often the SERVQUAL measure should be assessed. The frequency at which SERVQUAL is assessed is the key to how reactive the firm is to the changing customer's needs. The SERVQUAL measure serves as an indicator of how the firm is performing with respect to the customer's expectation. Hence, if the SERVQUAL score is collected infrequently, by the time the firm realizes that they are performing below customer's expectation, it may be too late for a timely measure to be taken. On the other hand, the firm may be incurring extra cost if they conduct the SERVQUAL measure too frequently. In this case, Run 4 assumed that the SERVQUAL score is immediately acted upon.

Run 4 was based on the same inputs as Run 1 except that in this case, the frequency of the SERVQUAL measure was changed from once every month to once every six months.

Industry Multiplier = 1 + STEP (0.1,4) + STEP (0.1,8)
Frequency of Test = 6

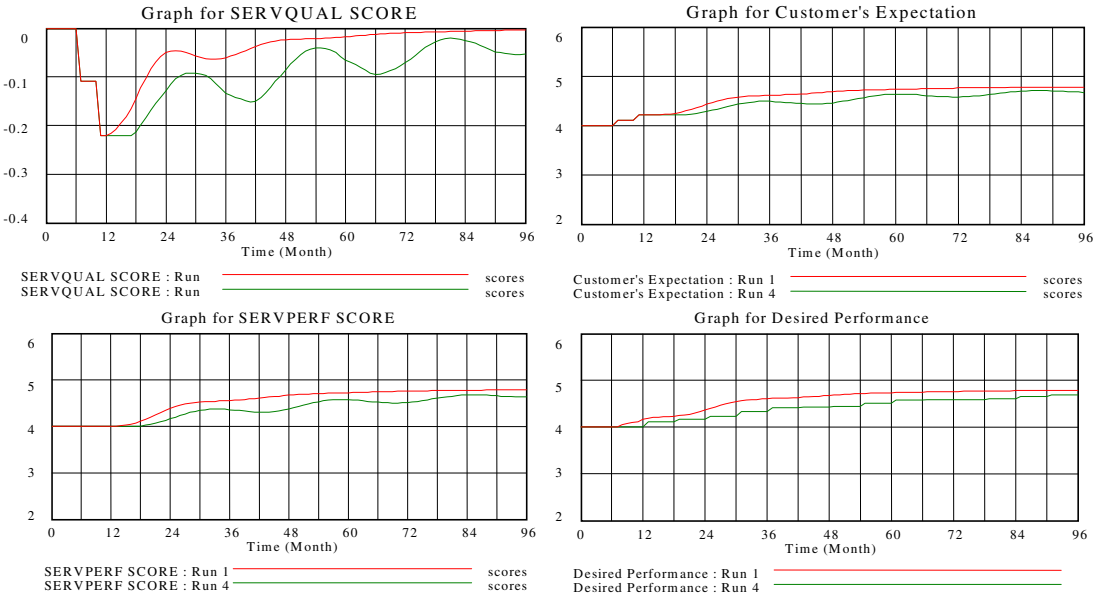

Figure 6: Simulation Run 4 Results

As expected, the SERVQUAL score for Run 4 was less stable than that in Run 1. In addition, since the feedback to the firm was now once every six months instead of monthly there was be a longer delay before the firm realized the change in the customer's expectation. Hence, desired performance only increased after a longer delay as compared to that in Run 1 (refer to Graph for Desired Performance). Furthermore, the fluctuation in the SERVPERF score was more drastic as the firm had to make a bigger adjustment in order to meet its desired performance. In addition, as illustrated by the Graph of SERVQUAL scores, it took longer for the firm to return to its desired service quality. Hence, its seems that the frequency at which the firm conduct the SERVQUAL measure will determine the ability of the firm in reacting to the changing customer's needs.

Discussion

Run 1 indicates that the instability in the SERVQUAL measure is due to the inherent delays and feedback in the service delivery system and not in the SERVQUAL measure. This supports ***Proposition 1***.

Findings from Run 1 suggest that the instability in the SERVQUAL measure is due to the ability of the expectation construct in capturing the changing needs and desires of the customers. As service quality is the ability to meet customer's changing expectations, the SERVQUAL measure is definitely a better measure than SERVPERF. This observation supported ***Proposition 2.*** Therefore, argument by researchers that the SERVPERF measure is more stable than the SERVQUAL measure in capturing service quality should not be viewed negatively.

Run 2 illustrated the effects of the reinforcing loop archetype inherent in the service delivery system. As customer's perception of performance forms the basis for the formation of future customer's expectation, the only equilibrium state in the service delivery system is when customer's expectation equals customer's perception, which is supportive of ***Proposition 3***. Whenever the firm improves its performance, increases in customer's perception will lead to increases in customer's expectation until the latter matches the performance of the firm. This raises the question of whether it is feasible to outperform customer's expectation as the only possible equilibrium state in the service delivery system in the long run is when the SERVQUAL score is zero.

Clearly, Run 2 suggested that in a competitive market, if the service firm wants to pursue a strategy of outperforming customer's expectation, the firm must be prepared to continuously increase its performance to meet the rising customer's expectation. Unless the firm can maintain the costs of such a strategy, this strategy is not likely to give the firm a sustainable competitive advantage in the long run.

Deducing from the conclusion suggested by ***Proposition 1***, if the instability in the SERVQUAL score is due to the inherent delays and feedback embedded in the service delivery system, then the SERVQUAL score will become more unstable if managers do not account for the effects of such delays.

Based on an understanding of the implications of delays and feedback inherent in the service delivery system, the frequency at which the SERVQUAL score is assessed and acted upon will determine the ability of the service firm to react effectively to customer's changing needs. As shown by the results in Run 4, when the SERVQUAL measure was assessed and acted upon every six months rather than monthly as in Run 1, the SERVQUAL score became less stable. It also took the firm a longer time to get back to the equilibrium of meeting customer's expectation.

When the firm conducts the SERVQUAL score monthly, managers will discover the changes in customer's expectation earlier and timely measures could be taken to improve the firm's performance to match increasing customer's expectation. As suggested by ***Proposition 4***, the microworld shows that the frequency at which the SERVQUAL scores are measured and acted upon affects the firm's ability to react positively to the changing customer's expectation.

Proposition 2 suggests that both the SERVQUAL and SERVPERF measures have their merits, depending on the firm's performance relative to the customer's expectation. Illustration of the effects of the reinforcing loop archetype in Run 2 shows that increasing performance above customer's expectation will eventually leads to an increase in customer's expectation. This observation implies that if the SERVQUAL score is used as a driver for improving service performance above customer's expectation, this driver becomes a moving target and there is a tendency for service capacity to escalate in the long run. Hence, in this aspect, SERVQUAL does not seem to be a good driver. SERVPERF, which is just the customer's perception of firm's expectation, seems to be a better driver in such cases. SERVPERF will give the firm a stationary target to work towards and the firm service capacity can be kept to a manageable level.

However, where the firm is performing below customer's expectation, both the SERVQUAL and SERVPERF measures become stationary targets. In fact, in such cases, SERVQUAL becomes a better driver as it gives a more objective goal to the service firm; to meet customer expectations. This is an important advantage as the key to success in the service industry is to meet the changing customer's needs and desires. Therefore, the ability of the SERVQUAL measure to objectively drive the service firm towards meeting customer's expectation gives it the edge over the SERVPERF measure. Hence, both the SERVPERF and SERVQUAL measures have their merits, depending on the firm's performance relative to the customer's expectation.

Conclusion

First, the instability of the SERVQUAL measure arises primarily from the delays and feedback inherent in the service delivery system. Contrary to arguments by researchers, the instability in the SERVQUAL measure should not be viewed negatively as it captures the inherently unstable expectation construct and the delays and feedback in the service delivery system.

Second, the model illustrates the ability of the expectation construct in capturing the changing needs of the customers. As the ability to meet customer's changing needs is key towards excellent service quality goals, the model supports Parasuraman's (1994) argument that the expectation construct is an essential component in service quality. Hence, the importance of the expectation component in shaping the firm's service quality goal cannot be overlooked. The delays and reinforcing loop structure inherent in the service delivery system also suggest that both the SERVQUAL and SERVPERF have their advantages. SERVQUAL will be a better measure if the firm is performing below customer's expectation. This is because it gives the firm a more objective target (customer's expectation) to work towards. However, due to the effects of the inherent reinforcing loop structure in the system, SERVPERF scores provide the firm with a stationary objective to work towards when the firm is performing above customer's expectation. Hence, managers can use both the SERVQUAL and SERVPERF measures as drivers towards excellent service quality, depending on the firm's performance relative to customer's expectation.

Third, the dynamic model also shows that the reinforcing archetype is embedded in the service delivery system. The only possible equilibrium state in the system is achieved when customer's expectation equals to customer's perception. This is contrary to current service quality literature that exhorts outperforming customer's expectation. This observation raises question about the feasibility of outperforming customer's expectation in the long run. The dynamic model has also illustrated the importance of accounting for the delays and feedback inherent in the service delivery system. The SERVQUAL score will become more unstable and fluctuates even more drastically if managers fail to consider the effects of such delays in the system. Hence while striving towards excellence in service quality, managers need to constantly account for these delays.

Finally, the dynamic model also provides a more holistic view of the service delivery process. It gives a richer understanding of the behavior of the service delivery system in a dynamic environment, as it captures and allows managers to analyze the effects

of changing customer's needs and desires. More importantly, managers can now experiment with their strategies in a computer model before putting them into actions. Flaws that are not obvious in a new strategy can be identified and resolved before the strategy is applied to the actual service delivery system. With the cost of failure in the microworld being negligible as compared to that in the real world, the firm can readily try out the new strategy with little financial risk.

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