Chapter 1
Design for Value Creation

Tomomi Nonaka

Abstract This chapter addresses the value creation design of “food”. Food has both the tangible characteristics of the food itself and the intangibility of its associated delivery processes. In designing food value creation, it is desirable to consider simultaneity, perishability, and heterogeneity as characteristics of services. Moreover, when designing food value creation, one must realize the three perspectives of customer satisfaction, employee satisfaction, and management satisfaction. To improve the added value surrounding food, one must positively analyze customer behavior, response to demand fluctuations, employee satisfaction, and link service profit chains. This chapter presents a description of analyses using customer and employee data at the realization site and food service system design.

In this section, food value creation design is discussed in consideration of the status and satisfaction of employees working at a food service provision site. Even in the same food service industry, widely various business forms exist, such as food service categories targeting restaurant service with cook–chill systems, restaurant service with cook–serve systems, and delivery of prepared food services. The effects of service characteristics such as intangibility, heterogeneity, simultaneity, and perishability vary depending on the business form of the food service and the characteristics of the service provided. Therefore, the importance of value creation design considering the type of food service, the characteristics of the provision process, and the external environment are described. In addition, food services are often labor intensive among service sites. The influence of employee feelings and conditions on the quality of services provided is regarded as important. This section introduces food value creation design that addresses employee satisfaction.

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1.1 Value Creation Considering Properties of Service

This section presents examination of design features for value creation in the food service business. Possible effects from properties of service such as intangibility, heterogeneity, perishability, and simultaneity are considered. Figure 1.1 depicts an outline in the food service business. For design for value creation in the food service industry, visualizing and capturing the energy consumption feature are executed as a first step. For energy management to create value, improving energy efficiency and managing energy peaks require several approaches. Improving energy efficiency is realized by reducing energy consumption per functional unit or its created value. It requires promotion of streamlining and/or reducing the input energy to be consumed.

1.1.1 Service Energy Efficiency

First, in considering value creation design, we examine the added value of food from the viewpoint of productivity. We discuss the improvement of value by improving productivity by taking energy consumption as an example among several productivity indicators. Toward the realization of a sustainable society, companies must conserve energy and natural resources. In the food service industry, which is part of the service sector, life cycle assessment (LCA) is currently expanding to address diverse product groups and production processes (Schau and Fet 2008; Bengtsson and Seddon 2013; Righi et al. 2013). In fact, LCA uses cradle-to-grave analyses of production systems to evaluate inputs and outputs in all life cycle processes from upstream to downstream of the systems. Schau and Fet (2008) states that food production has been much more energy-intensive because of industrialization. In the food service industry, in addition to the improvement of t operations aimed at improving efficiency (Shimmura et al. 2013a; Sill 1994), centralized efficient operations in central kitchens (Muller 1999; Kubo 1997), replacement of efficiency-enhancing equipment (Jyeshtharaj et al. 2011; Deng and Burnett 2000) and robots (Suzuki 2008) have been introduced for energy conservation.

In both manufacturing and service industries, reduction of energy consumption is necessary from the viewpoint of sustainability and global environmental protection.

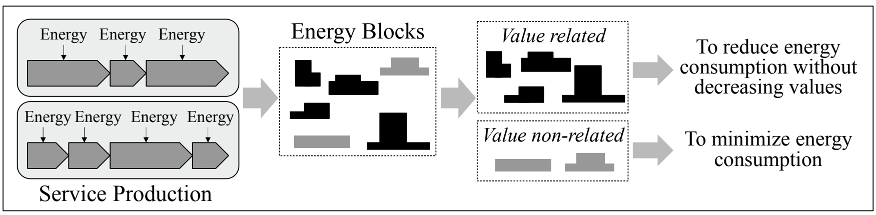

Fig. 1.1 Approach for improving service energy efficiency

Energy conservation is reducing the total amount of energy consumption necessary to create a certain value. The Energy Conservation Law in Japan calls for reduction in energy consumption intensity of more than 1% per year for businesses of a certain scale.

The energy consumption basic unit here can be set arbitrarily by the company. Generally, it often refers to energy consumption per unit production (amount), but in the manufacturing industry, the value of goods produced is fundamentally constant. Approaches typically aim at reducing the basic unit by increasing production efficiency. Other examples of denominator settings include one finished product, one intermediate part, product (part) weight, and product (part) length. However, in the service industry, the value provided is constant, considering its unique characteristics, i.e., "simultaneity," encompassing production and consumption, non-separation of products and processes, and "heterogeneity," encompassing receiver satisfaction.

By defining energy productivity as a service value maximization problem to maximize production per unit energy, it becomes possible to discuss service productivity from the viewpoint of energy consumption. Therefore, service energy productivity is defined as the quotient of the amount of input energy for the value created. Equation (1.1) presents an evaluation formula for service energy productivity (Nonaka et al. 2015).

$$\text{Service Energy Efficiency} = \frac{\text{Value Out}}{\text{Energy In}} \tag{1.1}$$

Service energy productivity can be improved through the following three approaches.

i. Decreasing the input energy in the denominator by increasing production efficiency
ii. Enlarging the effect by increasing value or increasing added value
iii. Decreasing the energy input to the denominator using methods other than increasing production

Figure 1.2 shows a service energy productivity improvement approach to reduce the input energy in the denominator using (i) and (ii) above. First, energy consumption is assumed to be classifiable according to whether it contributes to value by the production process; then energy consumption is modeled. For example, in the retail industry, energy consumption attributable to lighting and air conditioning in spaces where there are no customers or in areas where the store is not presented does not contribute to the value provided to customers.

Energy consumption associated with refrigeration for keeping food cooled is classifiable as contributing to value because product quality changes as a result of temperature adjustment. Energy that contributes to value requires an approach that reduces energy consumption without reducing value. Energy that does not contribute to value is necessary to minimize energy consumption. These approaches reduce the total energy consumption. Alternatively, the process is improved or reviewed so that

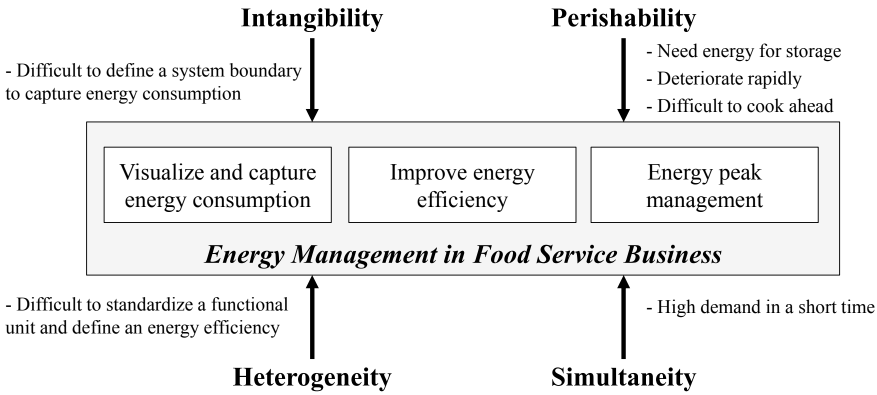

Fig. 1.2 Outline of energy management in the food service business (Nonaka et al. 2015)

the energy consumption peak amount that consumes large amounts of energy per time in a certain process is reduced.

1.1.2 Feature of Energy Consumption Considering Properties of a Service (Nonaka et al. 2015)

This section examines features of energy consumption in the food service business. It considers the possible effects attributable to properties of services such as intangibility, heterogeneity, perishability, and simultaneity. Figure 1.1 describes an outline of energy management systems in the food service business. For energy management, visualization and capturing energy consumption features are executed as first steps. Improving energy efficiency and managing energy peaks require several approaches. Improving energy efficiency can be realized by reducing energy consumption per functional unit or its created value. It requires promotion of streamlining and/or reducing the input energy to be consumed. However, energy peak management should consider not only efficiency but also how to operate and standardize energy consumption against demand peaks.

Intangibility: Distinction between goods and services in a tangibility continuum classification was discussed in an earlier report (Levitt 1981). In the food service business, a dish and related services are provided. The dishes can be regarded as tangible goods. Bebko (2000) reports that fast food retailing might certainly fit into the category of a differentiated good and service bundle that is attributable to a tangible food being offered with the food preparation and delivery service. Defining a system boundary is needed to capture and evaluate energy consumption accurately. Intangibility might make it difficult to set a boundary for the evaluation of service production systems.

Heterogeneity: In service provision processes, constant production of services is generally difficult to achieve. In a kitchen in restaurant service, service operations still entail many manual processes that create value (Shimmura et al. 2013b). An index of energy efficiency is generally evaluated by measuring the amount of energy consumption and its produced value. The heterogeneity of service might engender difficulty to define its produced value because of its lack of standardized functional units.

Perishability: Storage time of food is very short. In fact, food quality deteriorates rapidly in numerous cases in the food business. It is necessary to provide fresh cuisine to customers. Warm cuisine must be offered while warm; cold dishes must be served while still cold, so that a certain amount of energy is necessary for storage. Furthermore, difficulties of storing advance production inventories engender implementation of build-to-order manufacturing systems. A limited cooking operation can be implemented using batch production, which presents the possibility of affecting energy peak management and control of demand.

Simultaneity: A degree of simultaneity in food services is defined according to the location of consumption both spatially and temporally. Introducing a central kitchen system, batch production and production lead times can be regarded as influential factors.

Furthermore, large fluctuations in energy demand occurred because the restaurant service has high demand of the specific time slots at lunch and dinner times. High demand in a short time might cause difficulties for energy peak management.

Here, taking the cases of four food service businesses as examples, we consider relations between different business models, with different energy consumption and service characteristics. The four considered businesses are a restaurant with a cook–chill system, a restaurant with a cook–serve system, a delivery service, and home meal replacement.

In restaurants with a cook–chill system and a cook service system, customers order at a restaurant and eat there. In restaurants that have a cook–chill system, the cooking process is divisible into a central kitchen and restaurant, where energy can be consumed at each location. Energy input is necessary for transportation and storage processes. The cook–chill system, cook serve system, and delivery service run the main cooking process immediately after the customer order. Therefore, it should be inferred that simultaneity effects might be strongly affected.

In a home meal exchange service, the cooked process at the food processing plant is first implemented. Then the final cooking process is handled at the customer's home. The process is similar to the production of tangible goods. The description above explains that energy consumption in these four food businesses has effects caused by several characteristics and service characteristics related to energy consumption. Therefore, probably in the productivity improvement approach in food value creation, measures according to the characteristics of the service goods must be provided. Also, service characteristics according to the business model are necessary.

Here, value creation is divided into process design, planning stage and initial planning, and operational stages. Figure 1.3 portrays a conceptual diagram of production planning for value creation. In process design, the energy blocks input in each service

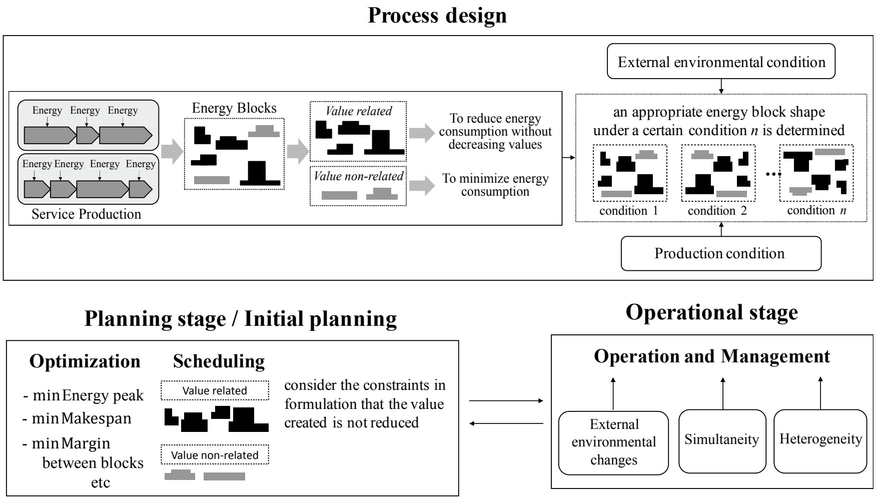

Fig. 1.3 Conceptual diagram of production planning for value creation

process are classified according to whether the process is related directly to value creation and whether the input energy contributes to value creation, or not. In energy input related to value creation, energy saving is attempted so that the value created is not reduced. However, an approach intended to minimize the amount of energy input that is not related to value creation is regarded as effective.

Next, based on classification results, an appropriate energy block shape is determined under a certain condition *n*. This problem defines the energy consumption time profile, i.e., the energy block shape, when processing is performed under certain external environmental conditions and production conditions. In the planning stage, a schedule is created using energy blocks under certain conditions found through earlier processes. In other words, the timing to execute a job that consumes the energy block is assigned to the time axis. The worker who performs the work and the equipment are assigned to the time axis. At this time, for the energy input related to value creation, we consider the constraints in formulation when creating the schedule so that the created value is not reduced. Subsequently, the derived schedule is used as the initial schedule. The plan is revised and updated according to environmental changes in the operation stage. Here, it is necessary to consider effects of heterogeneity, heterogeneity, and concurrency, which are the characteristics of services.

In addition, in labor-intensive processes, it is assumed that there might be a strong effect of factors unique to people involved in value creation and productivity improvement.

This can be regarded as the influence of heterogeneity on the service provider side. Therefore, the next section considers value creation that incorporates consideration of worker condition and employee satisfaction.

1.2 Value Creation Design Considering Employee Satisfaction

The importance of customer satisfaction in the service industry has been known for a long time (Bearden and Teel 1983). Studies have been conducted for evaluation of service quality and customer satisfaction (Taylor and Baker 1994; Sureshchandar et al. 2002), evaluation of waiting time, and major factors with which customers feel dissatisfaction (Luo et al. 2004; Shimmura et al. 2013c; Nonaka et al. 2014). Actually, customer satisfaction and service quality are closely related (Sureshchandar et al. 2002). In service value creation design, it is necessary to maintain or improve service quality and improve customer satisfaction while promoting efficiency. In the service industry, where production and consumption are performed simultaneously, the distance between employees and customers is short. Schlesinger and colleagues have proposed a "cycle of success" model that increases customer satisfaction by improving employee performance and by providing better service (Schlesinger and Heskett 1991). In the "Service Profit Chain (Heskett et al. 1994)" advocated by Heskett et al., the relation between employees and customers is expressed as a "satisfaction mirror". Then they influence each other. As a case study, many studies have evaluated the relation between employee satisfaction and service quality. For example, employee job satisfaction in banks (Reynierse and Harker 1992; Yoon et al, 2001) and hotels (Hartline and Ferrell 1996) is related to customers' perceived service quality. It has been shown to have a positive effect.

Especially in the service industry, for store services where employees provide services directly in contact with customers, the behavior and attitudes of employees are likely to be communicated directly to customers. In the restaurant industry particularly, many tasks require personal and manual work. The employee condition might strongly influence service quality.

Here, an overview of employee satisfaction research in the food service industry is presented. As a study in the food service industry, Bernhardt and colleagues have shown that positive correlation exists between employee satisfaction and customer satisfaction in fast food restaurants (Bernhardt et al. 2000). Koys conducted a questionnaire survey of employees and customers over multiple years. Results showed that employee satisfaction during the first year had a positive impact on customer satisfaction in the following year by multiple regression analysis (Koys 2001). In addition, Gazzoli et al. conducted a survey of 474 restaurants for employees and customers. Through covariance structure analysis, results demonstrated that employee empowerment and job satisfaction affect customer service perceived quality (Gazzoli et al. 2010).

The following sections introduce approaches that specifically examine employee satisfaction in the service profit chain. Here, when considering a value creation design that considers employee satisfaction, it is divided into employee satisfaction of two types according to the time constant of satisfaction. One is employee satisfaction related to job satisfaction over the medium to long term, which has been clarified by many studies through questionnaire surveys (Nonaka et al. 2016a). In addition, the section presents a description of short-term employee satisfaction that changes during the day or according to time.

1.3 Employee Satisfaction over the Medium to Long Term in Restaurant Services

Improving both employee satisfaction and service quality requires investigation of employee satisfaction and clarification of its structure. This section describes an analysis of employee satisfaction in restaurant services (Nonaka et al. 2016b). A Japanese restaurant chain in Japan was selected for analysis. The restaurant has employees of different types. Each employee must have specific skills and techniques in each context, depending on their position. Furthermore, service production in restaurants is done in a labor-intensive manner. Staff members working on the service floor provide services in direct contact with customers. In the kitchen, many manual processes create value for service operations. Therefore, staff working conditions can affect service delivery. A survey was administered to restaurant staff. Based on the results, an employee satisfaction model is proposed considering customer-oriented motives and contacts in the service delivery process. Correlation analysis and covariance structure analysis between kitchen staff, floor staff, laundry, and pantry staff are applied to the survey results, revealing differences in the satisfaction structure.

1.3.1 Questionnaire for Employee Satisfaction

Table 1.1 presents contents of the employee questionnaire administered to gather data to model employee satisfaction. The table provides an overview of question categories and question items. The questionnaire consists of two parts. The first group of questions investigates employee attributes. The second group is for employee satisfaction surveys. The questionnaire was administered with questions and free description questions using a Likert scale with question items accepting responses given at six levels: (1) strongly agree, (2) agree, (3) slightly agree, (4) only slightly agree, (5) disagree, and (6) strongly disagree. Paper question sheets were provided. Respondents completed the question sheets. The survey was administered as an anonymous survey.

Table 1.1 Outline of the employee questionnaire in a restaurant service

Question categories	Question items	Question type
Respondent attributes	Gender, Age group, Employee pattern, Length of working period at the current store, Length of continuous employment, Current working position, Experimented working position at the company	• Multiple choice question • Free descriptions
Ql: Work environment, viewpoint about work	*23 items [Q1-1–Q1-23] regarding;* Understanding of the company and workplace, Expectation of bosses and colleagues, Opportunity for challenging, Congenially employed, Good relationship with colleagues and bosses, Satisfaction with salary, Cooperation and collaboration with colleagues and bosses, Discretion, Satisfactory work, Pride in work, Understanding of their jobs by family (part of the items)	• Six level Likert question items
Q2: Work efficiency, service quality	*7 items [Q2-1–Q2-7] regarding;* Quality of dishes, Food preparation speed, Customer's reaction and satisfaction, Efficiency of work, Teamwork and collaboration, Staff assignment,Work environment (part of the items)	• Six level Likert question items
Q3: Relationship with bosses	*8 items [Q3-1–Q3-8] regarding;* Exact direction for work assignment, Advance directive, Work planning, Support, Complying with a request about shift schedule, Giving a goal for skill improvement, Listening to employee's voice (part of the items)	• Six level Likert question items

(continued)

Table 1.1 (continued)

Question categories	Question items	Question type
Q4: Philosophy, rules, and personal system	*5 items [Q4-1 – Q4-5] regarding;* Understanding of the personal system, Understanding of the work assignment and job rotation, Understanding of the batch production system, Understanding of the demand prediction, Understanding of the importance of collaborations	• Six level Likert question items
Q5: Education system	*2 items [Q5-1 –Q5-2] regarding;* Satisfaction for education system and its reason	• Six level Likert question items • Free descriptions
Q6: Attitude and motivation toward work	*8 items [Q6-1–Q6-8] regarding;* Interest in working for long period at the current company, Work fun, Desire to be more helpful at work place, Desire to enhance customer satisfaction, Interest in improving job skill, Continual awareness of providing good quality service (part of the items)	• Six level Likert question items
Q7: Interest in multi-skills development	*1 item [Q7]* About interests in increasing multi-skills	• Six level Likert question items

1.3.2 Questionnaire Design

Skills required for service production vary depending on the job type. This is especially true at labor-intensive service sites. For example, for a restaurant service, the cooking staff and the customer service staff probably differ not only in terms of their assigned work and required skills; the learning curve also differs greatly depending on the skill characteristics.

The skills to be acquired are defined herein as skills. The proficiency for each skill is defined as a skill. In the kitchen, there are skills of preparing ingredients, seasonings, cooking, dishing out foods, and so on. In catering, the items to be remembered differ depending on the target set, such as banquet dishes, luncheons, and regular menus. Therefore, the number of menus covered is a skill in itself. Additionally, how quickly and accurately it can be handled is regarded as a skill. Customer service requires skills such as guidance, order entry using a point of sale terminal (POS), banquet correspondence, and accounting. In this section, awareness of customer satisfaction, willingness to improve skills, and willingness to be a more skilled worker are examined so that differences in employee responsible duties, such as differences in customer contact and customer orientation (Homburg and Stock 2005) analyzed, can be considered. Differences, items to evaluate the degree of freedom and autonomy for work were set. The characteristic questions are presented below. As described in this paper, customer satisfaction is considered from the viewpoint of employees. It refers to customer satisfaction provided by services by which each employee can contribute through one's own responsible duty. For example, the staff members at the kitchen have a managing taste and control pace of cooking, the pantry and washing area has a speed of delivery, the set of dishes, the cleanliness of the dishes, the customer service is the attitude and smile at the time of customer service, and talking and serving dishes to customers in a timely manner.

- Relation between customer satisfaction and job type (Q1–22)
- Willingness to improve customer satisfaction (Q6–4)
- Service quality awareness (Q6–8)
- Willingness to improve work quality and skills (Q6–6)
- Willingness to increase skills and step up (Q6–7)
- Respect for your opinions (Q1–7)
- Self-discretion/self-judgment (Q1–17)
- Proactive proposals and problem solving (Q1–19)

The questionnaire was distributed at six stores; 128 employees responded to it. All segments of the restaurant staff were investigated, including both part-time and full-time workers in kitchens, service floors, washing places, and pantries. The percentage of respondents differed widely among age groups from teens to people in their sixties: 9% of people in their teens responded, 23% of people in their twenties, 9% of people in their thirties, 19% of people in their forties, 23% of people in their fifties, and 16% of people in their sixties. All teenaged staff members were part-time workers. Of the respondents, 31% were men; 68% were women. Results show that 26% of the staff worked in the kitchen, 18% in the washing area and pantry, and 50% on the service floor.

Many positive answers were given, suggesting high motivation for improving job skills, as observed particularly in the results of Q6-6 'Interest in improving job skill' and Q6-7 'Interest in increasing tasks which can be handled'. Both Q6-6 and Q6-7 received 89% positive answers, a categorization determined as the sum of (1), (2), and (3).

Next, we analyzed separate employee patterns that emerge when the staff is divided into different segments. Many positive answers including (1), (2), and (3) were received for the results of part-time workers and full-time workers. Similar trends with results across all segments are described above. A similar trend is apparent for both full-time and part-time workers in terms of motivation and emotion. In addition, full-time workers have a stronger motivation and deep understanding of strategy and rules than part-time workers have.

1.3.3 Correlation Analysis

We applied correlation analysis to evaluate the association between the two variables, which represent the respective question items. The analysis was applied for all combinations of question items, which are analyzed separately by respondent attributes. The questionnaire results of the six levels of Likert items are converted from the value of '1' to '6', which stand for (1) strongly agree, (2) agree, (3) slightly agree, (4) only slightly disagree, (5) disagree, and (6) strongly disagree. A value of $p < 0.05$ was inferred as statistically significant.

This section shows representative results with particular reference to three specific question items. The correlation coefficients among responses to questions Q6–2 are shown in Table 1.2. The question item is considered in reference to whether they might directly represent or influence employee satisfaction and customer satisfaction:

- $^{*}P<0.05$, $^{**}P<0.01$

As shown in Table 1.2, which presents correlation with Q6–2 and Q1–3 ($r = 0.581$, $p < 0.01$), and Q1–19 ($r = 0.586$, $p < 0.01$), only fair correlation was found in the segment of workers aged in their fifties and sixties. Aggressive policies providing the opportunity to propose, challenge, or implement improvement plans and problem resolutions have fair correlation, particularly for elderly workers. These policies might influence employee satisfaction of workers in their fifties and sixties more than other age groups. Actually, Q1-22 shows fair correlation with the kitchen staff ($r = 0.462$, $p < 0.01$) and service floor staff ($r = 0.559$, $p < 0.01$). Results illustrate that they might enjoy feelings toward contribution for customer satisfaction.

Correlation differences are visible according to segmentations. Particularly, the segment of current working position shows different trends of results.

1.3.4 Covariance Structure Analysis

Based on correlation between the questions in respective job categories shown in the preceding section and the role in customer contact and service production in each job category, a hypothesis of the employee satisfaction model is proposed in Fig. 1.4. Employee satisfaction (Gazzoli et al. 2010), consisting of motivation, job satisfaction, and empowerment, is not merely a one-way effect that affects service quality; it includes factors in service production systems that represent interactions with the structure and environment in which employees produce services. If a part of the service systems is changed, then it might affect employee satisfaction. We hypothesize that employee satisfaction engenders the next concrete action through the element of customer orientation. The behavior is an active behavior of the employees, as "I want to increase customer satisfaction," "I am always conscious of providing good service," or "It engenders the desire for skill acquisition and skill improvement." Here, in the service production system, they are necessary skills and other skills, and

Table 1.2 Correlation coefficients with Q6–2 (Do you enjoy your work?) and variables

Q6-2.	Do you enjoy your work?									
		Overall	Employment pattern		Current work position			Age gronp		
			Full time	Part time	Kitchen	Washing place and pantry	Service floor	10's and 20's	30 s and 40's	50's and 60's
Q1-3.	Do you have challenging opportunities ?	0.339**	0.471**	0.338**	0.269	0.493*	0.280*	-0.066	0.255	0.581**
Q1-8.	Do you feel that the company's mission and target give recognition to the importance of your own task ?	0.253**	0.607**	0.415**	0.237	0.663**	0.456**	0.222	0.400*	0.587**
Q1-13.	Do you feel the expectations of bosses and colleagues ?	0.327**	0.509**	0.428**	0.431*	0.352	0.425**	0.275	0.376*	0.583**
Q1-18.	Are common rules arranged for job processes ?	0.278**	0.444*	0.386**	0.564**	0.356	0.428**	0.116	0.568**	0.486**

(continued)

Table 1.2 (continued)

Q6-2.	Do you enjoy your work?									
		Overall	Employment pattern		Current work position			Age gronp		
			Full time	Part time	Kitchen	Washing place and pantry	Service floor	10's and 20's	30 s and 40's	50's and 60's
Q1-19.	Do you propose or implement improvement plans and problem resolutions actively ?	0.180*	0.330	0.288**	0.005	0.581**	0.284*	0.126	-0.076	0.586**
Q1-21.	Do you cooperate and collaborate with colleagues ?	0.239**	0.389*	0.497**	0.209	0.405	0.538**	0.373*	0.575**	0.491**
Q1-22.	Do you feel that your work leads to customer satisfaction?	0.366**	0.613**	0.409**	0.462**	-0.029	0.559**	0.299	0.613**	0.443**
Q6-1.	Do you want to work for a long period at the current company?	0.328**	0.792**	0.785**	0.812**	0.723**	0.800**	0.560**	0.875**	0.816**

(continued)

Table 1.2 (continued)

Q6-2.	Do you enjoy your work?									
		Overall	Employment pattern		Current work position			Age gronp		
			Full time	Part time	Kitchen	Washing place and pantry	Service floor	10's and 20's	30 s and 40's	50's and 60's
Q6-3.	Do you deire to be more helpful in the work place?	0.530**	0.709**	0.740**	0.598**	0.752**	0.706**	0.535**	0.659**	0.799**

**P<0.05, **P<0.01*

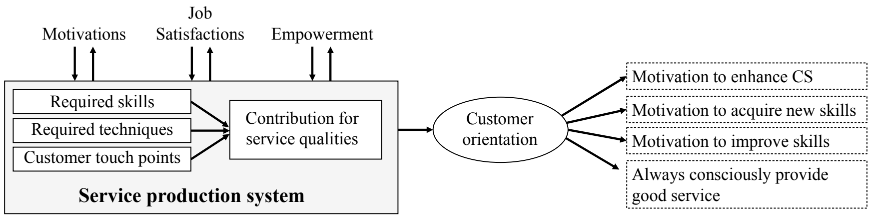

Fig. 1.4 Hypothesis model of employee satisfaction

customer contact points. Methods for contributing to service quality differ depending on the job type. The internal model of satisfaction is expected to vary depending on the job type in charge.

To verify the employee satisfaction hypothesis, covariance analysis was performed using the characteristic question group shown in "Questionnaire Design" in the preceding section and the question group, for which results differed for each job category in the correlation analysis in the preceding section.

For this analysis, "employee satisfaction" and "connection to customer satisfaction" are introduced as latent variables. Each question item is set as an observed variable. While examining the fit of the model, we verified the questions set for the employee satisfaction model structure and estimated the model. Results show the employee satisfaction models for each responsible duty depicted in Fig. 1.5a (cooking staff), Fig. 1.5b (floor staff), and Fig. 1.5c (pantry and washing staff). In the panels of the figure, small circles represent error variables, squares represent observed variables, and ellipses denote latent variables. The fit of the model was tested using RMSEA, NFI, and CFI values.

Next, the factor loading between the path connecting the latent variable "Lead to customer satisfaction" and "Motivation to improve customer satisfaction (Q6–4)" was high at around 0.8 for all three responsible duties. However, the factor load between "Motivation to improve work quality/skill improvement (Q6–6)" and "Motivation to increase skill/skill improvement (Q6–7)" was 0.93 higher than the observed variable. In contrast, the floor staff was only 0.56 for Q6–7 only; the staff at the bar and washroom was 0.92 only for Q6–7. These results were obtained probably because the internal model of employee satisfaction with the motivation from customer orientation to skill improvement and skill acquisition differs between the kitchen and other staff, where their technology is linked directly to service quality.

Consider the relation between the impression of the word "technical skills" and the staff members in charge of different tasks. Whereas cooking staff members tend to be highly conscious of skills, floor staff and pantry and washing staff might not place strong emphasis on skills. The floor staff and the pantry and washing staff are conscious of acquiring skills in the sense of learning work, but it is thought that the word "skill" is related directly to the work in charge and that it is difficult to imagine.

In addition, for customer service provided by the floor staff, the possibility exists that hospitality customer service that requires smiles and flexibility is not connected

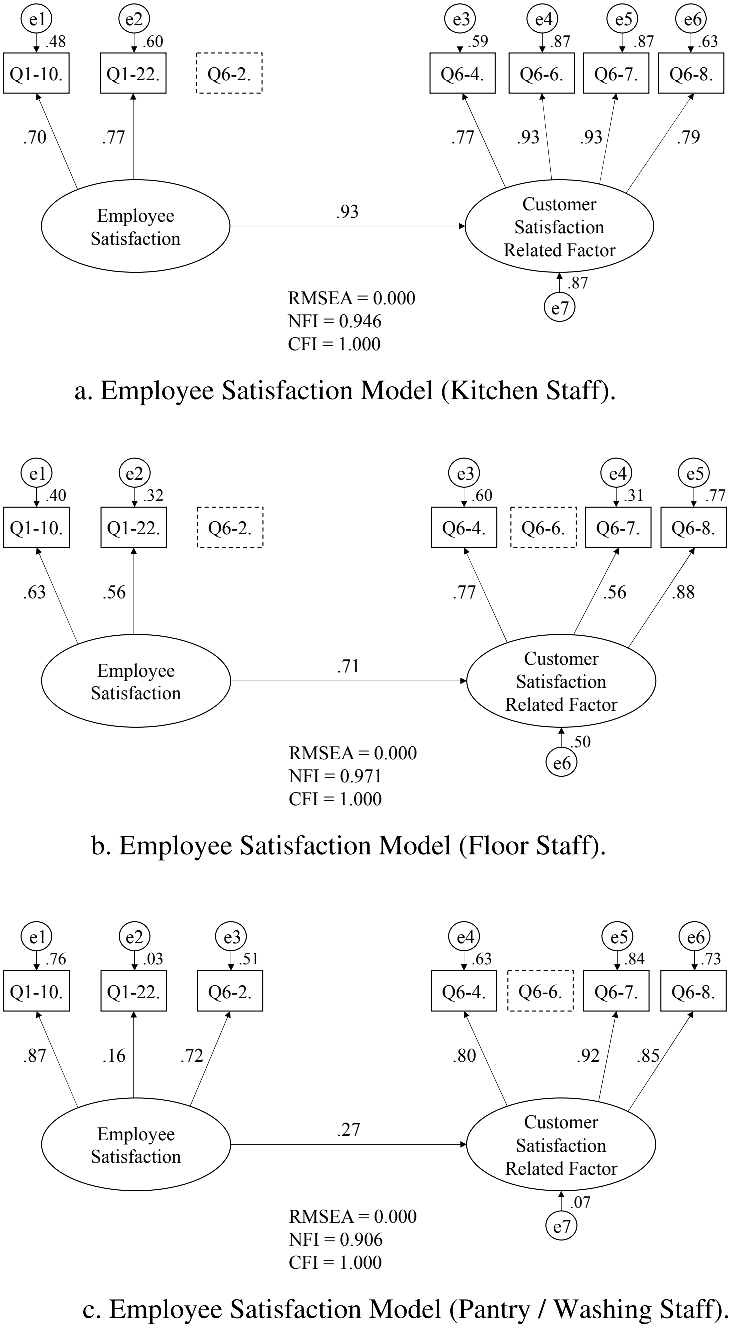

Fig. 1.5 **a** Employee satisfaction model (Kitchen Staff). **b**. Employee satisfaction model (Floor Staff). **c** Employee satisfaction model (Pantry/Washing Staff)

directly to the elements that can be acquired with skills and skills in the employee consciousness. Factor loading of 0.92 was strong only in Q6–7 in the pantry and washing area staff members. That result might derive from the fact that they have the desire to try to acquire widely various skills including other occupations resulting from other analyses.

Therefore, changing the job design based on the results described above might change and improve the internal structure of employee satisfaction for each job type. For the current job design, devising a way to allow staff to feel a customer's reaction in the kitchen and the pantry and washing staff with few customer contacts is expected to be effective. Additionally, it is possible that the consciousness structure of employee satisfaction of each job type will change by educating employees to make staff improvements and skill acquisition, and make them aware of the fact that skill improvement and skill acquisition contribute to service quality, and ingenuity related to their areas of responsibility.

Additionally, the consciousness structure of employee satisfaction of each job type might change because of education for staff improvement and skill acquisition with awareness of the fact that skill improvement and skill acquisition contribute to service quality, and ingenuity related to their areas of responsibility.

1.4 Employee Satisfaction in the Short Term

Regarding services for which production and consumption occur simultaneously, especially services for which employees face customers to create value, employee physical and cognitive ability and satisfaction can affect service quality. In such a scenario, the effects of employee status and employee satisfaction (ES) on quality and customer satisfaction (CS) are important. Most earlier studies dealing with ES and quality of service were conducted using questionnaire analysis. Many asked about medium-term to long-term satisfaction over a certain period from the time of questionnaire responses (Gazzoli et al. 2010; Judge et al. 2001; Iaffaldano and Muchinsky 1985; Harter et al. 2002). Survey results were analyzed using stratified data based on industry type, occupation type, etc. Nevertheless, few studies have examined details of work and work plans within the same profession (Nonaka et al. 2016a).

Employees are influenced by environmental factors such as demand fluctuation depending on the day or even during the day. Their feelings and attitudes might change. However, in studies presented in the preceding section, the standard or average satisfaction for each occupation was assessed, including those variations. Few studies have addressed effects of environmental factors on employee status and quality of satisfaction, either daily or during work.

This section specifically examines the effects of employee physical and cognitive skills, fatigue, and employee satisfaction (ES) levels on the productivity and quality of labor-intensive service systems. Short-term ES changes, productivity, and quality within the service production and delivery process are assessed (Nonaka et al. 2018).

Interaction with service systems is used to detect customer requirements, detect environments, modify task schedules, and update systems to clarify how employees adapt to and respond to environmental changes such as demand fluctuations. In addition, a proposed production planning game that simulates a service site is presented. In this game, employees work flexibly while adapting to changing service system demands and environmental changes. Employees produce products and services while mentally modifying and updating work plans. This game was designed using a restaurant service site as a use case.

1.4.1 Hypothetical Employee Satisfaction Model in the Short Term

In this section, restaurant services are considered as labor-intensive service sites. At such sites, employees need to adapt to demand fluctuations and respond to them. Moreover, advance preparation and efficiency are important. This requirement stems from the characteristics of the services that make up the restaurant services. Restaurant services might use a central kitchen, cook–chill system, or pre-cooking. However, it is common to start cooking after receiving customer orders. The restaurant is close to production and consumption areas. Both activities take place simultaneously. In addition, depending on the amount of demand on a given day, the amount of work might vary greatly with respect to labor input.

In the preceding section, we explained to target employees that differences exist in the internal structure of the employee satisfaction model, especially the customer-oriented specific actions and motivation pathways through ES. This condition is mainly attributable to different customer contacts depending on job functions. The survey examined the relation between ES and ES while confirming details of characteristics and work flows of each job process and task. The survey was administered via a questionnaire (Nonaka et al. 2016a) because it targeted average or standard ES. The hypothesis was that ES would change. We examined the change in ES over a one-day shift to investigate short-term ES.

Survey results show that the work performed by the employees comprised several processes and repetition. Each employee confirmed the demand forecast given by the store manager in advance, with information related to the shift plan and the staff composition, and made plans for preparation and setup for the assumed demand. They were not given a strict and detailed work schedule. Particularly, they established a detailed plan for preparation and areas for reserved guests to estimate work in advance. Furthermore, even after the start of the workday, we observed that the work priorities and task schedule were adjusted according to the status of orders, the overall work progress, and changing customer situations.

Here, if employees working at the service site can be represented as production facilities, it can be understood that “input,” “output,” and “sensing” are performed with flexibility and simultaneity. The inputs and outputs here are the materials required for production and the products produced. Employees sense the environment passively or actively. For example, passive sensing is given order data or a customer call. Active sensing, however, observes customers and seats and perceives fluctuations in demand based on visit and weather conditions. Employees update and modify their schedules and initialize their work schedules that are pre-assembled based on results of active and passive sensing in real time. Therefore, they sense changes in environmental order and change and adapt flexibly by capturing and updating environmental information, resulting in increased productivity.

At this point, by improving ES through a sense of accomplishment by improving productivity and achieving their own plan, or by being able to proceed as planned or feeling energized by deviations from expected demand, it is possible to improve productivity and quality. Figure 1.6 shows the hypothetical model of ES constructed considering these factors. In the figure, the component constituting the ES in the employee mental model comprises four elements. From the left, the four elements are time pressure (such as margin and impatience), work results (such as achievement and satisfaction), frustration (such as anxiety and discouragement) (Nonaka et al. 2018), and job satisfaction (such as enjoyment and fun). To verify this hypothetical model, a gaming simulation approach that simplifies and reproduces the operation in the actual service system for the purpose was adopted. The conducted experiment and the obtained results are presented in the next section.

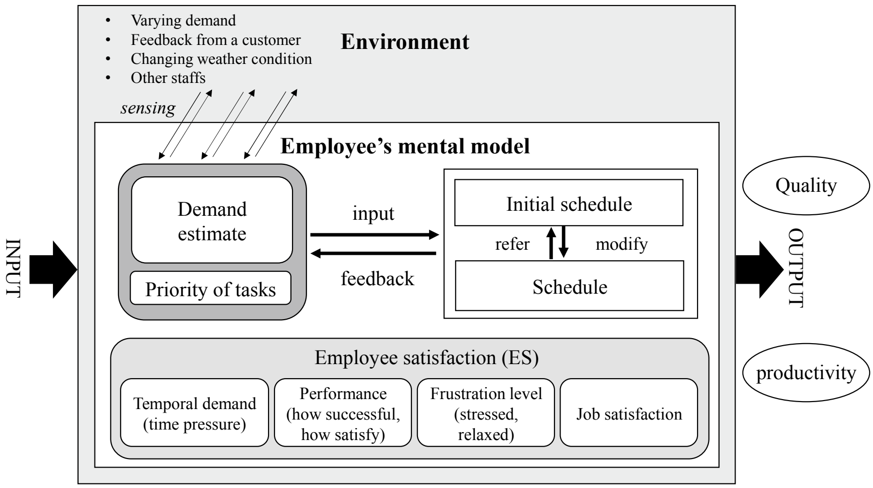

Fig. 1.6 Hypothetical model of employee satisfaction in the service delivery process (Nonaka et al. 2018)

1.4.2 Employee Satisfaction Model Verified Using a Gaming Simulation Approach

To elucidate short-term employee satisfaction, a triangular pyramid creation game was designed by simulating production planning in the service production process in restaurant services and labor-intensive service sites (Fig. 1.7).

In the game, for an order to arrive, the player manually creates and delivers triangular pyramids with paper using scissors and cellophane tape in a game format aiming for high score acquisition considering lot sizing problems. A triangular pyramid is designed in the game as an ingredient for a dish. The player is instructed that although it is permissible to start work and set up before ordering, quality will deteriorate over time from the start of work. The player is told, “Faster, freshly made, good quality triangular pyramids are pleasing to customers.” The player therefore recognizes that devising a production schedule that considers production LT, degradation degree, and quality is necessary to achieve a high score.

Demand forecast information is given to the player with different degrees of accuracy as the starting condition. Changes in productivity, quality, and ES are analyzed. Given the demand forecast information, the employee passively senses the information and corrects or changes the plan while mentally updating the assumed demand in real time. At this point, when very accurate demand forecast information is given, the difference between the assumed demand and the actual demand is small. In the demand forecast information with low precision, the difference between the assumed demand and the actual demand is large. A difference in productivity

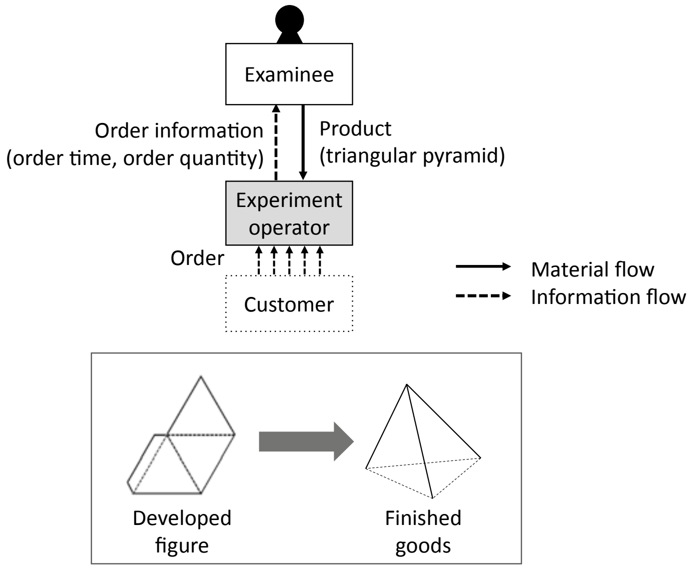

Fig. 1.7 Game outline

is assumed to produce effects on ES. The worker might reduce the operation time below the standard operation time in some situations. An example of the situations is that if the number of orders exceeds the production capacity of the employee or an order that diverges from the preliminary assumption arrives and the preparations and arrangements are insufficient. Reducing the time, however, lowers the quality even when completing the job on time. At this point, how employees deal with the tradeoff between quality and production lead time (production LT) is observed. The differences in quality and how productivity is achieved are analyzed.

In the game, the player uses scissors to cut the paper on which the development drawing is printed. Then a triangular pyramid is created by folding and taping the edges.The work itself is simple, but the degree of accuracy and task scheduling tends to influence the production quality. The player is given a sufficient number of sheets of paper as materials for producing the triangular pyramids. Figure 1.8 shows that the process involves first cutting the paper with scissors along the solid line in the developed view of the triangular pyramid and then creasing them along the broken line. Subsequently, assembly is completed by folding the overlapping parts and securing them with cellophane tape.

The triangular pyramid quality was evaluated based on the following five items: cutting of lines, no veering from lines, tape attached without any left over or protruding, laminations aligned perfectly for assembly, and proper tension on the side of the finished product.

The game flow is the following. After confirming the received order, the player formulates a production plan according to the order and creates a triangular pyramid. The player then delivers the triangular pyramid to the customer through the game operator as soon as all the sub-orders for an order are filled (Fig. 1.7).

Gameplay consists of three sessions with different demand conditions that are executed in some order. The conditions of three types are: high accuracy demand information (High), low accuracy demand information (Low), and no information (No). In fact, High shows the arrival time and number of orders, and Low shows only the total order quantity for the entire session. Order arrival time and order quantity are given as random numbers according to an exponential distribution and a normal distribution.

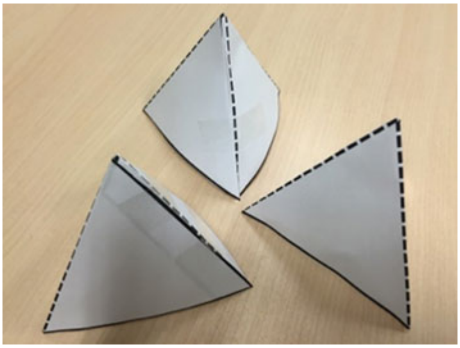

Fig. 1.8 Triangular pyramids created by one person with different quality

Game results are evaluated in terms of productivity, quality, ES, and CS in addition to the game scores presented. From the viewpoint of CS, the production LT of each order is evaluated against the quality and degradation scale described. The deterioration scale is obtained as the difference between the delivery time and the work start time: a higher value represents a greater degree of degradation. In addition, the number of orders in progress at the end of the game (disposal loss) and the number of undelivered orders are also evaluated. The provided quality is then calculated for each finished product, with each item assigned one point.

In addition, the player completes a questionnaire that evaluates "sensible production LT," "feeling of accomplishment," "feeling of impatience," "feeling of enjoyment," and "work efficiency" in ten stages following completion of each game session.

1.4.3 Experimental Evaluation

The proposed game was conducted using 18 college students as players. The time per session was assigned to players as approximately 10 min in three sessions per game. These three sessions were run under different conditions related to demand forecast information. For High, the order arrival time and number were given, but for Low, only the total order quantity for the entire session was given. There were nine orders per session, with two suborders per order on average, given as a normal distribution with a standard deviation of 1.5. Datasets of three types related to orders were prepared. Conditions were set for order datasets, session order, and forecast information by design of experiments so that players were not influenced by learning effects until they became accustomed to the work.

The average of the High quality scores was 2.46; the best score was that of High. The fastest average production LT, achieved with No, was 126.6, followed by 142.5 by High; then 158.8 Low. However, because No had the largest number of undelivered orders, the possibility exists that the value of the production LT might be small because they are not included in the calculation of the production LT. Conventionally, production LT and provided quality can secure a certain level of quality up to the threshold value before and after the standard operation time. However, for an order exceeding the production capacity that is hurriedly produced, a tradeoff exists between productivity and quality. The players planned the number of lots and the timing of job start while considering the assumed demand. At that time, highly accurate demand forecast information was useful, which is thought to have led to the high quality score and the speed of production LT.

Correlation was found between the quality score and the production LT and the subjective evaluation results for "enjoyment," "impatience," and "achievement feeling" were evaluated. The relation between ES and productivity and quality were analyzed (Table 1.3). Results show that, in the production "LT" and "impatience," moderate correlation was found for No because no demand forecast information was given. Therefore, it is easy for situations of unexpected or exceeded expectations to

Table 1.3 Results of correlation analysis

	High accuracy	Low accuracy	No information
Production lead time and product quality score	0.007	0.245*	−0.177
Production lead time and “impatience”	0.249**	−0.034	0.494**
Production lead time and “accomplishment”	0.012	−0.237	−0.030

*$p < 0.05$, **$p < 0.01$

occur. Furthermore, it is conceivable that impatience had an effect when recognizing that the production LT is longer. However, weak correlation was found for High. For High, no difference is likely to occur from expected demand. Consequently, a rush is made to make plans with little margin while understanding demand. For the factor leading to feelings of impatience, No and High might differ.

Quality of the triangular pyramids varied among individuals because of differences in player dexterity. However, considerable quality variation was confirmed even for a single player (Fig. 1.7). This inconsistency might result from the order being completed earlier and products rushed to completion, exceeding the acceptable range that guarantees quality before and after the standard operating time. The relation between these changes in quality and production capacity requires additional analysis.

For this study, an employee satisfaction model was developed to illustrate service provision processes along with a production planning game simulating the service site of a labor-intensive restaurant service. Subsequently, the influence of accurate demand forecasting information related to service quality and productivity was analyzed using the developed game. We analyzed the relation between ES and employee status and productivity and quality in a short term using the hypothetical model. A food value creation design was demonstrated to show employee status and satisfaction.

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