Evaluation of Detailed CSFs and Benefits Model for ITIL Implementation

Hitoshi Tsunoda and Yasunobau Kino

Abstract—In recent years, information technology infrastructure library (ITIL) has become a global de facto standard in the field of system operations of enterprise information systems. However, many companies face problems in implementing an ITIL (introduction, fixing, improvement) as it is very difficult. Although numerous empirical studies on ITIL's critical success factors (CSF) and benefits have been conducted, the results of these research works are somewhat abstract and a more detailed model of CSFs is required for IT departments. In addition, CSFs has been analyzed based on variables outside of the IT department or from a senior management viewpoint. CSFs has not been discussed from the internal viewpoint of the IT department. Based on the background and issues, this research aims to clarify the mechanism from CSFs to benefits on ITIL implementation by using detailed CSFs internal viewpoint of the IT department. In this research, we interviewed 20 employees from the IT department of various companies in Japan and proposed the "Detailed CSFs and Benefits Model" and evaluated it via a ITIL process improvement case. The results showed that 17 of the 18 detailed CSFs and benefits of the model could be observed.

Index Terms—IT service management, ITIL, CSFs, benefits.

I. INTRODUCTION

The role of information systems in enterprises has become important in recent years and high quality is required for system operations. For this reason, the IT departments of each enterprise are trying to improve the quality of system operations by introducing Information Technology Infrastructure Library (ITIL) [1]. ITIL represents system operation implementation best-practices published by the British government in 1989 and is now leveraged as a global de facto standard. ITIL consists of 26 processes such as incident management, change management and problem management, which encourage the introduction of processes and continual improvement in each company. However, an ITIL implementation has a high degree of difficulty, which is a problem for many companies. Numerous empirical studies on the Critical Success Factors (CSF) and benefits of an ITIL implementation have been published, however the content is somewhat abstract, and more detailed CSFs are required for IT departments. In addition, CSFs have been analyzed according to variables outside of the IT department and from the senior management viewpoint, and have not been discussed from the internal viewpoint of an IT department. Based on the background and issues, this research aims to

clarify the mechanism from CSFs to benefits on ITIL implementation by using detailed success factors internal viewpoint of the IT department. We conducted a semi-structured interview for 20 employees of the IT department of various companies in Japan, proposed a "detailed CSFs and benefits model", and evaluated it according to an actual case. As a specific case, we will address an information system subsidiary (T company) of the largest insurance company in Japan.

The structure of this paper is as follows. After reviewing the related work in Chapter 2, we propose the "Detailed CSFs and Benefits Model" in Chapter 3, report case studies in Chapter 4, and evaluate the model in Chapter 5. Note that ITIL is assumed to be the latest current version of ITIL V3 (2011 version).

II. RELATED WORK

A. CSFs and Benefits of ITIL Implementation

Based on the literature review of Iden *et al.* [2] published in recent years, the research theme of ITIL implementations mainly deals with the CSFs, benefits, motives and implementation status. Among them, CSFs are the most popular. This represents a heightened interest in the proposition of how to utilize CSFs to introduce, fix and improve ITIL.

Major prior studies on the extraction of CSFs in an ITIL implementation are as follows. Cater-steel *et al.* [3] distributed questionnaires to 110 members on topics such as CSFs, management support, IT staff training, and the changes within the IT staff itself. Tan *et al.* [4] also extracted CSFs related to the transformation of organizational culture and cooperation with vendors through an interview survey at government agencies in Australia. Pollard *et al.* [5] analyzes four other cases in the United States and further extracts both the internal and external communications of an IT department, as well as the application of technology and fostering an organizational culture that is familiar with ITIL when defining CSFs. Pederson *et al.* [6] extracted 18 CSFs, including a detailed interview survey on two companies in Denmark as well the quick wins (to advance the project from a small successful experience). Several CSFs have been extracted thanks to the studies described above, however in recent years research has been progressing in order to organize and integrate them. Sarvenaz *et al.* [7] described the following "seven CSFs" from previous literature surveys: (1) senior management support, (2) organizational promotion, (3) communication and cooperation, (4) strengthening of governance, (5) improvement of expertise of members, (6)

process implementation and application of technology, and (7) monitoring and evaluation of processes. However, what is needed for an IT department is a more detailed model of success factors than these CSFs. Previous studies have not provided a comprehensive representation of success factors at the IT department level. In other words, for an ITIL implementation, it is necessary to exhaustively extract success factors more than CSFs. This is the first focus of the research.

Next, the main preliminary research covering the extraction of benefits of an ITIL implementation is as follows. Hochstein *et al.* [8] announced case studies based on interviews with the IT departments of six large European companies, and the following three items are extracted as results. Client/service orientation and the quality of IT services respectively, efficiency due to standardization optimizing of processes and process automation, transparency and comparability through process documentation and process monitoring. Cater-Steel *et al.* [9] conducted a questionnaire survey of 65 companies in Australia, and the following six items are extracted as results. Improved customer satisfaction, improved response & resolution, roles/responsibilities clear, improved IT service continuity, reduced cost/incident, improved IT employee productivity.

B. Relationship between CSFs and Benefits

Major prior research on the relationship between CSFs and the benefits of ITIL implementation consisted of the following. Iden *et al.* [10] conducted a questionnaire survey of 446 companies in Scandinavia in 2014 and quantitatively clarified the relationship between CSFs and benefit and satisfaction. In this research, focusing on the context outside of the organization in addition to the CSFs, they focused on (1) sector, (2) size (enterprise scale), (3) ITIL expectation, (4) time (realization period) and (5) the business situation to introduce five external variables to clarify the relationship between external factors and benefits. Even though this research focuses on the context outside of the IT department, it is not discussed from an internal perspective. Mourad *et al.* [11] extracts eight issues from the interview survey of 10 firms of the UAE (United Arab Emirates). One of the issues is a "lack of support from top management", and the solutions are: "management needs to provide support from the initial stage of an ITIL project" and "management allocates resources (human resources and budget)" It must be secured from the management perspective, not from the perspective of the IT department. This is the second research subject. In this paper, we are practically aiming to present effective measures for IT department members to promote an ITIL implementation, and we discuss the relationship between CSFs and benefits from the internal viewpoint of an IT department.

III. METHOD

A. Data Collection

For extracting detailed CSFs and benefits, we conducted an interview survey from May to July 2017. The interviews were conducted with a semi-structured method in a conference room of the target company. The interview time was between 45 minutes and 1 hour. Prior to the interview, we obtained acknowledgment by sending the research purpose and question items to the target person beforehand by e-mail. The targets of the interview belonged to the IT department (including the information system subsidiary) of the Japanese company, and 20 members familiar with the system operations of the information system were targeted to be surveyed. The target people were extracted mainly from members of itSMF Japan and asked to participate in the investigation by e-mail. The companies to which the target company belonged were financial, manufacturing, infrastructure (electricity, gas), transportation (airlines, railroads), etc. and various members from various industries were asked to participate. In order to grasp the actual condition of companies not yet introduced to ITIL, the target group also included those belonging to companies that had not been introduced.

The main question items of the interview survey were as follows. (Q1) Does your senior management understand ITIL implementations? (Q2) Are there organizational measures? (Q3) Does the system operations department cooperate internally and externally? (Q4) Is there a push to try to improve the expertise of members? (Q5) Are processes being checked or improved? (Q6) What are the benefits? Though we prepared the questions in advance, during the interview, we asked additional questions flexibly so that the target person could freely talk about ITIL. At the beginning of the interview, I explained the objectives of the research and obtained the consent of the target person regarding the content of the conversation recording, securing confidentiality, the data storage method, etc.

B. Proposal of the Model

As result of the interview survey, 18 detailed CSFs and benefits, 6 CSFs and benefits and 3 categories were extracted (Table I). Fig. 1 shows the framework of the relationship between three categories including two CSFs and one benefits. In this paper, we call this model the "Detailed CSFs and Benefits Model" and propose it. Compared to the related studies, the seven CSFs of Sarvenaz *et al.* [7] (1) - (5) are "Support CSFs", and (6) - (7) are "Process CSFs".
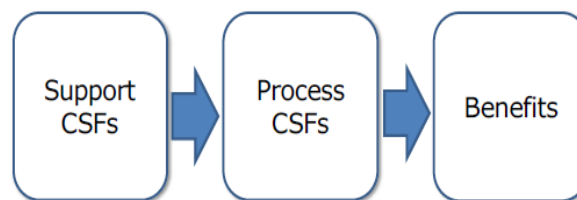

Fig. 1. Framework of the model.

C. Evaluation of the Model

The above proposal is evaluated via a case study. As a case, we select the information system subsidiary (T company) of the largest insurance company in Japan. T Company implemented ITIL's incident management process reform from 2012 to 2015. Specifically, they developed and applied new indicators to evaluate the activities of incident management. In this paper, we observe what kind of CSFs

and benefits have been demonstrated at T Company and evaluate the proposal by matching the model and the case.

IV. A CASE OF ITIL IMLEMENTATION

TABLE I: DETAILDED CSFS AND BENEFITS MODEL

Categories	CSFs and Benefits	Detailed CSF and Benefits
Support CSF	Senior Mng. Support	Senior Management Understanding
		Senior Management Involvement
	Organizational Support	Organizational Objectives & Internal Campaign
		Document and Sharing Knowledge
	Cooperation & Collaboration	Encouragement to Senior Management
		Collaboration with Developing Department
		Cooperation in Operations Department
		Motivation Maintain
	Human resource Development	Training & Qualification
		Knowledge and Ability of Process Design
Process CSF	Process PDCA	Building Process & KPI
		Process Implementation
		Monitoring & Check of KPI
		Process Improvement
Benefits	Benefits	Operational Quality
		Standardization
		Visualization
		Customer Satisfaction

A. Outline of the Case

T Company is the information system subsidiary of the largest insurance company in Japan and has 1360 employees. The company's main business are system development and system operations. In 1998, Japan's financial liberalization rapidly expanded and complicated information system. Around the year 2000, system failure became frequent and became a management problem. Therefore, the company has implemented various countermeasures. Since 2001 ITIL has been introduced and all employees in the system operations department are obliged to acquire ITIL Foundation qualifications, and they have been actively promoting ITIL. In 2006, T company also acquired the ISO 20000 certification. The company has obtained good results by setting up a system failure handling team called, an " IRT). Three full-time members are assigned to the IRT and they are responsible for troubleshooting with members of the department that caused the trouble. A dedicated room (war room) for handling the system failures are also provided. The dedicated war room is located in T company (Tokyo, Tama city) and when the incident occurs, they discuss it with the parent company's head office (Tokyo, Marunouchi) via video conference to discuss measures. For example, as part of the initial diagnosis of the incident handling process, members related to system failure are urgently called to grasp an event and an influence range. Specifically, it carries out the following four activities. In order to promptly perform the above activities, it is necessary to train the incident response team.

- When a system failure is detected, immediately notify the team responsible for troubleshooting by using in-house broadcasting and call related peoples, such as development personnel and operations staff to the dedicated room.
- Understand the events such as detection time, discovery history, and target system together with the convoked members.
- Understand the magnitude of the impact: which users? how much serious?
- To inform the IT department that a system failure has occurred, send the first report by mobile e-mail.

As measures against system failure, there are two efforts to reduce the number of occurrences and shorten the incident response time. The role of the IRT is the latter. In recent years, the number of annual occurrences of system failure has stabilized around 10 cases. Therefore, recent efforts at the company are accelerating restoration, strengthening the activities of the IRT, and as a part of it, it is a debate that "activities as well as benefits should be evaluated" At this point the case study initiatives were started.

B. Development of New KPI

TABLE II: NEW KPI FOR ITIL INCIDENT PROCESS.

Activities	Activities KPI	Points
Initial Diagnosis	A) Determine the event, and estimate the influence, history, cause promptly.	5
	B) After the initial diagnosis, send the first mail to the entire IT department promptly.	5
Escalation	C) Call the person in charge of occurrenced system failure promptly.	5
	D) If serious obstacles are anticipated, contact the director promptly.	5
Investgation and Diagnosis	E) In order to identify the cause, data acquisition and investigation are carried out promptly.	5
	F) Identify the cause from occurring events and the survey promptly.	5
Resolution and Recovery	G) Based on the cause, fix the countermeasure promptly.	5
	H) Implement countermeasures promptly.	5
Close of Incident	I) After the recovery, send recovery mail promptly.	5
	(Full Points)	45

The person responsible for system operation at T company asked two ITIL-familiar employees to create a new KPI (Key Performance Indicator). One of the two is an officer of itSMF Japan and possesses the ITIL master certification. itSMF is an international NPO to promote the spread of ITIL. The other employee is familiar with ITIL implementations and has ITIL expert qualifications. Table II is the new KPI they created. In this paper, Table II is called "Activities KPI for ITIL Process". All KPIs are defined qualitatively. The reason for this is that it is difficult to measure member activities with quantitative content. In addition, the KPI has content that can be measured for each incident. The reason for this is to make improvements for each case. This table pertains to ITIL's incident management process, we think this can be created for other processes as well. For each of the five activities, one or two KPIs are created, and the total number of active KPIs is

nine. Each item is assigned between 1 and 5 points, resulting in a maximum of 45 points across all items. The grading criteria was designed such that the evaluation differences do not occur between graders. A mutual evaluation method was adopted. Specifically, for each system failure, the activities of members other than the evaluator are scored. As there is no difference in the role of each member of the IRT, all actions of each member in each item were mutually evaluated. The representative value decided by discussing the scoring result was set as an "index value". This is a comprehensive evaluation of the activities of three Incident Response Teams. After scoring, we obtained approval from a responsible party, for example, the executive officer of the system operations department, and eliminated the arbitrariness of scoring as much as possible. The time required for the creation of the index was approximately 8 hours, and the time required for mutual evaluation was about 1 hour per activity.

C. Application of New KPI

The system failure targeted in this paper was classified as a serious system failure at T company. The company sorts system failures according to the importance of the system, the scope of impact, etc. and classifies it as either a serious system failure or a minor system failure. A relevant system fault could be, for example, one of the following: a case in which online access to accounts is temporarily stopped due to a hardware failure of the network, the response of important systems is deteriorated beyond the capacity of the network due to an increase in throughput, or the switch / router malfunctions due to a misconfiguration of the switch / router. The target period was 4 years from 2012 to 2015. The Incident Response Team tracked indicators for four years. The total number of data was 35 in fiscal 2012, 11 in fiscal year 2013, nine in fiscal year 2014, and eight in fiscal year 2015.

As a way to utilize indicators, we leveraged the PDCA cycle to extract weak points in the trend analysis for each fiscal year and to improve on it, in addition to using it for reviewing the troubleshooting for each case. Initially, the white bar in Fig. 2 expresses the index value by item in FY2012. From this graph, it can be seen that the index value is bipolarized. The values of A / B / C / D / I are high and the values of E / F / G / H are low. We implemented measures to strengthen E / F / G / H from fiscal 2012 with the aim of overcoming the weaknesses of the incident response team. The specific activities of each item are listed below.
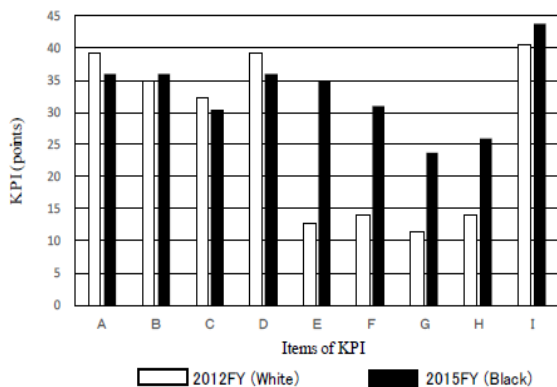

Fig. 2. Improvement of activities KPI.

Item E) represents the immediate data acquisition and survey execution and the incident response at the time of system failure. An analysis of the actions of the three teams based on the indicators shows that three members are not very familiar with the data acquisition method and therefore, it was found that it was occasionally delayed. As a result, the whole team acted quickly as we tried to acquire knowledge, such as performing study meetings with all the teams.

Item F) represents the identification of prompt cause. When examining the content of a system failure, many occurred when changing the base system. On the other hand, when we confirmed the actions of the three members of the incident response team, we found that one person's behavior was slow. When he was informed of the cause of the failure, he was not familiar with the infrastructure system, so it took a long time to determine the specific cause of the issue. As a result, we learned about the infrastructure system intensively along with him, and quick action became possible.

Item G) Confirmation of prompt countermeasures: When analyzing the reasons for the low indicator value of this item, it was found that the final judgment (decision-making) of the countermeasure implementation was delayed. As the eventual decision-making of countermeasures falls to the head of the IT department, the incident response team instantly contacts the IT department head in the event of a disaster (as the head of the IT department is stationed in Tokyo Marunouchi) and clarify the procedures of the team activities so that the IT department head can make decisions in real time.

Item H) Immediate implementation of countermeasures: Several countermeasures can be considered for system failure handling, such as restoration of failed parts and implementation of alternative measures. However, the company returns to the state before implementation as its first course of action. Therefore, in an instance where the original state can be restored, when the procedure was clarified in advance, the action became quick.

D. Result of New KPI

As a result of promoting the improvement of an activity KPI, the level of team activities improved greatly. Fig. 2 shows the improvement situation of the activities KPI in 2012 (white) and 2015 (black). From the figure, improvement of E / F / G / H is obvious. In FY2012 there was a difference between E / F / G / H and A / B / C / D / I, however in 2015 the white and black bar are at the same level. The increase in items E and F is especially remarkable. Item E is an immediate data acquisition and investigation, item F is a prompt cause identification. As a measure against these, IRT members acquired knowledge and skills. These are thought to have led to the strengthening of weaknesses of the team. The yearly trend of the average points of all KPI items was imploved. As the numerical values of E / F / G / and H rise, it can be seen that the overall average value also increased. The average KPI points were 26.1 points in 2012 and 33.3 points in 2015, which is an improvement of 27%. As a result, we were able to realize a level of improvement of the overall system response. As you can see, the efforts of this paper contributed to the improvement of the activities of the Incident Response Team. The improvement of the KPI is due to an improvement in activity and does not represent the benefits of this case. The results are described below.

E. Benefits

The benefit of this case is the improvement of the system operation quality. This is due to a shortening of the MTTR (Mean Time to Recovery). In order to confirm the benefits, we calculated MTTR for four years from FY2012 to FY2015. Fig. 3 represents the MTTR trend. In FY2012, MTTR steadily shrunk every year, it started at 268.1 minutes, and then became 168.4 minutes in 2015, 62.8% compared with the year 2012. Therefore, it decreased by 37.2%. From this figure, it is obvious that a decrease in MTTR could be realized. Although T company did not establish a numerical target for MTTR at the beginning of this effort, the company evaluated it as "It was a satisfactory benefit".
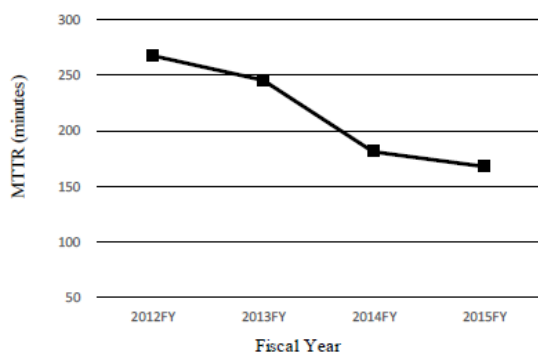

Fig. 3. Yearly trend of MTTR.

The correlation between KPI and MTTR is -0.509, indicating a negative correlation.

When test t is carried out, $p = 0.002$ (<0.01) and since it is significant (two-tailed test) within 1%, it is presumed that there is a direct or indirect correlation between restoration time and index value. A decrease in MTTR is not the only factor included in the efforts of this paper. Measures for shortening MTTR include organizational measures and technical measures, and the efforts of this paper are organizational measures. On the other hand, as a technical countermeasure, the company is trying to shorten the recovery time by implementing a duplex system and a redundancy system. However, technical countermeasures generally require significant cost and manpower, and the target system is also limited to some systems that require high availability such as key systems and accounting systems. Therefore, organizational measures and technical measures need to be carried out in a well-balanced manner.

V. EVALUATION

A. Method

The evaluation of the "Detailed CSFs and Benefits Model" in the case study was conducted by three methods: interview survey, observation of participation and confirmation of in-house documents. Firstly, we conducted an interview survey in September 2017. As an interview method, we conducted an individual interview in the conference room for 2 hours for each of the leaders of the IRT team and its boss. The interview was carried out by the author. Question items were unstructured interviews that allowed the target person to freely talk about what to decide in advance. As a part of participant observation, the author observed the IRT team for one month in October 2017. Participation observation is conducted to confirm the results of the interview survey. Confirmation of in-house documents was carried out in October 2017 in parallel with the participation observation. The documents were read with the permission of the leader of the IRT team. Confirmation of in-house documents was also conducted to confirm the results of the interview survey. A selection of in-house materials was decided upon while consulting with team leaders.

B. Results

Table III shows the results of the evaluation of the "Detailed CSFs and Benefits Model" by the case study. As a result of the interview survey, we were able to confirm 17 of the 18 CSFs and benefits. We could not confirm one thing, "motivation maintenance". However, this result does not indicate that employee motivation improvement could not be achieved. It demonstrates that it was not confirmed in the project, in retrospect.

In the interview survey, there were remarks from two of the targets such as, "I think they probably improved that". However, we were unable to confirm what their motivations ware improved in the participation observation and the in-house documents. Therefore, the evaluation results stated that "This could not be confirmed" in Table III. In the participating observations, we were able to confirm 11 of the 18 CSFs and benefits. In the in-house documents, we were able to confirm 8 of the 18 CSFs and benefits.

C. Implication

We consider that there are two future tasks. The one is to confirm 1 of the 18 elements of the detailed CSFs that we could not confirm in this paper such as motivation maintenance. The other is a problem with employees who are not cooperative with ITIL. In the interview, problems of employees opposed or passive to ITIL were pointed out. It is inferred that conservative employees tend to have that tendency. We are interested in how they turned into "positive employees".

VI. CONCLUSION

In this paper, we proposed the "Detailed CSFs and Benefits Model" and evaluated it through a case study. The model is defined at a greater level of detail than the conventional CSFs, and there is the novelty that it is described from the internal viewpoint of the IT department. In addition, this paper proposed valid ITIL implementation methods to practitioners belonging to the IT department of a company, which is useful as well.

The restriction of this paper is that it is merely a case report of one company, and therefore insufficient as a generalization. Hence, it is necessary to demonstrate these results for many cases in the future. This is the main limitation of this paper.

However, the methodology of this paper can also be applied to other ITIL processes such as problem management, change management, configuration management, and so on.

TABLE III: EVALUATION OF "DETAILED CSFS AND BENEFITS MODEL"

Category	CSF	Detail CSF and Benefits	Results of Evaluation	Interview	Observe	document
Support CSF	Senior Management Support	Senior Management Understanding	The understanding ITIL of senior management was comfirmed, such as the IT department head sent a message to fight system failure for the entire IT department.	✔		
		Senior Management Involvement	When a system failure occures, the IT department head immediately instructed the correspondence at the video conference. The process involving senior manager is built.	✔		
	Organizational Support	Organizational Objectives & Internal Campaign	Internal campaign has been conducted for 4 years. Although concrete numerical targets did not decided before the project, quantitative benefits have been realized as a results.	✔	✔	
		Document and Sharing Knowledge	Documented the new process. Not limited to this process, the company has made the contents of all processes manuals of 1000 pages or more.	✔	✔	✔
	Cooperation & Collaboration	Encouragement to Senior Management	In this project, the system operation department has worked on the IT department head to build a new process.	✔		
		Collaboration with Developing Department	The process of recovering in collaboration with the development department has built. Also, the process of collaborating and creating procedures to return to the original state at the time of failure was adopted.	✔	✔	
		Cooperation in Operations Department	In this project, it was confirmed that not only the IRT team but also the entire operation department cooperate. Specifically to investigate the cause at the time of failure.	✔	✔	
		Motivation Maintain	(This could not be comfirmed)			
	Human resource Development	Training & Qualification	All employees in the operation department have acquired ITIL Foundation qualifications, and all have basic knowledge.	✔	✔	
		Knowledge and Ability of Process Design	Two employees who designed a new KPI and the process supporting could be confirmed.	✔		
Process CSF	Process PDCA	Building Process & KPI	New KPI and process to fit to the company have been built.	✔		✔
		Process Implementation	The new process was steadily practiced according to the manual.	✔	✔	✔
		Monitoring & Check of KPI	Every time a system failure occurred, an index was acquired and checked. The checked contents were recorded.	✔	✔	✔
		Process Improvement	In this case, the process has been improved each year for 4 years.	✔	✔	✔
Benefits	Benefits	Operational Quality	MTTR (Mean Time To Recovery) has been shorten by 37.2% for 4 years.	✔	✔	✔
		Standardization	With the introduction of a new process, the incident management process was further standardized.	✔	✔	✔
		Visualization	The new KPI was shared in IT departments. Also, the content of the effort was reported regularly to the Board of Directors.	✔	✔	✔
		Customer Satisfaction	It was confirmed that the customer's parent company CIO was sending an email of appreciation for this project.	✔		✔

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