LABOR SCHEDULING PROGRAM FOR SUPERMARKETS FOCUSED ON MONTHLY PRODUCTIVITY
-- Case Study on Checkout, Meat, and Delicatessen Departments --

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Abstract
This paper proposes a new approach to the LSP (Labor Scheduling Program) for supermarkets. One of the LSP’s disadvantages is that it causes labor hours to exceed the budgeted hours because the LSP aggregates labor hours from each work task. In our proposed approach, first, monthly labor hours are determined based on the specified productivity rate (i.e., sales per man-hour) and the sales budget. Second, it determines each employee’s daily shift and labor hours. Finally, it computes the required tasks using the sales budget and then schedules and assigns them to the employees.

Keywords: LSP, supermarket, productivity, store operation

1. INTRODUCTION

Many Japanese supermarkets have suffered from a long economic depression. Increasing sales is difficult in an environment marked by low birth rates and increased longevity, yet many companies want to increase their productivity.

The LSP (Labor Scheduling Program), a method of increasing productivity, was first tried by U.S. companies 50 years ago and has now been adopted by Japanese supermarkets as strong tools for store operation, see (Murakami, 2004). Many other companies have tried LSP with some success, see (Kawamata, 2007) and (Tsuji, 2006); however, quite a few have failed.

Many of the supermarkets we consulted said that the LSP is very difficult to use and took years to produce advantageous effects.

This paper examines why the LSP is so difficult and proposes a new approach that overcomes its disadvantages. We then discuss case studies on three departments. A supermarket checkout department was able to reduce its required man hours by ten hours per day. Another store’s meat department was able to improve productivity by 3,000 yen per hour on particularly slow days.

2. REASONS FOR LSP FAILURE

Cases of LSP failure reveal that the program is fixed upon each act and its timing, and ignores the productivity of both the daily and monthly timespans. Aside from that fact, we identify five reasons why the LSP is so difficult for Japanese supermarkets:

1. Mismatch between LSP concept and the store
   In the LSP, we usually time each act for each worker, aggregate these times, and then decide upon a daily work schedule, but a store’s budgeted hours are usually fewer than the required hours. Hence, managers must reduce their hours and thus reduce sales or work late without overtime pay.

2. Disadvantages of setting reasonable expectancy (RE)
   The LSP sets an RE, the standard time, which is for a checkout department the number of consumers passing through a checkout lane per hour and, for a sales department, the number of product packs per hour. Some companies set this value as the time expended by their best worker, while others at a level somewhat higher than average. After this value is set, however, the quick workers (i.e., quicker than the RE) reduce the RE work speed, causing the slow workers to be unable to finish their tasks by the set time.

3. Difficulty of helping other departments
   A store’s operation system is important for the LSP. Store managers who find leeway or a shortage in a department must arrange for labor leeway in the department with the shortage. Japanese supermarkets cannot do this, however, because of their independent accounting systems.

   The checkout department offers a prominent example. When customers wait in long lines, workers in other departments occasionally take work breaks. Moreover, when department managers or headquarters’ buyers visit a store and find a stockout or sales problem while sales department workers are helping the checkout department, they will point to the help being given to the checkout as the reason for the sales problem.

4. High cost of sustaining operations
The LSP times each act for each worker and sets that time as the employee master. We maintain these master tables for each employee transfer or hire, but store staffs are too busy to do this maintenance in addition to their jobs. Hence, sustainable LSP operation requires that we assign headquarters staff to each department.

5. Problems in organization and standardization

As (Murakami, 1989) points out, the success of LSP in Japanese supermarkets depends on two important conditions: (1) the division of roles between headquarters and the stores and (2) standardization. However, many companies have tried the LSP before satisfying these conditions and have failed.

3. NEW APPROACH FOCUSED ON MONTHLY PRODUCTIVITY

As explained in the previous section, the traditional LSP places an excessive focus on each act and budget hours are fewer than required. Hence, we propose the following new approach focused on productivity:

1. Making a monthly numeric plan

First, each store will determine monthly sales and hours budgets designed to achieve the sales productivity headquarters has designated.

Headquarters often imposes virtually unachievable sales budgets, in which case we must budget enough hours for large-scale sales. However, supermarket sales do not increase in proportion to their labor hours, causing sales to miss their budgets and labor hours to add up.

Thus, rather than focus on headquarters’ sales budgets, we set the achievable sales budget as the objective and set the labor hours required to achieve headquarters’ sales productivity goal.

2. Making a daily numeric plan

This process involves setting daily sales budgets and labor hours to achieve each day's sales productivity target and to ensure that the sum of the sales budget and labor hours coincides with the monthly budget. Headquarters sometimes sets a daily budget, but this is very rough and irrelevant to the store. The department and store managers decide on the daily sales budget in light of the bargain days, local events, and days of the week. According to the daily sales productivity, the labor hours for each day are determined and each employee’s shift is scheduled. The labor hours on some days might exceed the contractually budgeted hours, but this is not a problem as long as the monthly productivity goals are achieved.

3. Making a daily work schedule

Using the shifts set in the previous step and the work volume of each day, we can make a work schedule for each day and find leeway and shortages by assigning employees for each task. To address shortages, we can consider the possibility of obtaining help from other departments and examine work arrangements and overtime. For leeway, we can consider the possibility of obtaining help from other departments, featuring sales promotions (including face-to-face sales), shortening the labor hours, and using the busiest time of the day for training towards increasing sales productivity.

Fig. 1 compares the traditional approach and our new approach. Since our new approach focuses on the overall productivity, we achieve the headquarters’ productivity targets. Further, since we don’t keep an account of each employee’s productivity, we obtain good results by utilizing lower costs and lesser time.

4. CASE STUDY

4.1 Case Study of Checkout Department

Since the checkout department of a supermarket has the most employees and provides direct service to customers, we will apply our approach to this department.

As they either composed their work schedules by hand or used spreadsheets, scheduling took a long time, and they found no shortages or leeway.

Fig. 2 shows a monthly and daily productivity table. When an item exceeds the criterion value, its cells become red as an alert. The sales productivity of the checkout department is usually between 60,000 and 90,000 yen, and the manager makes preliminary decisions about the standard value of the day of the week and its events.

First, the manager sets the value the monthly sales plan must achieve and then determines the monthly labor hours needed to meet the sales productivity goal set by headquarters. Next, he sets daily sales plans, labor hours, and employee shifts that coincide with the monthly values and the daily sales productivity. Finally, he makes a daily work schedule.

Fig. 3 and Fig. 4 show examples of work schedules in the employee view and work view, respectively. For the checkout department, we decide how many check-counters should open by using the hourly consumer data for the day of the week and then decide how to assign the required check-counters or tasks, as follows:

Assignment Process for Checkout Department

1. Decision on Starter

In order of check-counter priority, assign the employee who comes earlier and doesn’t do other work.

2. Decision on Closer

In order of check-counter priority, assign the employee who returns home later and doesn’t do other work (some companies use other rules)

3. Filling in blanks

For check-counters not filled by the previous two employees, fill in the blanks with others in order of check-counter priority.

4. Arranging for reduced check-counter moves
Fig. 1 Differences between the traditional approach and new approach.

### Traditional approach
- Prepare a task list
- Time for tasks: For each task undertaken by each employee
- Apartments every time

### New approach
- Monthly target productivity is reduced.
- Monthly target productivity is achieved.

#### Fig. 2 Monthly and daily productivity table

<table>
<thead>
<tr>
<th>Name</th>
<th>Start</th>
<th>End</th>
<th>Daily</th>
<th>Monthly</th>
<th>Annual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task 1</td>
<td>9:00</td>
<td>10:00</td>
<td>1</td>
<td>60</td>
<td>360</td>
</tr>
<tr>
<td>Task 2</td>
<td>10:00</td>
<td>11:00</td>
<td>2</td>
<td>30</td>
<td>180</td>
</tr>
<tr>
<td>Task 3</td>
<td>11:00</td>
<td>12:00</td>
<td>3</td>
<td>20</td>
<td>120</td>
</tr>
</tbody>
</table>

#### Fig. 3 Work schedule (employee view)

Through the previous three steps, some employees might have changed their check-counter. If so, re-arrange the assignments to reduce the number of changes.

5. Assignment of cashier (second) staff

![Work schedule (employee view)](image)

Sometimes, often in peak hours, we cannot follow just one employee at one check-counter. We then assign a second employee (a "cashier"). Some companies assign help from other departments.

Additionally, some companies use the configurations below:

- When a check-counter is functioning as the customer service desk, the counter is assigned to a qualified employee (sometimes, the number of customers per hour is configured as a low number).
- When employees have break times longer than 30 minutes, they are assigned to a check-counter that is either the same as or different from the one they were assigned to before the break. If they are assigned to the same counter before and after the break, we can assume that someone else is assigned to that check-counter during his break.
- Employees working in a busy check-counter on a given day are not assigned to busy counters for a few days (employees will ask why they are assigned to a busy counter every day).
- The priority of check-counters is different in the morning and at night because of the need to close them at night.
- Employees assigned to specific tasks (e.g., watching the self-checkout machines or attending the customer service desk) are not assigned to a check-counter preferentially but have flexible roles.
- During peak hours, the RE changes (usually becomes lower).

Furthermore, employees are assigned their work, except at the check-counters (e.g., watching the self-checkout, attending the customer service desk, doing accounting) in order of the priority of the work.

The hourly data on the number of customers from the POS (point of sales) are the interfaces for the master data on the hourly change of customers for the day of the week (for some days, such as Christmas, year-end, and the new year, we can use the data from the same day of the previous year). When the POS has only the data aggregated per hour, we divide the data into 15 or 10 minutes sections, with slopes for some companies. As the numbers of customers change, we can see the shortages and leeway that emerge.
every 15 minutes. When a shortage occurs (when the number of employees drops below what is recommended), the number of employees is displayed as a red character, as seen in Fig. 3 and Fig. 4. When leeway occurs (when the number of employees exceeds what is recommended), some employees are not assigned and a white zone is displayed, as seen in Fig. 3.

These work schedules are generated automatically, but the manager of the checkout department edits while watching for shortages and leeway. Employees who talk to each other are separated. When leeway occurs, the store manager is consulted. Employees are sometimes assigned to help other departments. Sometimes, an employee's shift is shortened and his shift during a busy day is expanded, if the employee agrees.

When a shortage occurs, the store manager is consulted, who will call for help from other departments or use employees who are contractually allowed to work the day if the day is a regular holiday.

Using this work schedule, a store manager can find the weeks' busy and slow times; in one case, ten labor hours per day were reduced this way.

The RE (number of customers) of the checkout department is usually configured around 50. Setting this value is very important because the leeway and shortages depend on it. If this value is low, there is no leeway. The RE is generally configured at the average speed or a little higher, but we consider these values inadequate. The POS data indicate that employees dealt with customers more quickly than the RE at peak times (when lines were long), suggesting that employees can work more quickly when speed is needed. We thus recommend that the RE be configured according to the top speed of the store.

Furthermore, in the checkout department, the number of customers per labor hour is a useful and valuable parameter for the store, in addition to sales productivity. Comparing this value to others allows us to identify stores with lower productivity; for example, a store may not have the machines others have or its employees may do additional work not done in other stores. Such a store could improve its productivity.

In the traditional approach, the work schedule is made according to the experience of the manager and cannot be made by others. Our approach provides a work schedule in one click; thus, not only the manager but also the sub-manager or others can make one, and the time required to schedule a shift is sharply reduced.

### 4.2 Meat Department Lower Case

We chose the meat department as the first on which to apply our new approach because it has the most advanced work standardization among the fresh departments and it was the most cooperative.

As with the checkout department, the department's work schedules were drawn by hand or on spreadsheets; thus, shortages and leeway could not be found, and managers didn't calculate productivity. Furthermore, the work spreads

![Fig. 5 Monthly and daily productivity table for the meat department](image-url)

- differingly among the employees. Since they do not have an RE (the number of packs per hour), there is no evidence when an employee is accused of being slow.

- Fig. 5 shows the productivity table of the meat department. In sales departments, gross margin productivity is added for the check index. In the meat department, sales productivity is usually from 1.2 to 2.2 thousand yen. This table allows the control of a daily sales plan for each day of the week along with particular events (e.g., store events, department events, local events). Then, the work shifts are adjusted so that headquarters' productivity plan and each employee's work hours are satisfied.

- Fig. 6 shows a work schedule for the meat department. In the sales department, acts are categorized into fixed acts (with work volume fixed by days) and volume acts (with work volume varying by sales, number of customers, or delivery quantity). There are five time zones because freshness is important. The store's important volumes are displayed, such as the opening time, the 11:30 volume, the 16:00 volume, and the store's closing time volume. Since employees must make packs for each time volume, we calculate the packs for each time and assign employees for each time and task, as below:

**Assignment Process for Meat Department**

1. **Decision on first worker**
   - In order of work priority, assign the best-skilled employee.

2. **Decision on employees except the first worker**
   - In order of work priority, assign the best-skilled employees until the man-hour goal is satisfied (some tasks limit the number of employees who can work at the same time because of the number of available instruments).

   - The RE can be configured as a different value by time zone. For example, the RE is higher before opening time, when there are no customers, than in a later time zone. As with the checkout department, we recommend configuring
As with the checkout department, work is assigned every 15 minutes. Quick work such as checking the sales situation and supervising employees might take fewer than 15 minutes but is displayed for information purposes.

Shortages in each of the 5 time zones and for the whole day (in all five zones) are shown in red in the work list, as at the bottom of Fig. 6. For some tasks and products, shortages are allowed to appear in some time zones as long as the work volume goal for the day is achieved (some products for evening might be made before noon during a part-time worker’s shift). Leeway is indicated as a white zone for each employee.

The department manager edits the work schedule drawn automatically, while watching for shortages and leeway and recognizing that some employees have better skills than others and that some events need to be considered. In the meat department, it is important to communicate new skills such as meat slicing and chopping to new workers. Managers will use any leeway as educational time. Companies can then increase the rate of their number of part-time workers.

In the sales department, the volume for each time zone, especially the store’s opening time, is important. Managers will be able to control the work in each time zone. In one case, sales productivity on a slow day increased by 3,000 yen.

4.3 Delicatessen Department Lower Case

Fig. 7 shows the work schedule of the delicatessen department. Some employees do several tasks at once, such as setting the steam convection, making tempura (Japanese stir-fry), and making bento (Japanese lunch packs). It is difficult to display this situation in a work schedule. Hence, this department just uses this work schedule as one barometer. Employees decide the kinds of work they will do in each time zone (rather than following the schedule strictly).

As with the meat department, the manager can find shortages and leeway. If employees agree, leeway labor hours are moved to busy days to increase productivity.

5. CONCLUSION

This paper proposes a new approach to the LSP for supermarkets. One of the LSP’s disadvantages is that its labor hours exceed the budgeted hours because the LSP’s labor hours are aggregated from each work task. In the new approach we propose, monthly labor hours are determined based on a specified productivity rate (the sales per man-hour) and sales budget. Next, each employee’s shift and labor hours for each day are determined. Finally, the required tasks are computed using the sales budget and then scheduled and assigned to the employees.

This method improves productivity and store operations by allowing us to find labor shortages and overages easily. In one case, a supermarket was able to reduce the man hours required by the checkout department by ten hours per
Fig. 7 Work schedule in the delicatessen department

day. In another case, the meat department was able to improve productivity by 3,000 yen per hour on particularly slow days.

A future study should apply this approach to other departments. On the fish department, with its professional skills and high labor charges, its effect should be large. However, they do not like coordinated work and are not cooperative in the adoption of this approach. An application to the glossary department, which deals with thousands of products and not only sales volume but also delivery quantities, must be considered. Further, we'd like to apply the new approach to other business categories such as drug stores, self-help stores, and large-scale bookstores.

Acknowledgement
The Core Project leader, the former executive managing director of Summit Inc., Takashi Akahori, gives us helpful advice in the writing of this paper, for which we express our gratitude.

References

