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서비스 시간 업무량과 서비스 레벨의 관계: 콜센터 운영 분석 관점

김 민 주(제1저자)
서강대학교 일반대학원 (박사과정)

김 민 균(교신저자)
서강대학교 경영대학 (교수)

The Relationship Between Service Work-load Time and Service Level: Call Center Operation Perspective

Kim, Min Joo(First Author)
Graduate School, Sogang University (Doctoral Student)

Kim, Minkyun(Corresponding Author)
Sogang Business School, Sogang University (Professor)

Abstract

The purpose of this research is using the call center's operational data, determine whether the service worker's processing speed is affected by the following workload: The relationship among the following workload on service time and service level were validated with hypotheses. For the empirical analysis, operational data from call center services in airline company are used. Using regression analysis, we observe a clear pattern of increasing service time (Aband Call, Average Hold Time, Average Handle Time) when the following workload is perceived as high. It reduces the level of service. Using operational

data from call center services, we show that the service time is increased by the following workload. We find that workers decelerate the service level as following workload increases. there is negative curved relationship between following workload on service time and service level. This means that if you feel that there is more work than a certain level, you cannot guarantee a consistent service level of the Customer Service Representative (CSR). If the call time (Aband Call, Average Hold Time, Average Handle Time), continues to increase, the call response time increases while service rate maintains. The provision of low service levels can be predicted due to delay in response time.

Keywords : Workload, Service Time, Service Level, Call Center, Operation Management

접수일(2023년 12월 09일), 수정일(2023년 12월 24일), 게재확정일(2023년 12월 25일)

I. Introduction

The need for this study is that research on call centers is still lacking, so a systematic study on field cases is needed. Previous papers in the field of service operation management assumed that service measurement occurs exogenously with the load level of the system. Using the call center's operational data, determine whether the service worker's processing speed is affected by the following workload: Observe a clear pattern of increasing service time (Aband Call, Average Hold Time, Average Handle Time) when the following workload is perceived as high. It reduces the level of service. The data raises a series of interesting research questions. (1) What factors lead to an increase in processing speed? Are staff simply responsive, or is there evidence that work is being completed late? (2) How does it affect service level? In order to answer these question, this research investigates factors affecting increasing service time. More importantly, it examines the relationship between the work-load time of providing service and service level.

Prior work in the area of customer satisfaction management, the role of call

centers has recently been highlighted. A call center, as a decisive place to solve customer problems at the closest distance to customers, can lead to customer satisfaction or dissatisfaction. One of the representative complaints is complaints about Queue times that are too long recent research has demonstrated that operating at high levels of utilization has many operational implications, including long Queue times (Hur, 2022). There also exists a significant body of literature that examines the relationship between the condition of work and employee's burnout in domestic airline call center (Yoon, 2007). Yoon consider that leading factors and outcome variables of Customer Service Representative (CSR)' burnout, and that the future study should focus on the outcome variables on how burnout affects employees' service attitudes and service level. As a result of these two trends, call centers have come under increasing pressure to operate at very high levels of utilization. From a macro perspective, high utilization is a desirable system property for a company and its employees, as it spreads the fixed cost over an increase in volume of customers. A low level of utilization (a high level of demand) leads to an increase in Queue times. A central assumption in this existing literature is that the service time, i.e., the time to care for a customer, is independent of the state of the process including the following workload. We observe a clear pattern indicating that the service time (Aband Call, Average Hold Time, Average Handle Time) increases with an increase in Customer Service Representative (CSR)'s following workload. Decision makers should thus take into consideration the full set of possible implications of a temporary increase in service levels. Thus, this research would fill the gap in the literature that high workload service time would make a negative impact on the representatives service level gradually, It also provides managerial implications that reducing process time for the representatives leads to more job satisfaction in providing their services. The remainder of this paper is organized as follows. In the next two sections, we present relevant literature and develop our hypotheses for a general model of service operations. We then operationalize our theory to the setting we study. We conclude with discussions and future avenues for research.

In order to achieve the research purpose presented above, this study is about the call center operation. First, a literature review on call center operation. Second, actual cases were analyzed and studied based on the operational status

and performance of call center. Third, based on the performance of the call center currently operated by company, the overall operational management of the call pattern analysis. The research on the operation method of the call center is limited to simply presenting or enumerating operational factors, and it is difficult to find a pattern analysis study through actual case analysis by using data from call center of airline company in Korea. Therefore, in this study, the pattern of employees is identified, and an efficient management plan is proposed.

II. Literature Review

In this paper, we present and validate a framework of service operations where workers vary their service rates with the state of the system. There also exists a significant body of literature dealing with health services, as reported by Kc and Terwiesch (2009). Many of these studies (Cho, 2004) explore the effect of various types of payment arrangements that incentive call center organizations into providing increase in quality of services. increase in quality is often achieved only at an increase in cost, of which workload and service rates are important contributors (Fuloria and Zenios, 2001). This stream of literature seeks to examine how, in the presence of unobserved cost factors, appropriate incentives can still be provided to call centers to induce increase in quality. In addition to this general research on call center operations. We contribute to this line of research by providing explicit evidence of the adaptive behavior in call center. For the service, we show that service level decrease when the following load on the system increases. Our work also extends prior studies of the impact of production system design on the productivity of employees. For example, using lab-based experiments, Schultz et al. (1998, 1999) consider serial production systems in which adjacent workers in a serial assembly line can observe each other's productivity, as measured by inventory levels between them. A key insight from this work is that workers tend to work faster or slower depending on the work in process inventory. Our objective in this paper is to demonstrate using actual operational data from a field-based study at an airline company, that Customer Service Representative (CSR) also demonstrate such adaptive behavior in response to the amount of following workload. In addition, the previous studies have not considered the aspects of stress that accompany service rate de-

celeration, or the impact on the level of service. our study augments the existing body of work to include the dimensions of stress and service level. Powell and Schultz (2004) show that when assembly line workers adapt to variations in load, they also improve the overall throughout of the system. One of the im-plications of our study is that the adaptive behavior of Customer Service Representative (CSR) decreases the overall process.

2.1. Definition of Call Center

The call center is recognized as a representative channel for the most active interactive communication between customers and companies. It is understood that the reason why customers prefer call centers is not only the convenience of being able to contact them at any time, but also the reliability of receiving vari-ous information through people. However, if you approach the call center in depth, you will feel the chaos as if you are looking at the human market of a multi-ethnic country due to the customers with various inclinations, the compli-cated IT system and communication equipment that support the call center, and the interaction between customers and Customer Service Representative (CSR). However, it was discovered that the fact that the call center is " a site where you can hear the voice of customers (VOC-Voice of Customer) most vividly, and an important customer relationship management channel that can promote customer satisfaction and profit creation activities at the same time ". Now, the call center is recognized for its existence as an important strategic point that cannot be left out in any area such as management strategy, marketing strategy, CRM strategy, and channel strategy. As a result, corporate marketers are stra-tegically choosing call centers in the process of developing new products, ex-ecuting marketing strategies to increase profits, and executing customer relation-ship enhancement programs. This is because the call center is an effective channel that can simultaneously perform various inbound telemarketing activities by people as well as the positive role of customer satisfaction activities. In ad-dition, today's marketing paradigm is changing from a mass marketing strategy that increases sales through indirect contact targeting an unspecified number of people to a target marketing strategy or one-to-one marketing strategy that si-multaneously engages in customer relationship management activities and sales

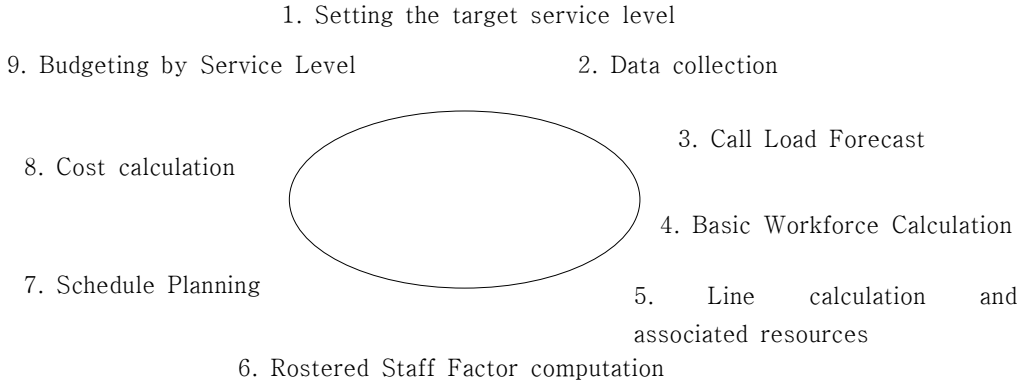
promotion activities while directly contacting customers. This is also the reason why call centers are selected as the largest execution channel for marketing ac-tivities including customer relationship management activities.

2.2 The operation management of the inbound call center

Call center operation management is Technology that enables the expected workload to be handled while maintaining the target service level and call quality level by calculating the appropriate number of required personnel and support resources and putting them in the right place in a timely manner.

As can be seen in <Figure 1>, According to the management process of the inbound call center process, the five main areas are Service Level (Call Quality), Forecasting, Scheduling, Staffing, and Operations Management. First, service level is one of the key evaluation indicators of the call center, and it is related to Average Speed Answer, abandonment rate, etc., and it is considered a speed to the standard.

<Figure 1> Management process of the inbound call center



2.3 Service Level

Definition of Service Level is X percent of calls answered in Y seconds. The criteria for service level are influenced by the value of the call, labor costs, line

costs, customer patience, and corporate attitude. Service levels and call quality are dependent, but closely related and must be managed at the same time. Maintaining a basic level of service is the most basic and essential thing. cf) Response rate: Percentage of calls answered regardless of time for incoming calls. There are Four Types of calculation method.

a. (Response calls within Y seconds + Waiver calls within Y' seconds) / (Response calls + Waiver calls)

b. Response calls within Y seconds / Response calls

c. Response calls within Y seconds / (Response calls + Waiver calls)

d. Number of response calls within Y seconds / (Number of response calls + Number of abandonment calls after Y' seconds)

A reasonable "response time" goal is needed to maintain consistent and appropriate service levels. Once the goal is set, the analysis and planning required to meet this level and address the customer will continue. The calculation of personnel, number of lines, scheduling, and budgeting are all determined by service level and response time goals. You can adjust it to suit the reality of the company.

2.4 Call Center Business Performance Metrics

As can be seen in <Table 1>, Anton (1997) presented performance indicators for each major task of the call center, which were presented as performance indicators for the call center and the details are as follows.

<Table 1> Performance indicators

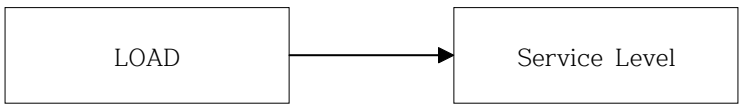
Service Level
Average Speed of Answer
Average Time in Queue
Average Talk Time

Average Auxiliary Time
Average After Work Time)
Average Blocking Rate
Average Handle Time
Average Abandonment Rate
Average Time to Abandon
Retrial Rate
Agent Utilization
Average Offered Call Volume per Hour
Average Handled Call Volume per Hour

III. Hypothesis

As can be seen in <Figure 2>, The hypothesis is that the increase in the following workload is perceived, the increase in the service time. This behavior can achieve response time and transaction time, but consequently wait time can last for a longer period. Workers may be motivated to work Pretending to do it when the workload of the Customer Service Representative (CSR)'s following task increases, but in the end, as the Customer Service Representative (CSR)'s following task seems vaguely numerous, it delays the service time of the previous task. Early research in the field of ergonomics showed that productivity decreased as stress increased. Tanabe and Nishihara (2004) studied changes in productivity using laboratory experiments and found that despite people being highly motivated in short-term experiments, they became stressed and reduced performance over longer periods of time with the onset of stress. Based on the discussion above, we suggest that service time is increasing as the of Customer Service Representative (CSR)'s following workload increases. To test the above hypotheses, we chose a call center service.

<Figure 2> Conceptual framework: The relationship between servcie workload and service level



Our theoretical framework is based on the relationships between service times,

workload, and service level. our hypothesis is that an increase in Customer Service Representative (CSR)'s following workload leads to an increase in service time, although each worker's productivity/service time gains may be achieved in the service level as we hypothesize, service level may not be reached due to Aband Call, Average Hold Time, Average Handle Time. During periods of increased load, a worker may be work slow with the work that they are handling now, because eventually stress effects may start to dominate. Early research in the field Tanabe and Nishihara (2004) use lab experiments to study changes in productivity and find that even though people are highly motivated in short term experiments, they become tired and performance deteriorates over a longer time frame as stress kicks in. our next consider the impact of the above effects of load, and service time on the level of service. We hypothesize that this decrease in the availability of resources can lead to a decline in service level. That is, Queue line will be longer because of increase in service time and who is admitted to an overworked unit has an increase in likelihood of encountering a quality lapse, as service workers who are more stressed are more prone to making rest and stay. the emotional labor behavior of Customer Service Representative (CSR) had a significant effect on job burnout. It was confirmed that it had no significant effect on decreased self-achievement and impersonalization. To test the hypotheses above, we choose airline call center data. A call center can be said to be a living comprehensive situation response center and customer happiness center of a company that touches customers. In particular, the importance of call center management has been recognized. Call center management goes beyond simply managing a call center and manages it professionally. However, in reality, call center management capabilities are very poor. In particular, the introduction of a more scientific management method is urgently required in that the productivity management system of the call center should be able to harmoniously handle the conflicting demands of "improvement of customer satisfaction" and "improvement of inefficiency" It is to derive the manpower scale and operation plan to achieve optimized operational efficiency with limited resources (manpower). aims to analyze the correlation by studying the efficiency of call center operation of company.

We address these two questions by conducting a detailed econometrics analysis of service processes (What factors lead to an increase in processing speed? How

does it affect service level?). In particular, we look at the resulting data of call center employees. Response processing time for each customer is measured and correlated with a set of covariates including current workload and cumulative stress or workload burden of service workers. This research design can make two contributions: First, it measures employee performance and shows that em-ployees adjust response time according to changing next load levels. Second, while employees can respond to increased workloads by maintain their pro-ductivity, we show that, in general, such productivity has a negative impact on service level. Employees will be stressed overwork when they feel that there is an exceptionally pressure of following workload. The effect of such workload can degrade service quality. In this paper, the goal is to demonstrate this behavior by service staff in response to the amount of Customer Service Representative (CSR)'s following workload, using real operational data obtained from field-based studies of airlines analyzed through regression analysis to investigate the rela-tionship between the following workload of call center Customer Service Representative (CSR) on the service level.

When employees are the factors that influence satisfaction or dissatisfaction with customers, the attitude of service employees affects the service level. Karasek (1979) suggested workload as a factor of job stress. Companies want to increase the service level with an existing Customer Service Representative (CSR)s rather than increase the number of Customer Service Representative (CSR)s. Conversely, it is inevitable to reduce the Queue Time or Wrap-up Time per consultation with a customer or to reduce the Customer Service Representative (CSR)'s rest time. Thus, irregular events occur, complaints in-crease, Average Talk Time, ATT increase, and exposed to risks such as verbal violence and sexual harassment from customers (Lee, 2016). The Customer Service Representative (CSR)'s workload can be evaluated as Aband Call, Average Hold Time, and Average Handle Time (Anton, 1997), and the increase in Customer Service Representative (CSR)'s following workload can cause job stress and negative effect on service levels (Lee, 2016). Through this, the fol-lowing hypothesis was derived.

Hypothesis 1: Customer Service Representative (CSR)'s following workload will have a negative (-) effect on service level.

If communication is sufficient when talking to a customer, and the number of Customer Service Representative (CSR)s exists, the requirements desired by the customer can be resolved more quickly. In addition, if the customers need is sufficiently delivered and the good service is provided, the quality of service perceived by customers will increase (Lee, 2016). However, if conversations with Customer Service Representative (CSR)s that can be delivered simply are unnecessarily prolonged, consistent service quality cannot be guaranteed not only to customers but also to Customer Service Representative (CSR)s who are providing services (Lee, 2016). Jung (2008) proved that excessive customer contact can lead to a decrease in service quality, and even if Talk Time increases above a certain level, service quality does not increase indefinitely. In particular, it shows that excessive communication time does not improve service quality. This means that maintaining an appropriate communication time for contact employees can reduce the emotional working hours of employees and control the efficiency of jobs and costs, and that companies do not need to unconditionally increase communication time with customers to improve service quality. It is inevitable that job stress exists, but not all stimuli induce the same stress. Boggs et al. (1968) conducted a study with different job difficulties and found that the more complex the job, the lower the task performance. This means that a person's processing ability is limited, and the more complicated and important the job becomes, the easier it is to be exposed to stress. If the difficulty of the job is low, expectations are lost, causing another stress. Quick and Quick (1984) classified stress into two stresses. Even if the job difficulty is low, the workload and service level are not necessarily inversely proportional in situations where stress occurs. In such a situation, the following hypothesis was established assuming that it would be a polymorphic (non-linear) regression relationship.

Hypothesis 2: The Customer Service Representative (CSR)'s following workload and service level will have a polymorphic regression relationship.

Lee (2016) verified the relationship between job stress and service quality to prove that job stress had a negative (-) effect on service quality. Therefore, this study further identifies the point at which the Customer Service

Representative (CSR) receives job stress from a certain point. Job stress refers to the psychological burden and nonconformity of an individual member due to inconsistent work characteristics or working environment with individual expect-ations or overload. In addition, it is the same as the theory of the Service Value Chain that causes a decline in the level and satisfaction of services delivered to customers and eventually reduces corporate profits. According to the job charac-teristics theory, job characteristics affect the psychological state of employees, which is shown to affect job attitudes (Hackman and Oldham, 1975). This study aims to find service level decrease point with actual data, job stress, and when fatigue.

IV. Analysis and Findings

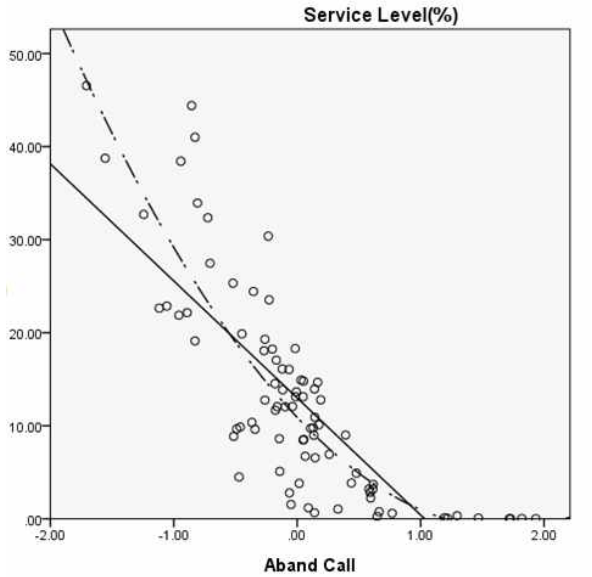
This study was analyzed through regression analysis to investigate the rela-tionship between the Customer Service Representative (CSR)'s following work-load of call center Customer Service Representative (CSR) on the service level. The data was collected from the reservation call center from one of airline companies in Korea. The data of workload and service level for each call was collected and measured at the same time. The reservation of airplane ticket with call center always takes longer time than customers' expectations. Thus, it has along waiting in the call and takes high workload service time.

A. Effect of Customer Service Representative (CSR)'s following workload on service level (Aband Call)

In order to find out the relationship between the Customer Service Representative (CSR)'s following workload and the service level, regression analysis was conducted by setting Aband Call as an independent variable and the service level as a dependent variable. As a result of testing the statistical sig-nificance of the model in which Aband Call of the call center counselor predicts the service level, the F-value was 138.934, and the level of significance was 0.000, indicating the service level at the significance level $p<0.001$. Therefore, it is analyzed that the Customer Service Representative (CSR)'s following workload has a negative (-) effect on the service level ($t=-11.787$, $p=0.000$). Based on

this, we adopt Hypothesis 1 that the following workload have a negative (−) effect on the service level. The following workload, regression for service level, and polymorphic regression graphs were different as shown in <Figure 3>. In the linear regression model, the service level was found to decrease as the Customer Service Representative (CSR)'s following workload increased, and in the polynomial regression model, it was found that the service level increased after a certain level. <Table 2> is the result of analyzing the Linear regression model and the Polynomial regression model (secondary curve). As shown in the <Figure 3>, both models were found to be significant at the $p<0.001$ level. However, if you look at the R^2 value, which means the explanatory power of the model, it can be seen that the Polynomial Regression model is higher. Therefore, Hypothesis 2 was adopted that the relationship between Aband Call and service level would lie in the Polynomial Regression.

<Figure 3> Effect of Customer Service workload on Aband Call



<Table 2> Model Summary

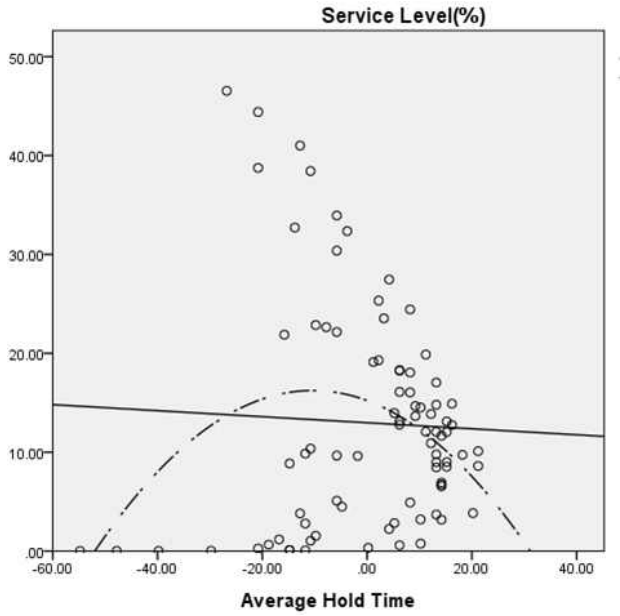
	R^2	F	df1	df2
Linear	0.629	138.934***	1	82
Quadric	0.718	103.213***	2	81

* : $p<0.05$ ** : $p<0.01$ *** : $p<0.001$

B. Effect of Customer Service Representative (CSR)'s following workload on service level (Average Hold Time)

In order to find out the relationship between the Customer Service Representative (CSR)'s following workload and the service level, regression analysis was conducted by setting Average Hold Time as an independent variable and the service level as a dependent variable. As a result of testing the stat-istical significance of the model in which the following workload of the call cen-ter counselor predicts the service level, F-Value was 0.145 and the level of significance was 0.705, indicating that the model did not significantly explain the service level. The following workload, regression for service level, and poly-morphic regression graphs were different as shown in <Figure 4>. In the linear regression model, it was found that the Customer Service Representative (CSR)'s following workload did not affect the service level, and in the polynomial re-gression model, it increased and then decreased rapidly after a certain level. <Table 3> is the result of analyzing the Linear regression model and the Polynomial regression model (secondary curve). As shown in the <Figure 4>, only the curve regression model was found to be significant at the $p<0.05$ level. Therefore, hypothesis 2 was adopted that the relationship between the Customer Service Representative (CSR)'s following workload and the service level would be in the Polynomial Registration.

<Figure 4> Effect of Customer Service workload on Average Hold Time



<Table 3> Model Summary

	R^2	F	df1	df2
Linear	.002	.145	1	82
Quadric	.084	3.732*	2	81

* : p<0.05 ** : p<0.01 *** : p<0.001

C. Effect of Customer Service Representative (CSR)'s following workload on service level (Average Talk Time, ATT)

In order to find out the relationship between the Customer Service Representative (CSR)'s following workload and the service level, regression analysis was conducted by setting Average Talk Time (ATT) as an independent variable and service level as a dependent variable. As a result of testing the statistical significance of the model in which the following workload of the call center counselor predicts the service level, F-Value was 14.013, and the level of significance was 0.000, indicating the service level at the significance level p<0.001. Therefore, it is analyzed that the following workload has a negative (-) effect on the service level (t=-3.743, p=0.000). Based on this, we adopt Hypothesis 1 that the following workload will have a negative (-) effect on the

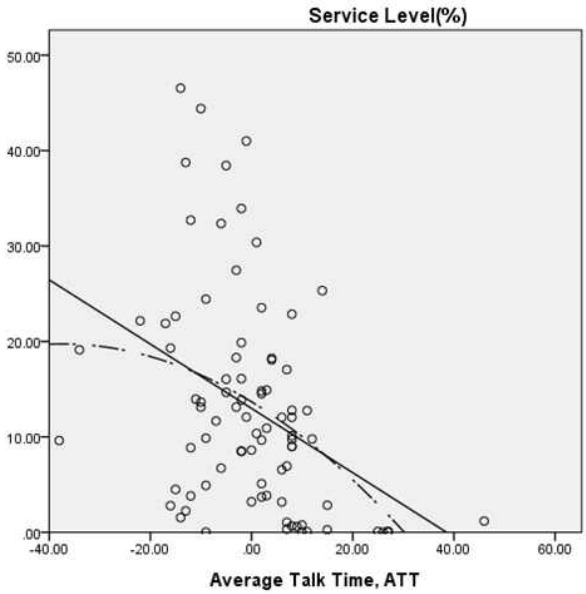
service level. The following workload, regression for service level, and poly-morphic regression graphs were different as shown in <Figure 5>. In the linear regression model, the service level was found to decrease as the following workload increased, and in the polynomial regression model, it can be seen that the service level rapidly increases after a certain level. <Table 4> is the result of analyzing the Linear regression model and the Polynomial regression model (secondary curve). As shown in the <Figure 5>, both models were found to be significant at the $p<0.001$ level. However, if you look at the R^2 value, which means the explanatory power of the model, it can be seen that the Polynomial Regression model is higher. Therefore, hypothesis 2 was adopted that the rela-tionship between the following workload and the service level would be in the Polynomial Registration.

<Table 4> Model Summary

	R^2	F	df1	df2
Linear	.146	14.013***	1	82
Quadric	.161	7.771***	2	81

* : $p<0.05$ ** : $p<0.01$ *** : $p<0.001$

<Figure 5> Effect of Customer Service workload on Average Talk Time, ATT

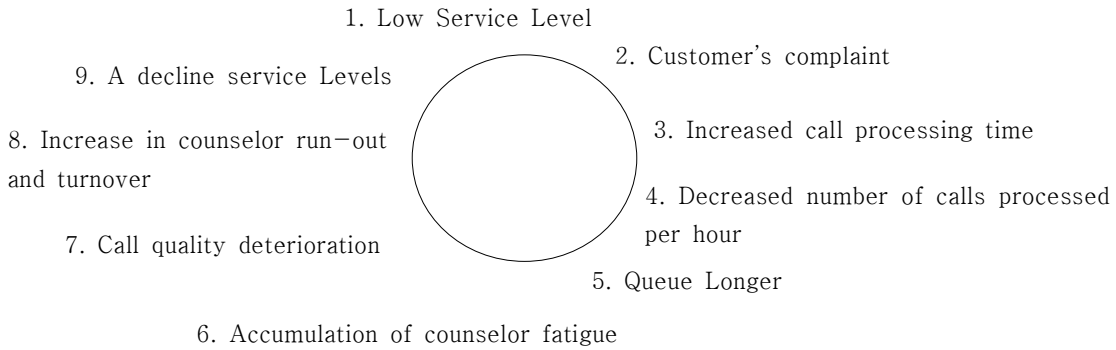


V. Discussion of findings

Prior research has assumed that the service rate in a service operations facility is independent of the level of load on the system. We present a model of service worker productivity that includes the effect of load and the subsequent overwork on service rates. In our study, we find that service workers cannot adapt to system needs by expending more effort to increase the service level as required. At high levels of load, a call center is ability to admit new loss. In this paper, we do not empirically examine the underlying incentive schemes. However, it is conceivable that a facing a high load may have a financial disincentive to increase of waiting for customers. As can be seen in <Figure 6>, As we demonstrate from our analysis, this could have negative consequences for the service rate of response. We also show that maintaining in productivity is not good. In many service operations, the impact of high system load on the level of service is a significant consideration for service managers. In our analysis, we find that overwork increases the likelihood of service time and maintains service level but negative impact to service level because of Queue time. The results obtained through a series of regression analysis processes can be sum-

marized as follows.

<Figure 6> Managerial implications of the inbound call center



It was found that the Customer Service Representative (CSR)'s following Workload of the counselor had an effect on the service level. In particular, as a result of estimating the regression line for the relationship between the two variables (Aband Call/Average Hold Time/Average Handle Time, Service Level) indicating that the relationship between the two variables lies in a curved relationship. This suggests that when the workload reaches a certain level, the operation management plan changes. This can be presumed to be due to the fact that the Customer Service Representative (CSR) has increased the intensity of his/her work in the absence of awareness of the importance of how much his/her work affects the company. In addition, it was confirmed that the relationship be-tween the Customer Service Representative (CSR)'s following workload and the service level was curved. This means that if you feel that there is more work than a certain level, you cannot guarantee a consistent service level of the Customer Service Representative (CSR). If the call time (Aband Call, Average Hold Time, Average Handle Time), which is the job of call center Customer Service Representative (CSR), continues to increase, the call response time in-creases service rate maintains, but in reality, the provision of low service levels can be predicted due to delay in response time. Effective and efficient manage-ment of manpower will be the foundation for survival. This study suggests that job management of Customer Service Representative (CSR) should be preceded

to provide better services to customers by empirically analyzing and testing the relationship between following workload and service level for call center Customer Service Representative (CSR).

The implications of this study through the research results are as follows. First, the following workload, which was not used in the previous study, was designated and measured as a variable. This will be the academic basis for following workloads that have not been noticed in academia, unlike the importance of following workloads in the industry. Second, through the secondary curve of this study, companies need to select an appropriate following workload ratio considering the status of Customer Service Representative (CSR) in operating call centers. The limitations of this study and future research directions are as follows. In this study, the types of businesses collected were limited. Customer Service Representative (CSR) in various industries cannot rule out the possibility that there may be a difference from the results of this study. Therefore, it can be said that in the future, a comparative test according to the industry is necessary. Future research needs to investigate if and how our findings apply to other services. For example, the impact of load on quality of inspections is of paramount importance in areas such as hospital (Kc and Terwiesch, 2009). Kc and Terwiesch (2009) notes that expect the effect of load and overwork to impact quality of service in a variety of applications and innovation researchers to participate so that the impact of load on quality of inspections is of paramount importance. Service time (Aband Call, Average Hold Time, Average Handle Time) could be a manageable tool for effective call center operation. One could also expect the effect of load and overwork to impact quality of service in a variety of applications. Future research could also look at accounting for other factors, beyond those used in the study that could affect the case severity. we hope that future research can extend our analysis to this important area of call center operations.

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* 저자소개 *

· 김 민 주(minjoo@sogang.ac.kr)

현재 서강대학교 일반대학원 박사과정에 재학 중이다. 서강대학교에서 경영학 석사 학위를 취득 하였다. 주요관심 연구 분야는 기술경영, 서비스품질 등이다.

· 김 민 균(minkyunkim@sogang.ac.kr)

University of IL에서 경영학 학사, The State University of New York at Buffalo에서 경영학 석사 및 박사를 취득 하였다. 현재 서강대학교 경영대학 경영학과 교수로 재직하고 있으며, 주요 관심분야는 공급사슬관리, 공급사슬관리에서 정보기술의 활용, 공급사슬과 지속가능경영 등이다.