Business Process Improvement Using Adjustable Parameters on Simulation–A Case Study in Restaurant Business

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***Abstract*—The business process plays an important role in an organization in achieving its goals. An organization makes a profit or loss depending on effective management procedures. Thus, in response to changes inside and outside the organization it needs to improve and optimize its processes for survival and competitive advantage in the market. Business Process Improvement (BPI) is a way to improve the existing process by using process redesign heuristics. In this paper, the adaptation of BPI methodology is used with redesign heuristics and integrated simulation to measure the influencing factors. An effective number of parameters for improving the performance characteristics of this process are proposed by considering those which affect the slow service response time and impact on queue times. The cycle time, the time taken to complete the task, the cost of operation, and the queue time, are shown in the test results of the simulation process.**

***Index Terms*—business process, business process improvement, process redesign, simulation**

I. Introduction

The business process plays a very important role in all organizations, including restaurants, retail stores, hotels and hospitals that the processes of works are focused on service. The service is a foundation of many businesses affect to customer relationship with an organization. Customers will comeback or not depend on the effective of service process in organizations. Ramaswamy [1] found that the effective of service process design depending on how long customers have to wait. The service process design refers as the management of facilities and provision of processes that the operations are delivered. As Joseph, *et al*. [2] point out, the time spent by customers is a crucial part in business world today. Organizations must change the process to improve their service to be able to serve customers as quickly as possible. Therefore, organizations must consider how to improve their process to be effective. In order to achieve its objectives, an organization needs to have a competitive advantage in the market, and therefore improvement in the business process is essential. It also needs to continually improve to be able to quickly respond to changes. Marlon *et al*., [3] define process redesign as improvement of the products or services quality by rethinking and reorganizing the business process with the specific purpose of increasing performance. Therefore, BPI approach is using with process redesign heuristics to improve a process. One way to analyze the process quality is to simulate assessment of its dynamic behavior over time. By using simulation, it is the way to estimate the business processes performance with specific conditions. Simulation tool can analyze the effective process flow. It also helps prevent problems that occur during the execution as well. As Dodds [4] states, the way to analyze the business process, it can be used by simulation. It can analyze the financial terms on the estimation of the process model resource and cost. The results may assist in decision-making, process design, or resource management with the aims of improving the process performance, product and service quality, and resource utilization. To ensure efficiency, the simulation tool [5] is used to test performance by adjusting the parameters for comparison between the current and new processes. The results of the simulation represent the most effective number of resources to improve the performance characteristics of the service process. The measures used for performance characteristics are defined as operating costs, queue times, tasks completed, and cycle time.

This research presents the adaption of BPI methodology with redesign heuristics to improve a process integrated with simulation to measure the process quality. We adapt this approach into a case study of service process of restaurant business.

II. Literature Review

A. Service Quality

Wong [6] state that the customer satisfaction may have a positive or negative loyalty and relationship depends on the service quality. Venetis and Ghauri [7] found that customer loyalty intentions to stay with a service organization depend on the quality of service. According to a survey by Kirti *et al*. [8] on customer complaints concerning restaurants, the most common complaint was slow service response times.

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B. Business Process in Restaurant Business

Restaurants are popular businesses because people need to eat every day and therefore worth the investment. Laube [9] said: "It's no secret that many new restaurant owners find themselves faced with moderate and even severe challenges when turning their restaurants into successful businesses". He also said that to create the best business opportunities, the first objective is to build a set of instructions for all operations in the restaurant. It should begin with analyzing the process in the restaurant from ordering and preparing, cooking, cleaning, and servicing. The most significant process has to be service. It is responsible for customer satisfaction and can guarantee they will return.

Lemmink *et al*., [10] categorized the restaurant process in terms of the service as four stages: greeting, ordering, meals, and checkout. Similarly, Young and SooCheong [11] represented four service stages: greeting and seating, order taking and serving, consumption, payment and exiting. According to [11] each stage is defined as follows:

Stage 1: greeting and seating. This stage starts from the host is greeting customers until they assign a table to customers.

Stage 2: order taking and serving. This stage begins when a customer ordering drinks and food until the first meal is served to the table.

Stage 3: consumption. This stage begins when a customer receives a meal until the customer requests the bill.

Stage 4: payment and exiting. This stage begins when the customers requests the bill and pay the bill until the customer get out of the restaurant.

C. Busines Process Improvement (BPI) Methogology

BPI is a fundamental business management process aimed at identifying those operations which could be improved to support more efficient workflow overall. Adesola and Baines [12] gather together common stages in different frameworks of BPI research methodology in their literature review and their proposals are set out in Fig. 1.

Figure 1. Business process improvement methodology.

D. Process Redesign

Hammer [13] suggests that "in order to achieve significant benefits, it is not sufficient to computerize the old ways, but a fundamental redesign of the core business processes is necessary". The top ten redesign heuristics found by Mansar and Reijers [14] are shown in Table I. There are various ways to improve the process and in this research, task elimination and task composition are only used to remove unnecessary activities or tasks in process.

TABLE I. THE BEST PRACTICE OF PROCESS REDESIGN HEURISTICS [14]

Best practice	Definition
1. Task elimination	Eliminate unnecessary tasks from a business process
2. Task composition	Combine small tasks into composite tasks and divide large tasks into workable smaller tasks
3. Integral technology	Try to elevate physical constraints in a business process by applying new technology
4. Empower	Give workers most of the decision-making authority and reduce middle management
5. Order assignment	Let workers perform as many steps as possible for single order
6. Sequencing	Move tasks to more appropriate places
7. Specialist-generalist	Consider to make resources more specialized and more generalist
8. Integration	Consider the integration with a business process of the customer or a supplier
9. Parallelism	Consider whether tasks may be executed in parallel
7. Numerical Involvement	Minimize the number of departments, groups and persons involved in a business process

E. The Measures Used for Process Performance Characteristics

Kallio *et al.*, [15] gather process performance measurements from their literature review as shown in Table II. The four common measures used are cost, time, quality, and efficiency. They mention that cost, time, and quality are easy to measure and simple to use. Efficiency is more difficult to measure since it involves a variety of data, including the number of transactions, staff reductions, and reduced organizational investment.

TABLE II. THE EXAMPLE OF PROCESS PERFORMANCE MEASUREMENT

Example of measures used	
Cutting of cost	Service and speed
Reducing Process time	Serviceability
Number of activities in process	Flexibility
Mission	Quality of work life
Customer value	Perceived quality
Efficiency	Empowerment
Quality	Lead-time
Time	Robustness
Features	Customer satisfaction
Reliability	Growth
Conformance	Strategic measures
Durability	

III. Research Methods

The method used in this research applies BPI methodology with process redesign heuristics to integrate simulation as a way of measuring the influential parameters affecting response time and slow service. The number of parameters will be adjusted to improve the process performance characteristics. The methodology consists of three steps as shown in Fig. 2, with the first and second steps being adapted from the BPI methodology used by Adesola and Baines [12].

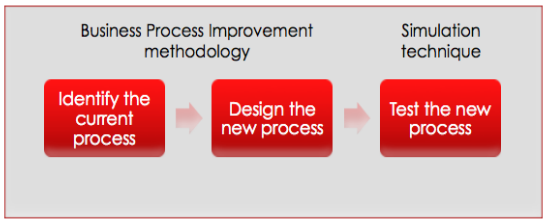

Figure 2. Concept of the proposed methodology.

A. Identify the Current Process

The first step is the creation of a process model of the current conditions in work activities to discover the existing process preforms and to understand the current situation of the existing process. During this stage, activities that have become outdated or irrelevant should be considered and removed at the next stage.

B. Design the New Process

The second step involves the selection of specific improvements to the new process and identifies various ways to improve the process [14] using the top ten-redesign heuristics. In order to improve the current situation, this work needs to apply the redesign heuristics to create a new process.

C. Test the New Process

The last step is simulation to ensure the new process improves performance, product and service quality, and resource utilization. The input of simulation comprises of process flow, resources, and initial value of decision parameters. The results of process simulation are quantitative information, including time, cost and resource usage, e.g. queue time, cycle time, cost per resource and number of resource. This research uses this simulation tool [5] to measure the performance of the new process.

In this section, the considered input parameters are shown in Table III. All input parameters are based on the simulation tool [5] and show the comparison between this work and that of another research study. However, in this work, the adjustable parameters indicate decision variables where a number of resources affect the performance characteristics of the process. Other input parameters are defined as fixed variables. In Table IV, there are process performance measurements concerning another research study. Therefore, the additional characteristic of service process is proposed. In this research, the process performance characteristics in terms of cost, time, and quality as shown in Table V according to the literature review by Kallio *et al.* [15].

TABLE III. The Comparison of Input Parameters

Input/Authors	Isa Muslu [17]	In this research
Time duration in each task		X
Time of delivery task		X
Operating period	X	X
Cost of the resources		X
Pay rate hours		X
Probabilities distribution		X
Number of resources		X
Number of task created		X

TABLE IV. The Comparison of the Considered Process Performance Measurement

Performance/Authors	Isa Muslu [17]	In this research
Processing time		
Transportation time		
Queue time	X	X
Task completed		X
Cost of operating the process	X	X
Cycle time		X

Performance Characteristics

- Minimizing the cost of operating the process.
- Minimizing the queue time; the total of the operating time on a task from its creation to completion as queue time.
- Maximizing the number of task completed that the process can be handled.
- Minimizing the cycle time: the average period between tasks, which have reached the end of a business process.

TABLE V. The Process Performance Measurement

Measures used for process performance characteristics	
Cost	- Cost of operating the process
Time	- Cycle time, - Queue time
Quality	- Task completed

IV. Casestudy

A. Identify the Current Process

In Fig. 3, this step identifies the service activities in a restaurant as the current process. In this stage, the service process of the restaurant is observed by the number of service activities that they perform. Firstly, hosts or hostesses have to check table availability for the customer when they enter the restaurant. If a table is not available, the customer has to wait. The host will seat the customer when a table is available. A waiter or waitress will then take the food order and enter it on to a POS device. The POS device records the order and sends the details to the

kitchen. Next, the chefs prepare food for the customer. Once the food has been prepared, it is the duty of the waiter to serve it to the customers. After the customer has eaten their food, they will ask for the bill and the waiter has to print the bill by generating it using the POS device. They will then obtain the bill from the POS device and return it to the customer. Lastly, the waiter will collect the money and confirm payment via the POS device. The POS device processes the payment and prints a receipt. The waiters will obtain the receipt from the POS device and give it to the customer.

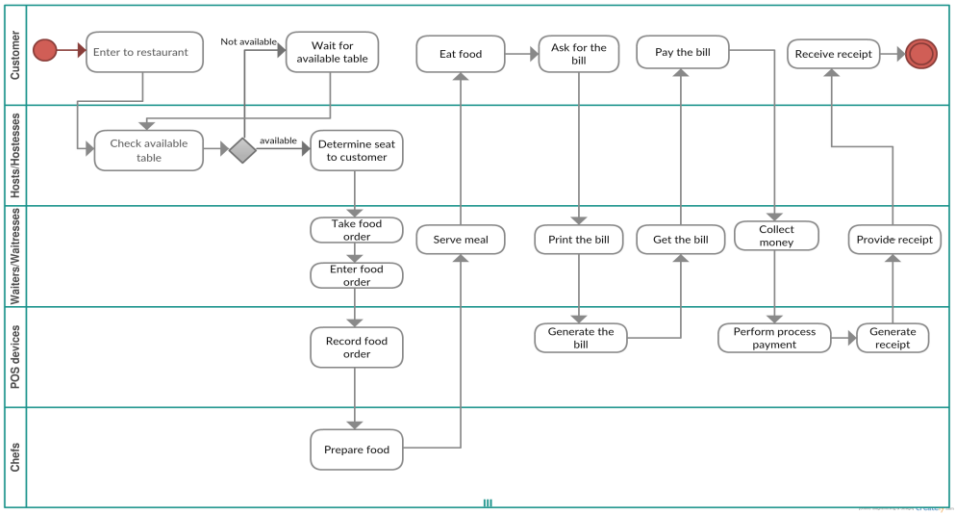

Figure 3. Business process model of the current process

B. Design the New Process

In order to improve the current process, redesign heuristics [14] are selected for application in the current process.

- *Task elimination*: Entry of food order activity is eliminated. This activity is unnecessary for the process and has no additional value in increasing the speed of processing, and reduces resource costs. The drawback is a decline in service quality.
- *Task composition:* Printing bills, generating bills, obtaining bills, payment process, generating receipt, and providing receipt activities are combined in the collect money activity. All of these are steps in money collection. Therefore, the time spent in resources for each activity is reduced.

Fig. 4 shows a new process to improve the service in order to reduce queue times, cycle times, and costs, thus increasing the amount of completed tasks.

C. Test the New Process (To-Be Process)

In the simulation, this research focuses on the steps or activities related to employees. It does not cover customer-related activities. The flow diagram of the process contains the steps and resources in response to each step as representations of the simulation. Fig. 5 shows a flow diagram of the new process. The new process is simulated to ensure that it is effective by adjusting the parameters to select the number of resources needed to improve the performance characteristics of the service process.

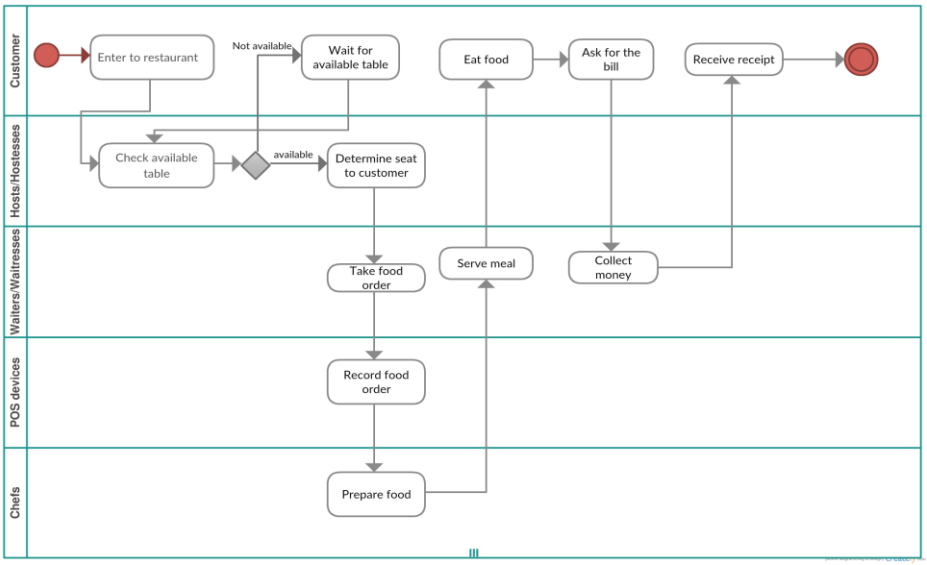

Figure 4. Business process model of the new process

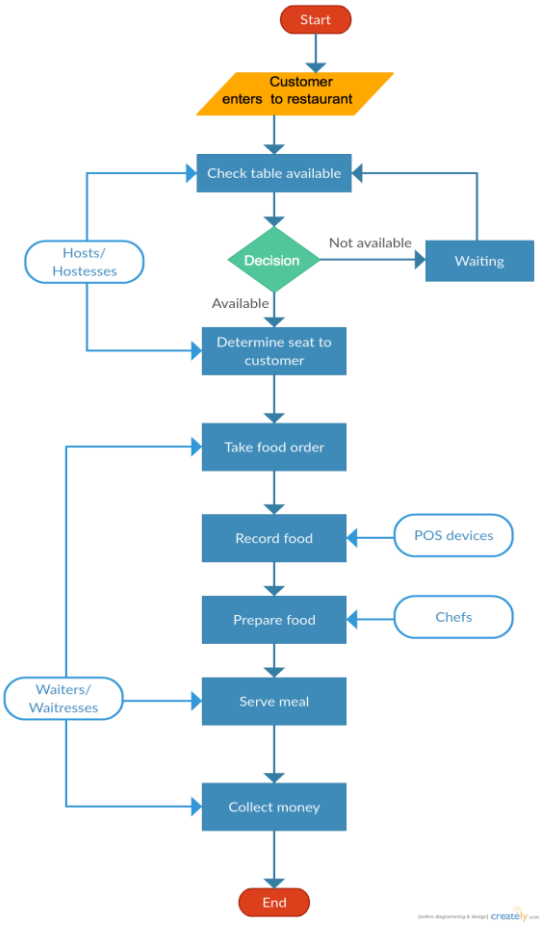

Figure 5. The simulation flow diagram of the new process

D. The Simulation Results

The results are separated into three rounds. The number of tasks created is fixed at 195 for all rounds, which are for 75 customers in 10:00 – 14:00 and 120 customers in 18:00 – 20:00 on the operating period of simulation.

In the first round, the number of hosts and chefs are fixed at two and the waiters and POS devices increased from two to six.

In the second round, the best results from the previous round are selected. Chefs are the considered variables in this round in order to discover whether increasing their number affects the process. The chefs are therefore increased from two to six.

In the last round, as before, the best result is selected from the second round. The number of waiters, POS devices, and chefs are fixed and then only the number of hosts is increased from two to six to find whether or not this affects the process.

As shown in Tables VI and VII, results are provided for both current and new processes, respectively. The results between the yellow lines compare the best in each round of the current and new processes. The cost, tasks completed, queue times, and cycle times of the new process are definitely better than the best results from the current process in every round. This implies that the performance is improved in the new process, in terms of reduced queue times, cost, cycle times, and resources as well as increasing the number of completed tasks.

TABLE VI. THE SIMULATION RESULT OF THE CURRENT PROCESS

	Hosts	Waiters	Chefs	POS devices	Queue Time	Task created	Task completed	Total cost	Cycle Time
1st round									
1	2	2	2	2	04:35:45	195	69	1534.82	00:08:59
2	2	3	2	3	03:28:51	195	71	1498.10	00:08:10
3	2	4	2	4	02:58:56	195	73	1551.83	00:08:22
4	2	5	2	5	02:20:32	195	84	1737.94	00:07:54
5	2	6	2	6	03:13:11	195	72	1569.35	00:08:34
2nd round									
1	2	5	3	5	01:51:08	195	73	1621.23	00:07:16
2	2	5	4	5	01:56:28	195	72	1549.30	00:08:25
3	2	5	5	5	01:11:36	195	77	1505.78	00:07:06
4	2	5	6	5	01:22:02	195	74	1605.26	00:08:38
3st round									
1	3	5	5	5	00:42:51	195	130	2843.98	00:05:09
2	4	5	5	5	01:03:14	195	77	3132.82	00:06:50
3	5	5	5	5	01:00:26	195	79	3177.60	00:06:20
4	6	5	5	5	01:20:25	195	75	3192.90	00:06:31

TABLE VII. THE SIMULATION RESULT OF THE NEW PROCESS

	Hosts	Waiters	Chefs	POS devices	Queue Time	Task created	Task completed	Total cost	Cycle Time
1st round									
1	2	2	2	2	01:06:18	195	99	2001.18	00:06:11
2	2	3	2	3	01:06:22	195	115	2066.34	00:05:56
3	2	4	2	4	00:56:35	195	119	2025.16	00:05:48
4	2	5	2	5	01:01:24	195	114	2002.94	00:05:59
5	2	6	2	6	01:07:30	195	111	2002.48	00:05:59
2nd round									
1	2	4	3	4	00:23:23	195	138	2248.16	00:05:00
2	2	4	4	4	00:11:07	195	158	2519.28	00:04:20
3	2	4	5	4	00:04:56	195	172	2660.99	00:04:00
4	2	4	6	4	00:06:27	195	164	2674.91	00:04:05
3st round									
1	3	4	5	4	00:05:27	195	174	2702.83	00:03:56
2	4	4	5	4	00:05:56	195	169	2723.24	00:04:01
3	5	4	5	4	00:05:05	195	170	2734.70	00:04:03
4	6	4	5	4	00:06:16	195	172	2691.09	00:04:01

V. CONCLUSION

This paper focuses on the service process of a restaurant business. In order to improve its effectiveness, the process redesign heuristic based on BPI methodology is used to improve the current process integrated with simulation to ensure the new process is better than the current process. Different amounts of resources were used by adjusting them to measure their effectiveness in optimizing the service process of a restaurant. The simulation tool is used to consider those parameters impacting on performance of process. The number of resource parameters affects the performance process, including the amount of tasks completed, operating cost, queue times, and cycle times. This performance indicates an effective process. The results of the simulation show that the resource parameter controls performance. However, the tasks completed, cost, queue times, and cycle times are process performance measurements affected by changes in the number of resources. Therefore, improvement of the service process leads towards a successful restaurant business.

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