THE IMPORTANCE OF THE BULLWHIP EFFECT IN SERVICES SUPPLY CHAIN AND A RESEARCH IN THE TELECOMMUNICATION SECTOR

Hizmet Tedarik Zincirlerinde Kamçı Etkisinin Önemi ve Telekomünikasyon Sektöründe Bir Araştırma

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Abstract

The factors that cause the bullwhip effect are described well in the goods supply chain, but those factors have different validity regarding services. Five different situations could explain the bullwhip effect in service supply chains. Those are backlogs, customer feedback frequency, the return point, waste impact, and the lack of administrative data. Within the scope of research, we are trying to examine the causes of the bullwhip effect in the service sector in Türkiye. Therefore, a company in the telecommunications industry within the service sector in Türkiye was chosen as the scope of the research. In this case, the sample was selected according to the probability of case occurrence instead of random sampling because of the ongoing research to develop the theory in the service sector. For these reasons, research is exploratory research. In this context, the data collected by interviews was classified with content analysis and tried to illuminate the research question and fifteen propositions associated with research questions. The causes of the bullwhip effect are discussed within the limits of samples.

Keywords: Service supply chain, bullwhip effect, supply chain

Özet

Kırbaç etkisine neden olan faktörler mal tedarik zincirinde iyi tanımlanmış ancak bu faktörlerin hizmetlere ilişkin geçerliliği tartışmalıdır. Hizmet tedarik zincirlerinde kırbaç etkisini beş farklı durum açıklayabilir. Bunlar birikmiş işler, müşteri geri bildirim sıklığı, geri dönüş noktası, atık etkisi ve idari veri eksikliğidir. Araştırma kapsamında Türkiye'de hizmet sektöründe kırbaç etkisinin nedenlerini incelemeye çalışıyoruz. Bu nedenle araştırmanın kapsamı olarak Türkiye'de hizmet sektöründe yer alan telekomünikasyon sektöründe bir şirket seçilmiştir. Bu durumda, hizmet sektöründe teoriyi geliştirmek için devam eden araştırmalar nedeniyle örneklem, tesadüfi örnekleme yerine vakanın ortaya çıkma olasılığına göre seçilmiştir. Bu nedenlerden dolayı araştırma keşfedici araştırmadır. Bu bağlamda görüşmeler yoluyla toplanan veriler içerik analizi ile sınıflandırılarak araştırma sorusu ve araştırma sorularına ilişkin on beş önerme aydınlatılmaya çalışılmıştır. Kırbaç etkisinin nedenleri örneklem sınırları dahilinde tartışılmıştır.

Anahtar Kelimeler: Hizmet tedarik zinciri, kamçı etkisi, tedarik zinciri

INTRODUCTION

Bullwhip effect can be defined as demand fluctuations seen in the steps of the supply chain from manufacturers to retailers (Lee, Padmanabhan and Whang, 1997: 96). Bullwhip effect, or in other words, the increase of demand fluctuations, can occur not only following the exchange between the supply chain members but also between different departments of the same company, which has an independent order policy (Holweg, 2005: 173). The reasons that cause the bullwhip effect are divided into four main factors. Those are non-zero demand signal processing and lead time, batch sizing, price fluctuations, and shortage games (Towill, Zhou and Disney, 2007: 446). According to Towill et al. (2007: 449), solutions to reduce the bullwhip effect can be divided into two main categories: improving each supply chain unit's operational contribution and efficiency, enhancing supply chain structure, and developing relationships within the supply chain. Towill's other article with McCullen (2002: 171) divides them into four categories. These are sharing information within the data point of sale, creating groupings within the channel to exchange decision-making rights, reducing order lead time, and eliminating forecast updates. Wikner, Towill and Naim (1991: 243) have grouped the solutions under five main headings. These five main headings are improving the decision-making rules of each level, better transforming the regulations to be used between the levels, reducing postponements, removing some distribution steps, and ensuring a better flow of information sharing throughout the channel. On the other hand, Lee et al. (1997: 46) grouped under three headings: information sharing, channel integration, and operational efficiency.

However, these studies conducted in goods supply chains have different validity regarding services. There is a growing literature on the bullwhip effect in the service supply chain. Akkermans and Voss showed in their study in 2013 that there is a bullwhip effect in the service supply chain. Anderson, Morrice and Lundeen (2005: 220) explained the dynamic behavior of service supply chains through diversifying demand and information sharing. Like manufacturing supply chains, service supply chains must also carefully balance their supply with demand. Analyzing demand patterns and their subsequent variations is crucial to improving service supply chain management (Ramish, Hamid and Nadarajah, 2022: 287). This study provided the infrastructure conditions for the bullwhip effect in services. Since there is no area in the service supply chain where final products can be stocked, as in the classical product supply chain, service providers must arrange their workload very well. While some researchers position the service supply chain only under the service sector (Ellram, Tate and Billington, 2004: 25), others say the service supply chain should be placed under the production and service sectors. This is because many sectors have a mixed supply chain network, meaning they must keep stocks and backlogs under control. Five reasons that may cause the bullwhip effect in service supply chains are backlogs, increased customer contact frequency, return point, waste effect, and lack of managerial understanding (Akkermans and Voss, 2013: 775).

Within the scope of the research, we examined the reasons for the bullwhip effect in the service sector in Türkiye. For this reason, this study focused on a company in the telecommunication sector within the service sector in Türkiye. This choice is because the ongoing research in the service sector aims to develop the theory. In this case, we employed the logic based on the possibility of repeating the selected sample instead of the random sampling logic. In this sense, the research is exploratory. In this context, the data collected by the in-depth interview method was classified by the content analysis method, and the study's central question and fifteen related propositions were tried to be elucidated. Within the limits of the sample, the possible causes of the bullwhip effect were discussed.

In this context, the data collected by the in-depth interview method was classified by the content analysis. The central question of the research and fifteen related propositions were elucidated. Within the limits of the sample, the possible causes of the bullwhip effect were discussed. The factors that cause the bullwhip effect in the service sector in Türkiye have been clarified. Consistent with the prior empirical findings (Akkermans and Voss, 2013), results revealed serious evidence regarding the backlog of work, frequency of customer feedback, and lack of managerial data. However, the findings showed no supporting evidence regarding the return point and waste impact. In this sense, while contributing to theory development efforts in this field, we aimed at pioneering studies on this subject in Türkiye, potentially shaping future research and academic discourse. In addition, the study included propositions to investigate the origins of these reasons. Besides, we identified the effects of errors in information processing, decision-making, and implementation regarding work accumulation. The authors further observed that business accumulation increases the frequency of customer feedback. Study results

indicate that a decrease in service quality and increased repetitive tasks cause a reduction in productivity. However, our findings yielded no relationship between the decline in productivity and the occurrence of a return point. The waste impact could not be detected during the automation process because the relevant company's workload was not in this area. Lastly, the results suggest that the need for a managerial perspective and supply chain perspective plays a significant role in forming managerial knowledge deficiency.

1. Service Supply Chain

Those working on service operations management have researched the service supply chain more than those working on supply chain management. One of the arguments is that trying to explain the service supply chain with models developed based on classical product supply chains neglects the nature of the service supply chain (Sampson, 2000: 350). Researchers from this perspective point out that the service supply chain is a network, not linear, like the classical supply chain. In addition, service is fundamentally shaped by being in contact with the customer during service delivery (Cook, Goh and Chung, 1999: 326). It is a value created by the service provider and the customer (Vargo and Lusch, 2004: 2). Since there is a situation of co-creating value, it is possible to talk about a two-way flow (Sampson, 2000: 350). Therefore, it is possible to define service as the mutual interaction process of the producer and the customer. Rather than a process, the service supply chain is a network of multiple process management units that direct interdependent service processes. The process management unit refers to the companies, customers, or customer associations participating in the process (Sampson, 2012: 184). Several distinct differences between goods and services affect the structure of the service supply chain. For example, creating warehouse areas to meet excess demand is impossible. Instead, work for piles up; there is waiting in queues, or an appointment system is used (Rajani, Heggde, Kumar and Bangwal, 2023: 2814). In addition, demand management is also frequently used in the service sector. For example, in air transportation, demands are managed through space control (Kimes, 1989: 351). The most distinguishing factor in the service process is the participatory role of customers. Based on this fact, it is a reality that while customers are the group that causes a great diversity in service, customers are also in the group that complains about the inconsistency of services. It is possible to talk about five different varieties in the service sector. These are emergence diversity, demand diversity, feasibility diversity, subjective preference diversity, and stimulated customer diversity (Frei, 2006: 92).

2. Bullwhip Effect on the Service Supply Chain

Although service supply chains have some similarities with goods supply chains, they have significant differences, such as the service sector and reasons for the bullwhip effect. Creating business accumulation rather than constructing warehouse areas is the critical element of the service supply chain. The interaction between workload and quality causes fluctuation, which causes errors to increase as we move up the supply chain, and the increase in these errors causes the workload to increase again. Sales campaigns, overtime, and errors triggered by volatility cause more volatility (Akkermans and Voss, 2013: 772). In another study, Anderson et al. (2005: 220) investigated the conditions in which the bullwhip effect can be seen in the service sector through the system dynamics model and the conditions in which the bullwhip effect shows an increasing impact instead of a decreasing effect in the supply chain phase. According to the results found here, the bullwhip effect increases at every level of the supply chain with the increase in underlying demand, and this leads to the expansion of the bullwhip effect literature. Accuracy of demand information reduces the fluctuation range in the decision to increase capacity to meet demand. However, reducing first-tier service deferrals increases capacity volatility, which increases hiring, training, firing, and related costs, while backlog volatility decreases. As the backlog decreases, something must absorb demand uncertainty and capacity in the service sector. Therefore, there is a trade-off between reducing backlog variance and increasing capacity cost. Five reasons that may cause the bullwhip effect in service supply chains and their interaction are discussed below (Akkermans and Voss, 2013).

2.1. Backlog

Ellram et al. (2004: 25) have stated that delays in the managerial control cycle are crucial to the occurrence of the bullwhip effect. What can be added to this premise is that backlog diversity is a manifestation of the bullwhip effect in the service sector (Anderson et al., 2005). Researchers studying

control theory and system dynamics have suggested three types of postponement, from the occurrence of a change in the physical system to the implementation of actions that will correct the change in this physical system (Akkermans and Voss, 2013: 773). (1) Errors or delays in the information processing process: How long does the company realize it needs to increase capacity? (2) Errors or delays in the decision-making process: How long did the firm decide what action to take? (3) errors or delays in the implementation process: How long did it take the company to implement its decision on capacity adjustment?

2.2. Increase in Frequency of Customer Contact

Customers are co-producers of services, and when there is a problem with service production, they tend to contact units directly at the next level within the service supply chain. This contact is usually made by phone or e-mail. Additionally, the number of callers is one of many determinants of the volume of customer contacts. Another reason for the increase in customer contact is the frequency of contact. A company that receives one or two calls per customer per year under normal circumstances may make one or two calls daily when a problem is encountered until the issues are resolved. Research in the retailing literature shows that the longer these problems last, the more annoying customers can become. Therefore, as the problem of customer pool grows, the additional calls from these customers also increase (Anderson et al., 2005: 221). Customers' contact with companies and the impact of these communications varies greatly. However, delays in meeting customers' needs or problems in the service sector cause backlogs. This leads to an increase in the frequency of customer contact (Akkermans and Voss, 2013: 774).

2.3. Return Point

If employees do not have to work overtime for long periods in a row, they will not have difficulty completing their daily tasks and will have a small amount of extra workload. The constant increase in workload, in return, can lead to everything going wrong after a certain amount of procrastination since the accumulated workload exceeds what employees can handle. This will reduce productivity and increase errors. If this process continues, the number of accrued jobs will increase exponentially, and at some point, employees will drown in the work swamp. This is called a rework cycle (Olivia and Sterman, 2001: 896) and is consistent with tipping point behavior (Akkermans and Voss, 2013: 778). If something is quietly increasing, nothing is visible in the first place. However, after a return point is encountered, significant changes in behavior and events are observed, as if everything happened simultaneously. Employee burnout is observed as the time to return to normal takes longer. As employee morale and capacity decline, more employees take sick leave than usual. The increase in employee turnover further reduces capacity, and the situation worsens (Olivia and Sterman, 2001: 897). Business accumulation also leads to changes in customers' behavior. Under normal circumstances, customers who meet with helpful, understanding, and polite employees tend to be more patient to receive the best response to their requests. Nevertheless, this situation changes when under pressure. As workload increases and employee morale simultaneously decreases, they begin to need more time and ability to deal with customers appropriately. This situation causes customers' behavior to change negatively. Patience and goodwill evaporate in a very short time. Customer contacts and complaints are increasing (Akkermans and Voss, 2013: 779).

2.4. Waste Impact

Quality-related issues disproportionately impact employee needs in highly automated service processes. Take, for example, a situation where, under normal circumstances, five percent of customers' queries fail to be answered automatically. This five percent slice is defined as order waste. The information technology system provides error warnings for these queries, which are transferred to the standard service process as order waste. Employees resolve these five percent of queries. Suppose that a five percent point in customer inquiries answered by the automated system is exceeded. In that case, this may seem reasonable, but if this increase continues to grow from five percent to ten, the need for the number of employees to whom these problems will be transferred doubles. Thus, decreases in quality or increases in problems considered relatively reasonable in automated service processes cause significant increases in workload requirements. The increase in workload is more tremendous in automated service processes than in non-automated service processes. This increase is a potential cause

of the bullwhip effect for both the focal company and the supply chain. Quality problems such as rework caused by waste constitute a significant part of the backlog. A slight increase in sales in an automated process results in a significant increase in order waste. The customers with orders that cause this increase are the group that increases the searches. The waste impact within an imperfect information technology system causes increased demand upstream within the supply chain (Anderson et al., 2005: 222).

2.5. Lack of Administrative Data

The bullwhip effect may only sometimes occur due to a triggering reason, such as a sales increase or technical problems. Proper capacity planning, rapid communication, and rapid response to unexpected situations can prevent this. If managers need help understanding the root of the problem, they will need to learn precisely how to avoid delays and volatility from occurring. If data is available but needs to be more straightforward for managers to read, they may need to recognize the increase in service backlog. For example, although waste effects manifest themselves routinely over time, managers may perceive this as something other than the beginning of a problem. Weekly management reports focus on orders received, competition, and managerial objectives, and the one or two situations where things could be going smoothly, which lead to small backlogs compared to orders received, are of little importance. Customer contact increases due to customers needing to be deemed worthy of reporting to managers (Akkermans and Voss, 2013: 778). However, managers have a high tendency to look at flow rates rather than looking at the accumulation of work accumulation. This creates a situation called stock/flow error. One of the reasons for this situation is that managers focus only on their own companies and do not overthink situations beyond the company's borders. The main reason for this is that managers in the service sector need a supply chain perspective. If managers do not tend to see the process from one end to the other, that is, in its entirety, they will ignore incoming data about this situation (Anderson et al., 2005: 223).

3. Research Methodology

Although the concept of goods supply chain is well defined, definitions of service supply chain are still open to debate. There is an obvious connection as we talk about the flow of tangible physical products in the commodity supply chain. These open links are the shortcomings of the service supply chain (Akkermans and Voss, 2013). Several distinct differences between goods and services affect the structure of the service supply chain (Rajani et al., 2023). Most of the four major causes of the bullwhip effect listed by Lee et al. (1997) appear to be related to goods rather than services. For example, bulk purchasing of services is not possible. For this reason, questions arise about the origin of the bullwhip effect in the service supply chain. What are the managerial actions triggered by or affected by the bullwhip effect? When these questions began to be discussed, research on the bullwhip effect in the service sector began to increase. It was put forward to talk about the bullwhip effect; the event must occur within the supply chain structure, there must be observable triggers, a delay must happen, and, most importantly, a fluctuation.

The scope of this research is limited to companies in Türkiye's service sector. This study focused on the telecommunications sector, considering that the ongoing research in the service sector is aimed at developing the theory. In this case, the logic based on selecting the sample from industries likely to be repeated or where similar studies have been conducted was used instead of random sampling logic (Eisenhardt, 1989: 541). In this study, we employed critical situation sampling to determine the sample. For this reason, department employees of a leading company in the telecommunications sector, which is known to be subject to the bullwhip effect, were included in the sample. Critical situation sampling is used in the presence of essential situations. A critical situation is in question when an event is expected to occur in one place, and the same event is likely to appear in similar situations. “It is the presence or absence of a judgment that if this group encounters this problem, all other groups encounter a similar problem.” Despite these judgments, critical situation sampling does not allow generalization. However, if rich and convincing data can be obtained as a result of the research, a limited generalization can be made (Yıldırım ve Şimşek, 2008: 110).

We employed an in-depth interview method, one of the qualitative research techniques. In-depth interviews are one of the most frequently used methods in social sciences. “It is defined as a mutual and interactive communication process based on questioning and answering style, carried out for a predetermined serious purpose” (Yıldırım and Şimşek, 2008:119). As an In-Depth Interview method, a

standardized open-ended interview approach was used because it reduces the bias or subjectivity of the interviewer. This approach minimizes subjectivity and bias, making it easier to analyze and increasing reproducibility. However, it can prevent the emergence of previously unforeseen events (Malhotra, 2020: 166).

Based on the findings of the research by Akkermans and Voss (2013), we investigated the causes of the bullwhip effect in the service sector in Türkiye and made managerial suggestions in this field while attempting to contribute to the theory-building effort pioneered by Akkermans and Voss.

In this context, the following research questions and propositions were created.

RQ: What factors caused the bullwhip effect to emerge in Türkiye's service sector?

P1: Errors in information processing cause backlogs.

P2: Errors in the decision-making process cause work to pile up.

P3: Errors in the application cause work to accumulate.

P4: Increases in backlogs cause a bullwhip effect.

P5: The accumulation of work causes an increase in customer callbacks regarding these works.

P6: Increases in the frequency of customer feedback cause a bullwhip effect.

P7: Increasing workload causes work efficiency to decrease.

P8: A decrease in people's service quality causes a reduction in work efficiency.

P9: Decreased work productivity causes a return point to occur.

P10: The occurrence of the return point causes the bullwhip effect to occur.

P11: Increased automation of services increases waste impact.

P12: Increases in the waste effect cause a bullwhip effect.

P13: Lack of managerial understanding causes an inability to access administrative data.

P14: Lack of supply chain perspective causes lack of access to administrative data.

P15: Lack of administrative data causes a bullwhip effect.

4. Analysis and Results

The content analysis method reached concepts and relationships that could explain the collected data. In this context, the data was coded within the framework of predetermined concepts shown in Table 1. Then, themes were determined, and the data were defined according to these codes and themes. Finally, the findings were interpreted.

Table 1: Pre-Prepared Code List regarding The Causes of the Bullwhip Effect

Possible Causes	**Antecedents of Causes**
Backlog	Errors Resulting from Information Processing
	Errors Arising from The Decision-Making Process
	Errors Arising from The Application Process
Customer Feedback Frequency	Postponed Work
Return Point	Work Efficiency
	Personal Service Quality
	Repetitive Tasks
Waste Impact	Impact of Automation
Lack of Administrative Data	Lack of Managerial Perspective
	Lack of Supply Chain Perspective

The people we interviewed using the in-depth interview method within the scope of this research are in an institution that provides internet service in the telecommunications sector. In addition to this primary service, the relevant institution offers its customers services that are close to the leading service. Within the scope of the research, to understand the process well and to fully handle the process from a distance, the authors consulted an expert from the purchasing department working under the supply chain management unit regarding the purchase of the necessary supplies for the service, a senior marketing manager involved in corporate marketing strategies, and customer relations. A sales manager who works jointly with the management, an expert from the sales department who makes the sale in delivering the service to the end consumer, a person working in the call center, which is a function of

the sales channel and stands out as the point where customer feedback is collected, and the necessary personnel in the process. Interviews were held with a human resources expert who had the information. With the information provided by these people, the authors attempted to determine the leading causes of the bullwhip effect in the service supply chain. In this context, using the telecommunications sector is deemed appropriate for the current study, given that its existence has been proven in various articles on the industry, which supports the principle of selecting a sector previously validated by empirical research.

As previously stated in the literature stage, the factors causing the bullwhip effect are grouped under five main headings: backlog, customer feedback frequency, return point, waste impact, and lack of managerial data. By researching the factors that are effective in forming these main headings, we attempted to make the analysis easier and gain information about the origins of the problems. To talk about the existence of the bullwhip effect, the relevant company must be included in the supply chain. There must be a visible disorder. Thirdly, there must be postponements. Finally, the fluctuation must appear. In this context, the company we consider is in a service supply chain. They are disturbed by the periodic increase in customer feedback. During this process, it is observed that waiting times for new jobs are increasing. It has been observed that, in specific periods, the increase in sales within the company remained lower than the increase in customer feedback in the relevant periods. In the same period, the total increase in customer feedback fell behind the total increase in negative feedback as a percentage. This shows the existence of fluctuation.

Between the emergence of physical problems in the formation of the bullwhip effect and the implementation of the necessary precautions, errors will occur in three different stages. These are errors in the information-processing process, errors in the decision-making process, and errors in the implementation phase. These errors are related to how long it took to notice the problem, how long it took to decide to solve the problem, and how long it took to put this decision into practice.

In the interviews about errors in the information processing process, the length of time it takes to notice the problem has been observed. The interviewer's opinion in the sales department on this issue is as follows.

"We sometimes give targets to channels. These targets can sometimes fall far short. In this case, we are investigating the reasons. Workload analyses are performed. "The load amount of the work we do, that is, the density during the day, is determined, and human resources determine the situation of excess or understaffing."

This stage is revealed in the meeting with the sales manager after the necessary sales figures are checked and the feedback received from the customers is evaluated. Regarding expectations, what can be done if such problems arise is ignored at the first stage.

"If I evaluate the infrastructure personnel needs from my perspective in the first place, we prepare a report in project-based studies and calculate what kind of things we need, especially in terms of personnel and technical, infrastructure, and administrative terms. An evaluation is made with returns on one side and costs on the other. We try not to change these needs, costs, and personnel needs too much within the project. However, from time to time, some projects progress much faster than we expected. For example, a channel with a target of 500 or 1000 reacts well above expectations and says you can make 2000 sales through me. The request comes from the customer, but we cannot respond immediately. At this stage, we need to revise our expectations. Considering it within the scope of such a project, it does not take less than two months to perceive this."

However, since the necessary workload studies are carried out only a few years and are handled at the request of the relevant department, errors in the information processing process cause work to accumulate on people. This confirms the first proposition.

"This study is not carried out every year. A study is carried out per the department's or top management's request. This is done following demand rather than a periodic increase."

Errors in the decision-making process arise from delays. In the relevant discussions on this subject, it was seen that the decisions may differ in terms of strategic importance. Still, if the applicable regulations about department budgets can be met, decisions can be made quickly and avoid causing too many problems in this context. However, it has been observed that making strategically essential decisions causes delays due to managerial decisions going through multiple levels, meetings being held to obtain the necessary approvals, and thoroughly explaining the problem taking longer. In this regard,

since the decision-making process continues with insufficient capacity, work accumulates until this process is corrected. This situation confirms the second proposition.

"Since such decisions come from senior management, this process can be time-consuming. It can take months. Capacity increase is a decision made by the senior management. If it is large, but if it is small, for example, we need voice-over on television, and this can be solved within 1 to 2 weeks, but this is subject to the budget limits of the department."

"It is about how much the capacity will be increased; it is impossible to increase the capacity that exceeds the general budget. However, the senior managers are contacted first if a capacity increase does not exceed the general budget. Then, the relevant unit is contacted, and the necessary procedures are carried out. While these processes take an average of 15 to 20 days, the necessary decision is made in around 45 days."

The fact that implementation takes a relatively shorter time than other processes after the decision-making phase is over due to training and that this training period is immediately put into practice because the employees perceive it as a phase of the decision-making process shows that no different problems are encountered at this stage. Although the education process is seen as the only postponement at this stage, this factor confirms the third proposition. In other words, mistakes in implementation cause backlogs.

"After the decision is made, it is implemented within a week. It is presented to senior management through the management decision system. Work begins as soon as senior management approves this system. Tenders are being held. Furthermore, people are wanted. Problems are resolved within a week at most."

At this stage, as stated in the literature, the formation of business backlogs for the three reasons listed above is the cause of the potential bullwhip effect. The feedback received and the fact that there is an increase in negative feedback in this context support these views. It may create the problems and fluctuations necessary to talk about the bullwhip effect. Even server-related errors that speakers consider a minor problem exponentially increase customer and negative feedback rates. In this context, the fourth proposition, that backlogs are a reason for the bullwhip effect, remains valid for the Turkish telecommunications sector.

"Of course, in the end, let me say this: even though our subcontractor provides us with a special service, we receive feedback about it (regarding its quality) because we offer this service to our customers. We have provided over 400 meeting transfer services, and although customer feedback is generally positive, we have received a small number of negative complaints. However, the malfunction in the servers on a particular day was the main reason for these complaints."

Interviews show that business accumulation has led to an increase in the frequency of customer feedback. What is meant by frequency in this feedback is repetitive feedback, as stated in the literature. In other words, specific customers increase the number of conversations they have with the service provider due to the problems they encounter. These can generally be viewed as negative feedback. The longer this backlog lasts, the more customers and employees will be affected and tense, causing this discussion to continue. This effect was tried to be eliminated thanks to the HRpartner system established within the company. Still, this process only has little effect other than accelerating the situation assessment within the company and shortening the time for customer relations. The relevant research also supports the accuracy of the fifth proposition.

"We generally get positive feedback. We convey negative feedback to subcontractors so that they can make the necessary adjustments. However, I must say that negative feedback usually comes from the same customers, and they do not stop calling until their problems are resolved."

It is thought that increases in the frequency of customer feedback will naturally increase customer feedback. Since the rise in this frequency generally comes from customers who encounter negative situations, the proportional increase in feedback and negative situations will multiply each other. For this reason, it is seen that it will cause fluctuations when compared to the sales figures of the relevant company. This idea is supported by the data obtained in the in-depth interview.

"Some days, I even think I talk to the same people repeatedly. We constantly face the same problems. Later, when this period ends, I can complete the day with fewer meetings."

The authors observed that senior managers skip the periods when productivity decreases, perhaps because they cannot obtain an individual impression when evaluating this. They think that the necessary evaluations only occur sometimes when productivity decreases due to factors such as the low

frequency of busy periods when the required working hours are adhered to. This suggests that a sub-cause related to the return point will not occur. However, studies conducted in human resources show the opposite result. Findings of the current study revealed that employees think that the increase in working hours, in which their workload increases, although periodic, affects their productivity, and at the same time, they are unhappy because they do not see the reward of this overwork. It is possible to observe that the increase in backlogs causes a decrease in work efficiency when lower-level employees and the human resources specialist evaluate the interviews.

"While working in another department, I often worked overtime there. Because work was so busy, I worked overtime and took work home. Expectations were very different there. As I said, we even worked at home. Whether it was presentations or the need to study tables, you could not get bored of the job, but it was very tiring. I thought I was not productive enough because I came to work tired. Sometimes, it made me feel like I was doing more work than I could."

Although service quality decreases are tried to be resolved in the shortest possible time, it has been determined that during this process, people are temporarily interested in correcting such problems or cannot deal with other customers because they are involved in the issue, causing a decrease in productivity. This confirms the eighth proposition: that decreasing people's service quality reduces work efficiency.

"It means that the delivery was made on time, the technical service was provided fully, and the product had unique features, leading to increased sales due to happy customers. Otherwise, although it remains valid, we are trying to make corrections as soon as possible."

To fully talk about the existence of a return point, it is expected that decreases in service quality and increases in workload will reduce efficiency, and such situations will begin to spread within the relevant department or company; in a sense, voices will rise, and a cycle will occur. While it was possible to establish a relationship with the conditions necessary for decreased productivity from the relevant situations, there was no evidence that these formed a consecutive cycle. Regarding the spread of this within the company, it is thought that sometimes such problems can be encountered within the departments, but they can be resolved quickly, and this does not turn into a bad atmosphere for the employees. Such issues can be solved without allowing a return point for the relevant company. Therefore, the proposition that reduced work productivity would cause a return point could not be confirmed. However, when considering the staff's past experiences, comments, and observations about other companies, it is evident that this situation can be mentioned. Even though such a relationship cannot be established within the relevant company, it is possible to talk about the existence of this relationship that significantly impacts the formation of the bullwhip effect.

"We have not encountered this kind of thing very often. This, of course, causes a serious decrease in performance. Of course, he is a person who works like this. Moreover, if you do not compensate for this, this may increase the pressure on employees. This may not be a big problem when working with a bonus system, as people know they will earn more when they work more. However, if such a situation is not the case, it will demotivate the employees. Even if one works with a bonus, after a while, the person who works too much explodes because he has no social life and cannot spare time for himself and his family. Even if there is a return, he starts not to want it. We have not encountered anything like this in the company."

The waste effect is explained as the fact that these tasks have to be done by personnel due to the functioning of the mechanism in an automated business process or due to malfunctions. This effect has yet to be observed in the relevant sector. The participants did not mention this issue and stated that they had not experienced such a thing when asked questions about it. A situation that may be effective in this case, contrary to the literature, is that, as stated by one participant, automated transactions need to catch up in Türkiye compared to abroad. Although there are automated services within the company, there is no follow-up mechanism regarding this situation, and feedback has yet to be received regarding this issue. Employees express the opposite opinion, stating that automation increases efficiency and provides service quality under higher conditions.

"We have operations management software. Thanks to this software, the service requested by customers is automatically displayed and scheduled on our screens. The system automatically creates the program, which is reflected in our subcontractor. Automating helps. Routine tasks do not have to be repeated again and again. In other words, there is a production line; in car factories, the bodywork,

doors, and engines are placed on the production line like this. Automation in our country is crucial for the work to go smoothly. We have not encountered any problems so far."

Since the formation of the waste effect cannot be observed in the relevant company due to the reasons mentioned above, it is impossible to comment on whether the waste effect is one of the reasons for the formation of the bullwhip effect. For this reason, the eleventh proposition, that increases in the waste effect cause the bullwhip effect, could not be confirmed.

From a managerial perspective, intentionality is defined as the management ignoring or not correctly evaluating an obvious fact. In this context, the most important thing that stands out within the company is that although the employees complain about their workload, this situation is ignored by the managers, even though human resources have conducted surveys and focus group studies on this issue and reported it to the managers. While the participants stated this, this was revealed in the interview with the senior manager. This shows that this type of issue is not accepted as administrative data. Therefore, the lack of managerial perspective causes the lack of managerial data.

"Since such decisions come from senior management, this can be time-consuming."

Although the company has a supply chain management department, it is clear that this issue still needs to be fully understood. Rather than considering the supply chain as a whole, the concept that most employees think about on this subject is purchasing and relations with supplier companies. It has been observed that the supply chain management department is more interested in the supplier relations process, and a holistic perspective on the chain cannot be developed. This leads to incorrect evaluation of some issues. While all participants stated that increasing the quality of the service provided, which can be accepted as a general truth, will improve the quality of the service provided, the benefits of suppliers monitoring the entire process can be ignored. This includes deficiencies in converting some decisions into managerial data since they are far from the supply chain perspective.

"I did not perceive the service supply chain fully. We see the service as a value-added service. We aim not only for profit but also for the company's prestige, which is important. We are the intermediary. We buy the service from someone else and sell it to the end customer. Our suppliers can be individuals and institutions."

In addition, the answers received from supply chain members to questions about customers showed that this group needed to be considered within the supply chain. This highlights the need for a supply chain perspective.

"Maybe it is already known, but our company is the second most loved brand in its sector. It was chosen as the second brand this year. Our relationship with our end customers is solid. We do a lot of work for them. We carry out these studies for their loyalty, to thank them, and because they are with us. I think our relations are generally very healthy."

We understand that due to the lack of managerial data resulting from the lack of managerial knowledge and the lack of a supply chain perspective, senior managers may take a long time to make decisions or make wrong decisions in some cases. They cannot respond quickly enough because they have difficulty understanding the cause of the problem. This causes the bullwhip effect, the fifteenth proposition, and the lack of administrative data. It confirms his proposition.

"If the capacity increase is a decision made by the senior management and it is of a large scale, it may sometimes take longer than expected to perceive the problem and evaluate the necessary solutions fully."

This research attempted to reveal the underlying reasons for the bullwhip effect in the Turkish service sector.

Therefore, we investigated the reasons for the bullwhip effect in the service sector and concepts such as backlog, feedback frequency, return point, waste effect, and lack of managerial data, previously suggested by Akkermans and Voss (2013). According to data obtained in this research, backlogs, feedback frequency, and lack of managerial data can cause a bullwhip effect. The return point did not occur because the company knew that such a situation might arise and could take the necessary precautions quickly. However, The views of the relevant participants on the possibility of things worsening if such a thing occurs might indicate that this might be one of the reasons for the bullwhip effect. Waste impact refers to situations that require the manual use of automated processes. As mentioned in the research, this field in the service sector in Türkiye has yet to reach sufficient density due to being behind compared to other countries. For this reason, companies in the industry do not encounter too many problems while benefiting from the positive aspects of this field.

As a result of the evaluations, many of these reasons are parallel to the characteristic features of the service sector. First of all, since stocking cannot be done to meet demand, as is the case with service products, increases in demand may lead to postponements and the need for capacity increase. Here, the choice that can be made in service supply chains is between postponements or capacity increases. The relevant company can decide by comparing the cost of capacity increase with the cost of the bullwhip effect that may arise due to the postponement of works. Postponements may reduce the workload in the short term and reduce the fees paid for overtime, but this increases customer feedback and negative feedback and may even lead to loss of business in the long term. This increases pressure on employees and reduces profitability.

One of the characteristic features of the service sector is that the customers of the service are also co-producers. For this reason, it has been observed that customers tend to be more involved in the process and increase their feedback frequency, especially during periods of problems. As revealed in the interviews, this effect increases the workload of the company's relevant personnel, which causes new jobs that are too challenging to handle and increases costs.

The waste effect and return point can be considered among the characteristic features of the service sector, but its relationship with the bullwhip effect was not observed in our research. The first of these, the waste effect, depends on a highly automated process, so waste does not occur when the process is not highly automated. Therefore, there is no need for personnel to handle these tasks. This effect is expected to reduce productivity due to increased variation in the jobs that staff would typically be required to handle. Given that the study did not have an extreme sample, it is understandable that the return point was not revealed. This point can be defined as where it becomes difficult to get things back to normal. This is a melting point. From this point on, the deterioration of work becomes a cycle; as work efficiency decreases, repetitive work increases and service quality decreases, and as repetitive work increases and service quality decreases, work efficiency decreases. It is possible to associate this with the workforce-based service sector. However, studying extreme examples to obtain more in-depth findings would be more beneficial.

In this context, fifteen propositions were made within the scope of the research. The situation regarding whether these propositions can be verified during the research process is as follows.

Table 2: Verification Status of Propositions

No	Proposition	Verification Status
P1	Errors in information processing cause backlogs.	Verified
P2	Errors in the decision-making process cause work to pile up.	Verified
P3	Errors in the application cause work to accumulate.	Verified
P4	Increases in backlogs cause a bullwhip effect.	Verified
P5	The accumulation of work causes an increase in customer callbacks regarding these works.	Verified
P6	Increases in the frequency of customer feedback cause a bullwhip effect.	Verified
P7	Increasing workload causes work efficiency to decrease.	Verified
P8	A decrease in people's service quality causes a reduction in work efficiency.	Verified
P9	Decreased work productivity causes a return point to occur.	It could not be verified.
P10	The occurrence of the return point causes the bullwhip effect to occur.	It could not be verified.
P11	Increased automation of services increases waste impact.	It could not be verified.
P12	Increases in the waste effect cause a bullwhip effect.	It could not be verified.
P13	A lack of managerial understanding causes the inability to access administrative data.	Verified
P14	A lack of a supply chain perspective causes a lack of access to administrative data.	Verified
P15	Lack of administrative data causes a bullwhip effect.	Verified

The effect that explains the role of management in the formation and development of the bullwhip effect is the need for more managerial information. The authors estimate that the presence of this effect will increase the incidence of the bullwhip effect. Although the managers in our sample resolved the bullwhip effect, it is not difficult to understand because they were not defined in this direction, and this concept was never mentioned in the interviews. This supports the view that the lack of managerial information is considered one of the reasons for the bullwhip effect. The lack of a supply chain perspective, one of the reasons this information must be included, is a clear indicator of why the bullwhip effect is not even brought to the agenda.

As a result, based on the research conducted, the factors that cause the bullwhip effect in the service sector in Türkiye have been clarified. In this context, while serious evidence was found regarding the backlog of work, frequency of customer feedback, and lack of managerial data, among the reasons put forward by Akkermans and Voss (2013), no supporting evidence was found in the context of the sample regarding the return point and waste impact. In this sense, while contributing to theory development efforts in this field, it is aimed at pioneering studies on this subject in Türkiye.

In the service sector, the bullwhip effect is among the potential causes of customer dissatisfaction and high costs. Therefore, the management needs to detect it promptly and take the necessary steps to prevent or reduce it. Managers must confront the fluctuations and the issues regarding which activities should be handled. In the service sector, fluctuations in demand and workload can occur due to customer demand, service updates, and technical problems. Customers' desire to be involved in the process may also cause this fluctuation. To meet these fluctuations, businesses may decide to increase capacity. These decisions can take place in a planned or unplanned manner. What a manager says during interviews regarding this issue is vital regarding awareness of the process.

CONCLUSIONS

The two basic strategies managers can use to combat the bullwhip effect are demand and capacity management. While demand management can prevent the bullwhip effect from occurring, capacity management is vital in reducing it. This research highlights some issues managers should be more careful about in demand management.

Automation, which could not be observed in this research, might be one of the points managers should pay attention to in the future because, in this research, we assume that this issue did not arise due to the insufficient level of development in Türkiye. For this reason, it would be beneficial to re-investigate it depending on developments in the coming years. At the same time, since automated systems have a particular technical infrastructure, it should always be considered that any malfunction in this infrastructure may cause unexpected fluctuations. At the return point, which is the other impact, it should always be addressed that the demand for service may sometimes come from new and old customers due to various problems. The basic strategy on this issue is based on a choice between the cost of having higher capacity and the cost of allowing delays. The cost of postponements may be much higher than expected due to the bullwhip effect.

The cost includes not only the cost of lost customers due to postponements but also the costs of reduced productivity due to the rapid increase in customer feedback and the pressure placed on employees to reduce postponements.

If the right strategy is not determined here, new fluctuations will likely occur if the bullwhip effect is caught unprepared at its peak. The research shows that the customer developed these strategies, and their adequacy is open to debate. It is observed that a strategy developed with a holistic flow perspective to the supply chain, rather than just customer-focused strategies, will be more successful.

In cases where the strategies developed to prevent the bullwhip effect do not work, methods to eliminate it should be created if the bullwhip effect occurs. In this context, the results obtained in the research show that it often takes a long time for managers to perceive the situation, decide on a solution, and quickly implement it. Therefore, to increase the visibility of this impact, each supply chain process should be closely monitored, along with any delays affecting the customer. Only in this way can managers perceive the total capacity of the service supply chain in response to demand and develop more appropriate solutions. Timely recognition of this situation prevents customers in the product supply chains from adopting scarcity behavior.

Bullwhip effect studies in service supply chains are in their early stages of development. Each of the topics touched upon in this research needs to be developed with new research. Examining the

effects of these reasons on the formation of the bullwhip effect through similar modeling will provide a deeper perspective. At the same time, research can be developed in service areas requiring more or less infrastructure and in places where automation is more. To understand some issues better, extreme examples can be taken. The most important limitation of this research is that the relevant sample offers the opportunity to observe a single-service supply chain. This poses an obstacle to generalizability. However, if supported by similar research, this situation can be resolved by researching larger samples. In addition, it is possible to develop research on mixed supply chains where products and services are offered together.

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