Paper:

Multiproduct Traditional Japanese Cuisine Restaurant Improves Labor Productivity by Changing Cooking Processes According to Service Product Characteristics

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This study introduces three cooking process improvements for a multiproduct traditional Japanese cuisine restaurant to improve labor productivity and to assess relations between offered process changes and service product characteristics. Restaurant productivity is the lowest among service industries because restaurants are labor-intensive. Therefore, the industry is affected by service product characteristics. Combining line and cell cooking systems, batch cooking using partial freezers, and combining built-to-order and built-to-plan cooking are introduced into actual multiproduct traditional Japanese cuisine restaurants to change cooking operations and improve labor productivity. Results show that all cooking process changes reduce work hours. The correlation coefficient between work hour and sales revenue improved by line and cell cooking, but it is degraded by batch cooking and built-to-order and built-to-plan cooking. Line and cell cooking enhance simultaneity and reduce the influence of perishability because the system adopts hourly work hours to fluctuation of hourly sales by changing cooking systems (line/cell). However, the system does not resolve heterogeneity and intangibility difficulties because the system is intended to resolve quantitative difficulties of cooking operation systems. Batch cooking systems reduce the influence of simultaneity and perishability of service products because the method reduces cooking frequency using partial freezers. Furthermore, the system improves heterogeneity because the restaurant can provide head-chef-made dishes even if the chef is not working at the restaurant. However, the system does not resolve difficulties of intangibility because the system is not designed to improve customers' subjective evaluation for service. Built-to-order and built-to-plan cooking reduce the respective influences of simultaneity, perishability, and heterogeneity of service products to some degree because built to plan teams also practice batch cooking using partial freezers. However, the system does not resolve the difficulty of intangibility because the system is not intended to improve customers' subjective evaluation for service.

Keywords: service engineering, labor productivity, restaurant, production system, work scheduling

1. Introduction

In the 1970s, the Japanese restaurant industry changed production methods. The industry introduced a chain store system to enhance labor productivity [1]. The system introduces food factories (central kitchens) to reduce cooking processes conducted in restaurant kitchens. Furthermore, the system simplifies menu and cooking processes to reduce dependence on chef skill, and to increase the use of part-time workers. In addition, the industry developed a cooking machine kitchen system. For instance, steam convection ovens were developed to increase the cooking capacity of simmered foods and baked foods [2]. Sushi boat (kaiten sushi) restaurants developed sushi-cooking systems by combining robots and sushi conveyors [3].

In the 1980s, the industry introduced information systems. Point of sale (POS) systems cut order information communication operations between kitchen and service staff [4]. Furthermore, the restaurant industry changed management systems from skill-based operations to system-based operations. The industry expanded rapidly.

During the 1990s to the 2000s, the industry introduced simulation, which was developed in manufacturing industry [5], and production planning to enhance kitchen operation efficiency. For instance, a procedure for determining the number of cooking machines was proposed to optimize the production capacity of cooking machines and customer orders [6]. A kitchen layout design method was proposed to improve the kitchen staff traffic line [7]. Furthermore, a kitchen simulator was developed to improve the kitchen staff capabilities [8]. Consequently, the restaurant industry has become a key industry in Japan by introducing these systems and methods [9]. Although the industry developed continuously and although the author introduced various systems and studies, some difficulties are still not resolved.

The first issue is customer demand diversification. In recent years, customer preferences have become diverse [10]. Therefore, a gap arises between customer needs and cooking systems. Chain store systems and conventional studies are aimed mainly at atomization and simplification of cooking processes and to reduce dependence on chef skills. By contrast, customers today want to eat dishes that are not off-the-shelf dishes but which are customized. Restaurants must evolve cooking systems from chain operations to customized-product-based.

Traditional multiproduct Japanese cuisine restaurants fit customer needs today. The restaurant category provides various dishes adapted to various customer needs. Moreover, the restaurant category can customize dishes based on customer needs. However, the production system of the restaurant category brings low productivity compared to chain store restaurants because they are compelled to hire many chefs to maintain production capacity and food quality. Moreover, low productivity engenders bad working conditions. Chefs must work from morning to prepare lunch dishes, and must work until late night to provide dinner dishes. For that reason, they work long hours. Therefore, restaurants are typically so-called *black companies* with notoriously poor work conditions. The restaurant category must develop new production systems to improve labor productivity and working conditions.

A second issue is labor productivity. Although restaurants have become the largest industry, labor productivity remains at a low level [11]. As many reports have described, labor productivity of service industries is lower than that prevailing in manufacturing [12]. Furthermore, restaurant industry productivity is the lowest among service industries [13]. Conventional studies are aimed mainly at maximizing production capacity, or at minimizing labor input. Although these approaches are important, the most important issue for the restaurant industry is to resolve low productivity caused by service product characteristics.

Service has intangible contents (intangibility). Therefore, service providers cannot stock service contents (perishability). For that reason, services must be produced simultaneously to satisfy a customer order. The service provider must have some stocked production capacity by staff (simultaneity). In addition, the quality and production capacity of service deeply depends on the skill of the service provider (heterogeneity) [14]. By contrast, manufacturing products are tangible goods. Therefore, products are produced at a factory, and are stocked in warehouse. As a result, manufacturers need only to export a product when a customer orders it. From that perspective, demand and supply are asynchronous. Moreover, quality and production capacity can be controlled by quality design and production planning.

A prepared dish is a tangible good, but dish characteristics are similar to those of service contents, especially traditional cuisine restaurants. For instance, the shelf life of sushi rolls is only 1 or 2 min because the sushi roll quality worsens rapidly after preparation. Therefore, the chef must cook it simultaneously with the customer order. Furthermore, quality, and production capacity depend deeply on the chef's skill. A skillful chef can prepare more than 60 sushi rolls within 1 hour, but a cook in training can produce fewer than 20 sushi rolls within 1 hour. The restaurant category must adopt a production method to overcome the difficulty of characteristics of service product.

To resolve these difficulties, plural production systems are designed and introduced for use in actual multiproduct traditional Japanese cuisine restaurants. Based on the results, the productivity improvement effectiveness of these systems is then discussed. Also, the relation between the purposes of these systems and service product characteristics is assessed.

2. Changing Cooking Processes

2.1. Combination of Line and Cell Production

Traditional allocation of tasks at restaurant kitchens is similar to a line production system. Conventionally, at traditional Japanese restaurant kitchens, chefs are assigned individual cooking positions such as fried foods, baked foods individually, to prepare and cooked dishes. Typically, chefs do not help each other despite being busy because of their customs and pride. If a kitchen is swamped with orders, then the system works well because of a high operation rate. However, it does not work well because of the low availability ratio at some kitchen positions while a restaurant is idle. Customers order dishes of various kinds not only during rush times but also during restaurant idle times. Therefore, chefs must be assigned all kitchen positions to maintain production capabilities at all cooking positions. Consequently, chefs are assigned at all times to all positions. Low availability during idle time is important cause of lower productivity.

To improve idle-time productivity, a cell kitchen was introduced at multiproduct traditional Japanese cuisine restaurant A. At cell kitchen, all cooking machines, such as simmer, fryer, and griller are placed, and a chef, multiskill worker, cooks all kind of dishes using cell kitchen. To combine line kitchen and cell kitchen, restaurant can enhance elasticity of labor input.

While a restaurant was busy, the kitchen was operated by conventional allocation of tasks (line cooking). When the restaurant operations slowed, the kitchen changed the cooking system from line kitchen cooking to cell kitchen

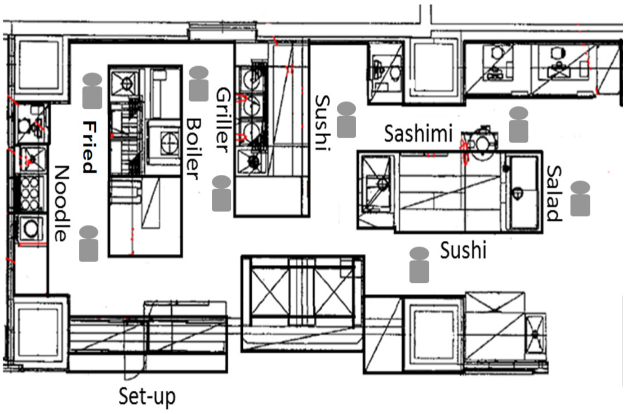


Fig. 1. Conventional kitchen layout and placement of staff.

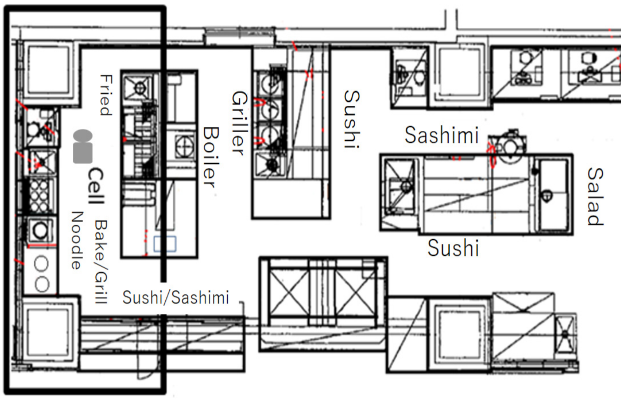


Fig. 2. Combination of line and cell.

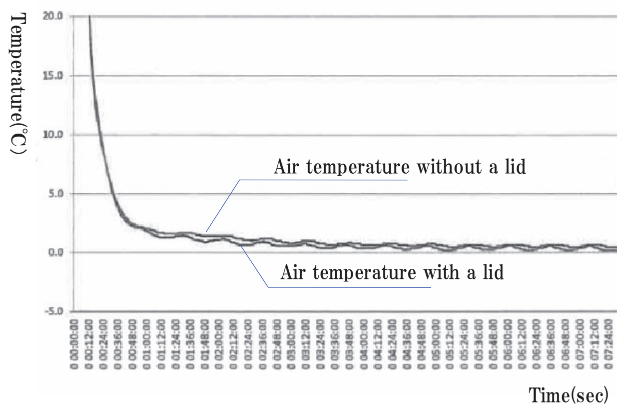


Fig. 3. Temperature of partial refrigerator.

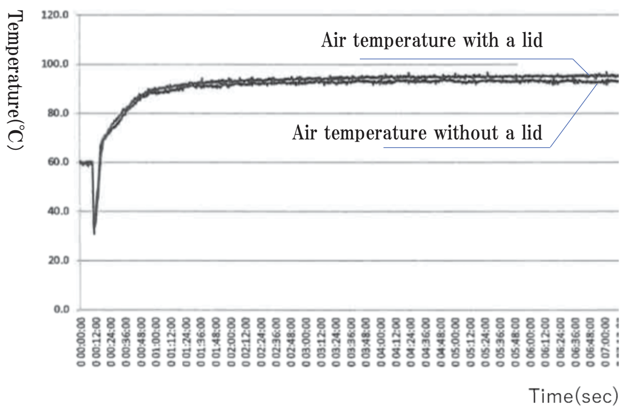


Fig. 4. Humidity of partial refrigerator.

cooking to reduce total of cooking staff. By necessity, chefs resist such cooking systems, so the purpose of the combination of line and cell was explained to the restaurant chefs by a general chef. Thereafter, chefs had repeated meetings to discuss the purposes of the new cooking system. Subsequently, a cell kitchen was placed in the test kitchen at corporate headquarters. Chefs of the restaurant were trained to become accustomed with cell-cooking for 4 weeks because they did not cook all types of dishes simultaneously. After preparation, a cell kitchen was introduced at the restaurant kitchen. **Fig. 1** depicts the line kitchen layout. **Fig. 2** shows that of cell kitchen.

2.2. Batch Cooking-Changing Cooking Frequency

Conventionally, dishes are cooked by a chef every day to maintain high quality of dishes because it is difficult to stock them for a long time. For instance, the shelf-time of sea bream papery sashimi (usu-zukuri) is only a few minutes after preparation. Therefore, it must be cooked at the time of order receipt. In addition, refrigerator temperatures prevent restaurants from stocking dishes overnight because the refrigerator temperature changes from 3°C to 10°C. The quality of dishes can be maintained if kept at 3°C, but at higher temperatures, the dish quality worsens because of bacteria growth. Moreover, the humidity inside a refrigerator is around 20%. Therefore, the food surface dries out [15].

If a head chef works at a restaurant, then the quality of dishes is good because the chef can cook them, but if the head chef does not work there because of a holiday, the quality of dishes falls because food quality depends strongly on chef skill. Restaurants must have at least two head chefs to maintain quality. Having fewer head chefs engenders low productivity at traditional cuisine restaurants.

By contrast, partial freezer temperatures can be kept at 0°C to −3°C, with 100% humidity. Therefore, dish quality can be maintained at a high level for multiple days. If ingredients are stocked 0°C, then the water in the ingredients freezes. Therefore, bacteria cannot breed because they lack free water [16]. Furthermore, the food surface does not dry because partial freezing maintains 100% humidity. **Fig. 3** presents the partial freezer temperature; **Fig. 4** shows the humidity.

Although a partial freezer is better than a refrigerator, the price of a partial freezer is double that of a refrigerator. They are not popular. Moreover, chefs believe that food quality worsens overnight. Therefore, few traditional cuisine restaurants have freezers, even though partial freezing maintains high food quality.

Partial freezers were used in a multiproduct traditional Japanese cuisine restaurant to change cooking processes. Before their introduction, the partial freezers were used in a test kitchen at the headquarters of a traditional Japanese cuisine restaurant company to check the storage of respective ingredients and dishes, and to persuade chefs to use them.

First, 87 ingredients were prepared or a dish was cooked. They were then stocked in a partial refrigerator for 7 days. A chef (61 years old, 42 years of experience) checked the taste, smell, color, and moistness daily, and evaluated each on a five-point scale: very good=5, good=4, normal=3, not good=2, bad=1. If all factors received a 4 or 5, then it was possible to use it for prepared dishes. If a factor was judged as 1, 2, or 3, then it was evaluated as not useful for cooking. Of the 87 ingredients and dishes, 38 were selected for partial freezing stock.

Those 38 ingredients and dishes were stocked again using the partial freezer. The CEO, three directors, grad chef, and six general chefs checked them the day before the eat-by-date for freshness to confirm their quality and to judge the availability partial freezer for long-term stock. After that procedure, a partial freezer was placed at a traditional Japanese cuisine restaurant B kitchen to check the quality under actual cooking environment because the freezer door is opened frequently. Under those circumstances, the quality of ingredients and dishes might not remain sufficient for business use. The same member checked them and confirmed their availability.

Subsequently cooking operations were changed from every-day cooking (real time production) to multi-day cooking (batch production). Based on the defined eat-by freshness date, ingredients were precooked and dishes were cooked when the head chef of the restaurant worked, and stocked them for multiple days. In addition, the work schedules of the restaurant kitchen changed. Preparation for everyday orders was conducted every day in the morning, but preparation cooking was moved into daytime hours to reduce work hours at the kitchen.

2.3. Built-to-Order and Built-to-Plan (BtO/BtP)

Conventionally, at a Japanese restaurant kitchen, cooking tasks are assigned by cooking position. Therefore, kitchen staff members must cook both pre-ordered dishes (customers with reservations) and random orders (customers without reservations). Chefs start cooking for lunch customers with reservations in the morning because they have already ordered dishes. They can cook for lunch customers without reservations at the time of the customer order. Additionally, chefs must cook dinner for pre-reserved customer while the restaurant is idle (14:00–17:00) because they must cook dinner for customers without reservations. As a result, cooking staff must cook for a long time. This point is a most important cause of long work times and low productivity.

If cooking tasks are assigned according to order information (customers with and without reservations), then cooking time can be reduced. Chefs assigned to with-reservation tasks start cooking in morning, cook all dishes the restaurant received in a planned manner, and finish working after they have finished cooking for the day. Therefore, they can do production planning to reduce their working time. However, chefs who are assigned without reservation orders operate the kitchen only for lunch and dinner times. Therefore, they need not work during the morning or idle time.

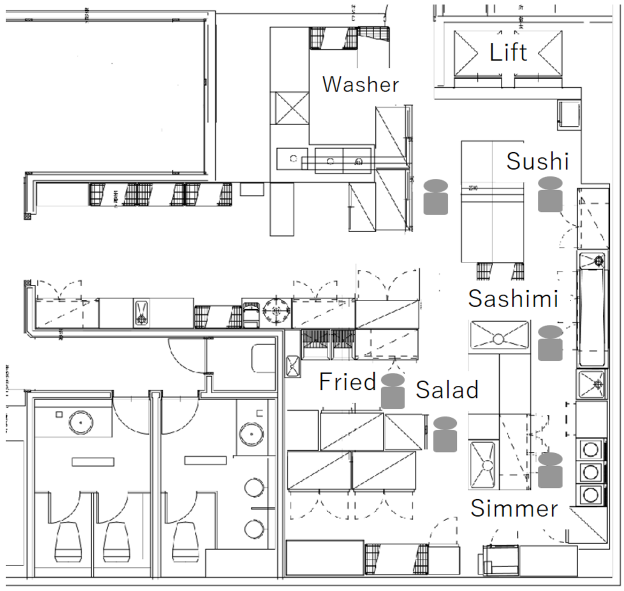
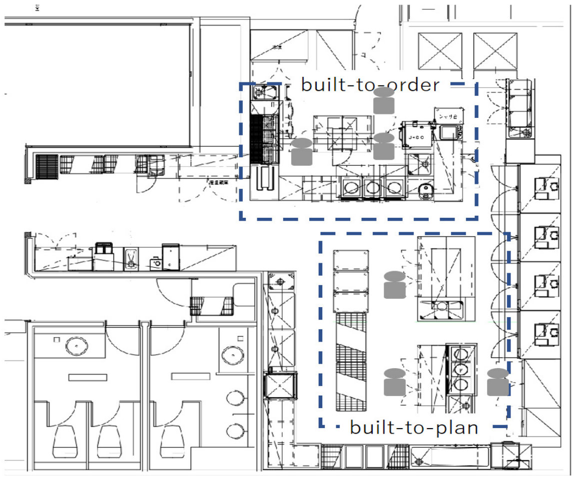


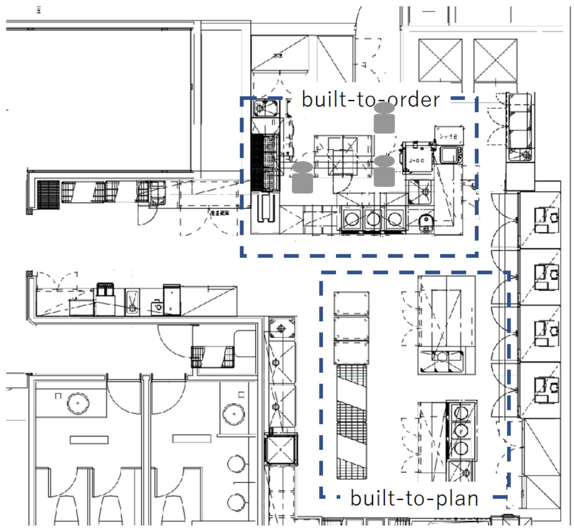
Fig. 5. Existing kitchen layout.

To change the cooking assignment, the kitchen layout and information system are changed at a traditional Japanese cuisine restaurant C. First, cooking staff members are divided into two teams: built-to-order and built-to-plan. Furthermore, the restaurant kitchen layout is changed to redesign cooking tasks. **Fig. 5** depicts a pre-redesigned kitchen. **Fig. 6** portrays that after redesign. **Fig. 6(a)** shows both built-to-order team and a built-to-plan team work, and **Fig. 6(b)** shows that built-to-plan team finish working. The information system of restaurant C is customized to divide order information. Information for customers with reservations is transmitted to kitchen staff from the reservation management system to the built-to-plan area. Information for customers without reservations, or random order information, is transmitted from the POS system to the built-to-order area.

Sales per worker hour of cooking staff are measured as a KPI for productivity. Daily labor hours of cooking staff are recorded by the attendant management system, and daily sales is recorded by POS system for 9 weeks, before and after introduction of these three systems.

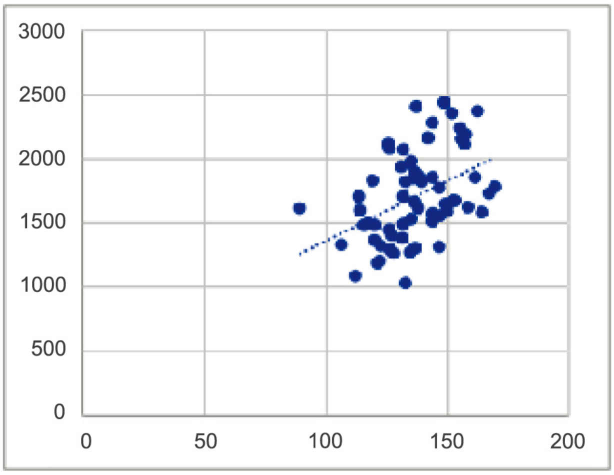


(a) BtO/BtP kitchen (two team cooking).

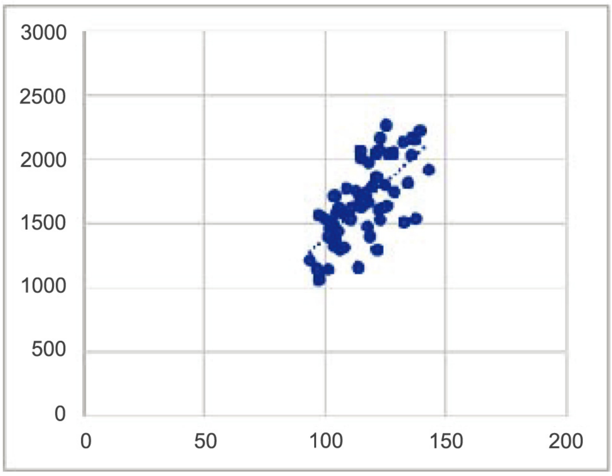


(b) BtO/BtP kitchen (BtO team cooking).

Fig. 6. Redesigned kitchen.



(a) Scatter plot of existing kitchen:
X=work hour (hr) / Y=sales (1,000 yen).



(b) Scatter plot of line and cell kitchen:
X=work hour (hr) / Y=sales (1,000 yen).

Fig. 7. Scatter plots of existing kitchen and line/cell kitchen.

3. Results

3.1. Combination of Line and Cell Cooking

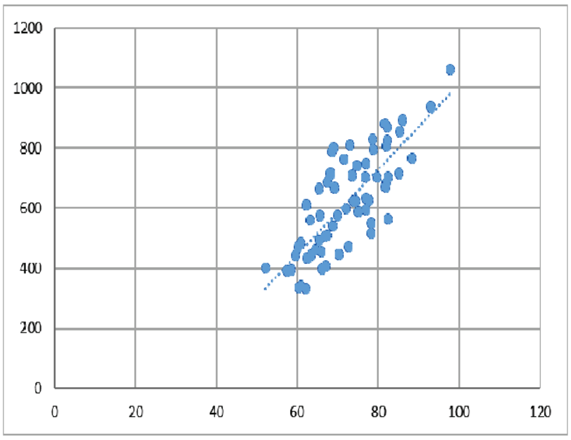
Average work hours for pre-introducing line and cell cooking were 137.3 hr (SD=16.2 hr). Average sales per labor hour were 12.432 yen (SD=2,374 yen). The correlation coefficient between work hours and sales was 0.42 ($p<0.01$). Average work hours after introducing line and cell cooking were 116.0 hr (SD=12.2 hr). Average sales per labor hour were 14.318 yen (SD=1,898 yen). The correlation coefficient between work hours and sales was 0.69 ($p<0.01$). **Fig. 7(a)** presents a scatter chart of pre-introduction sales and work hours. **Fig. 7(b)** shows that after the introduction of line and cell cooking.

3.2. Batch Cooking-Changing Cooking Frequency

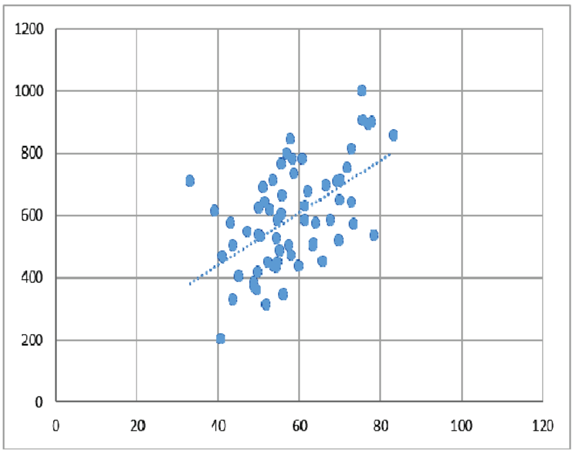
Average work hours for pre-introducing batch cooking were 72.5 hr (SD=9.4 hr). Average sales per labor hour were 8.501 yen (SD=1,607 yen). The correlation coefficient between work hours and sales was 0.79 ($p<0.01$). Average work hours after introducing batch cooking were 58.2 hr (SD=11.0 hr). Average sales per labor hour were 10.302 yen (SD=2,773 yen). The correlation coefficient between work hours and sales was 0.55 ($p<0.01$). **Fig. 8(a)** depicts a scatter chart of pre-introduction sales and work hours. **Fig. 8(b)** shows that after introduction of batch cooking.

3.3. Built-to-Order and Built-to-Plan

Average work hours for conventional cooking system were 70.3 hr (SD=8.7 hr). Average sales per labor hour were 12.274 yen (SD=3,279 yen). The correlation coefficient between work hours and sales was 0.68 ($p<0.01$). Average work hours after introducing built-to-order and built-to-plan cooking were 56.7 hr (SD=9.6 hr). Average sales per labor hour were 15.562 yen (SD=3,790 yen). The correlation coefficient between work hour and sales

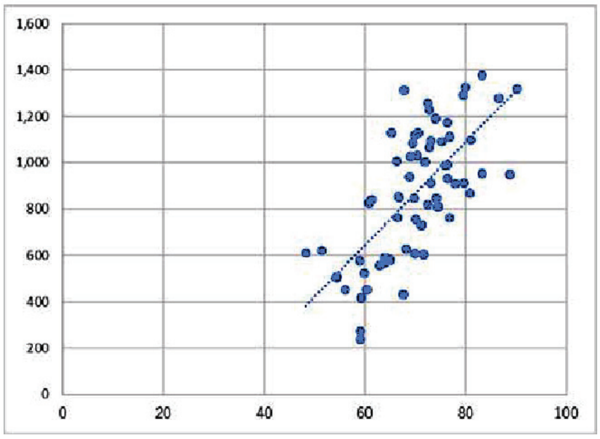


(a) Scatter plot of existing kitchen:
X=work hour (hr) / Y=sales (yen).

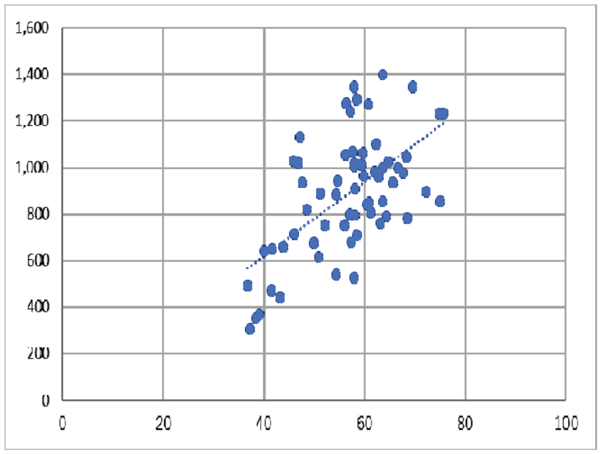


(b) Scatter plot of batch cooking:
X=work hour (hr) / Y=sales (yen).

Fig. 8. Scatter plots of existing kitchen and batch cooking.



(a) Scatter plot of existing kitchen:
X=work hour (hr) / Y=sales (1,000 yen).



(b) Scatter plot of BtO and BtP:
X=work hour (hr) / Y=sales (1,000 yen).

Fig. 9. Scatter plots of existing kitchen and BtO/BtP.

was 0.60 (p<0.01). **Fig. 9(a)** depicts a scatter chart of pre-introduction sales and work hours. **Fig. 9(b)** shows that after introduction of built-to-order and built-to-plan cooking.

4. Discussion

First, the relation between changing cooking system and simultaneity of service is discussed. The correlation coefficient of batch and cell cooking improved from 0.42 to 0.69. By contrast, that of batch cooking fell from 0.79 to 0.55. That of built-to-order and built-to-plan also fell from 0.68 to 0.60.

The main purpose of the combination of line and cell cooking is to increase the elasticity of work hours to adapt to fluctuations of sales during the day. Therefore, restaurant A changed hourly work hour input to adapt to fluctuations of orders during the day, using line and cell styles, to increase the simultaneity of the customer order time and cooking time.

By contrast, the main purpose of the batch cooking system was to divide the order-receiving time and the cooking time. If a restaurant does not introduce storage conditions such as a partial freezer, then the restaurant must cook dishes when the order is received to maintain food quality. Restaurant B decreased the simultaneity of the customer order time and cooking time by introducing batch cooking using a partial freezer.

The main purposes of built-to-order and built-to-plan cooking are to reduce simultaneity. Dishes for customers with reservations are batch-cooked by a built-to-plan team, and are stocked using a partial refrigerator. Therefore, simultaneity of the customer order time and cooking time is decreased, as with a batch cooking system. However, dishes for customers without reservations are cooked consecutively by built-to-order team. Therefore, the simultaneity of the customer order time and cooking time is increased, as with line and cell cooking. Results show that the correlation coefficient of batch cooking fell by 0.24, but that of built-to-order and built-to-plan fell by 0.08.

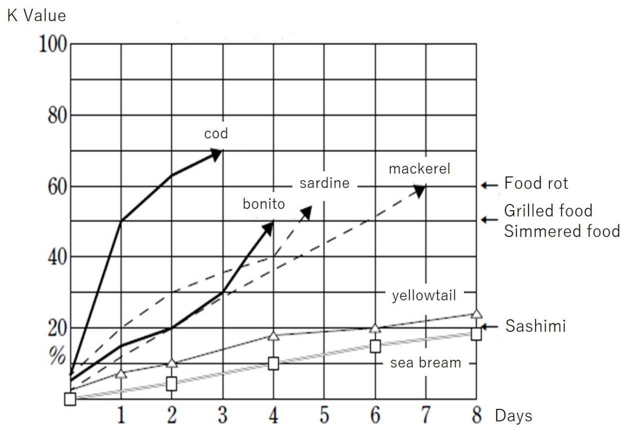


Fig. 10. Time passage and K value.

Second, the relation between changing cooking processes and the perishability of service was discussed. As explained earlier, food is a tangible good but food characteristics are similar to service products because food quality worsens rapidly immediately after preparation. Partial freezing prevents food from quality deterioration. Therefore, batch cooking reduces the influence of perishability. Built-to-order and built-to-plan cooking partly reduce it. However, line and cell cooking do not reduce the influence of perishability.

The reason is similar to the relation between cooking systems and simultaneity of service. Both the batch cooking system and built-to-order and built-to-plan introduce the use of a partial freezer. The freezer keeps foods fresh. Therefore, partially stocked food can maintain good quality, and reduce the influence of perishability.

Its utility notwithstanding, a partial freezer cannot stock food of all kinds. The freezer cannot keep dishes warm. For instance, fried foods must be fried at the same time the order is received to heat it. In addition, the freezer keeps food moist. Therefore, it cannot stock dried foods. For instance, sushi rolls must be prepared at the time of order because nori-paper immediately moistens, which degrades its quality. To resolve that difficulty, another stock method for warmed foods and dried foods must be introduced.

Third, the relation between changing cooking processes and the heterogeneity of service is discussed. Food quality does not improve because of the use of line and cell kitchens, but it is improved by batch cooking, and is partly improved by built-to-order and built-to-plan cooking.

The first point is introduction of partial freezer. An earlier study has demonstrated that the taste of ingredients depends deeply on the contained amount of umami (inosinic acid), especially meat and fish [17]. Japanese cuisine gives weight to it because the main ingredient of Japanese cuisine is fish. **Fig. 10** shows a relation between the time of storage and the contained amount of K value in ingredients. The K value is a typical index of umami (inosinic acid). As **Fig. 10** shows, the K value increases over time. Therefore, amounts of ingredients stocked in a partial freezer are expected to increase. To confirm that point, additional interviews and taste checks were conducted. The CEO, three directors, the grand chef, and six general chefs also reported that the tastes of partial-stocked ingredients were better than those of refrigerator-stocked ingredients. Therefore, the taste of dishes stocked in a partial freezer improves because of increased amounts of inosinic acid.

A second point is the enhanced food presentation. If a restaurant staff cooks a dish at the time of a customer's order, then the quality of food presentation deeply depends on the workload. If a chef is overloaded with orders, then the chef sacrifices quality of the dish presentation for the sake of cooking speed. However, if a restaurant introduces batch cooking and built-to-order and built-to-plan systems, then chefs can arrange food in a planned manner, especially when the restaurant is idle. They have sufficient time to check and revise the food presentation.

To confirm the relation between the cooking system and the quality of food presentation, an additional study was conducted. Results show that the food presentation of batch cooked is better than when foods were cooked consecutively. In addition, the cooking speed and timing were improved because batch-cooked food was so-called ready-made. The chef needs only serve dishes if the food is batch-cooked. Therefore, the chef can control the serving timing. Waiting time and serving timing are important for customer satisfaction [18, 19].

A third point is the chef skill. Batch cooking and built-to-order and built-to-plan systems introduce partial freezers to stock dishes for days. The head chef can precook dishes for non-work days. Therefore, the dish quality does not worsen because of differences in chef skills.

The relation between quality of service and skill of service provider is an important factor affecting service productivity. The quantity of service products is one factor for service productivity, but the quality of service products is a more important factor. The quality of tangible goods is stable. Therefore, productivity is defined by the amount of production. By contrast, the quality of a service product fluctuates according to the service provider. Productivity is defined by the provider's skill. If a provider provides a low-quality service, then a customer will reject it, require that it be redone, or change the service provider.

Fourth, the relation between changing cooking processes and service intangibility is discussed. Food is a tangible good. Methodologies are offered with the intention of improving food production (tangible goods). Furthermore, traditional Japanese cuisine kitchens are located in the rear of restaurants. Customers do not see the cooking areas. Therefore, a customer evaluates quality of dishes physically. These points have nothing to do with intangibility of service.

However, other production systems such as sushi and bar counters, represent a deep relation with service intangibility because these production systems are located at the front of a restaurant. A customer usually sees the cooking situation. Customers evaluate the service quality

Table 1. Cooking system and characteristics of service.

	Line/Cell	Batch	BtO/BtP
Simultaneity	Up	Down	Down
R	0.27	−0.24	−0.06
Perishability	–	Improved	Partly Improved
Category	–	Cold Meal	Cold Meal
Heterogeneity	–	Improved	Partly Improved
Category	–	Cold Meal	Cold Meal
Intangibility	–	–	–

based not only on dishes but also on the attitude of a service provider such as their conversation, smile, and hospitality. To improve customers' subjective added value, mental and psychological approaches are also required, as well as a physical methodology [20].

Table 1 presents a summary of this discussion. As the table shows, each system partly resolves difficulties of low productivity caused by characteristics of service products, but does not resolve them fully. To resolve this difficulty, additional cooking systems must be introduced, especially to overcome the characteristic of intangibility.

5. Conclusions

This study introduces three cooking process improvements for traditional multiproduct Japanese cuisine restaurants to improve labor productivity. The study also analyzes relations between offered process changes and service product characteristics.

First, the combination of line and cell cooking was introduced to restaurant A to enhance the elasticity of labor input to fluctuation of sales during the day. Second, batch cooking using a partial freezer was introduced at restaurant B to reduce cooking frequency and to stabilize the quality of dishes. Third, the combination of built-to-order and built-to-plan cooking systems was used in restaurant C to change cooking operation assignments and work scheduling.

Results show that all cooking processes reduce work hours. The correlation coefficient between work hours and sales revenues was raised by line and cell cooking, but was lowered batch cooking and built-to-order and built-to-plan cooking.

Line and cell cooking enhance the simultaneity of customer orders and cooking time by changing the cooking system (line/cell). They also alleviate the difficulty of perishability of service products. However, the system does not resolve the difficulties of heterogeneity and intangibility because the system is intended to resolve quantitative difficulties of cooking operation systems.

The batch cooking system reduces the influence of simultaneity and perishability of service products because the method introduces a partial freezer. It keeps ingredients fresh for several days. Therefore, the head chef precooks foods for use on multiple days. In addition, the system improves heterogeneity because the restaurant can provide head-chef-made food even when the chef is not working at the restaurant. Nevertheless, the system does not resolve the difficulty of intangibility because the system is not intended to improve customers' subjective evaluation of the service.

Built-to-order and built-to-plan cooking systems partly reduce the influences of simultaneity, perishability, and heterogeneity of service products because the built-to-plan team also conducts batch cooking using a partial freezer. However, the system does not also resolve the difficulty of intangibility because the system does not improve customers' subjective evaluation of the service.

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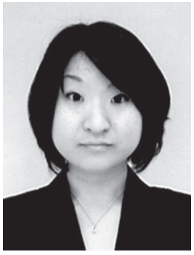

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