# **Repair Service Process Improvement for TCYC**

## 1. Background, Motivation and Purpose

At the beginning of the school year, more than 50% of students in the dormitory will experience a lengthy repair service, which may last up to 1 month or have secondary repairs. Besides, the repair website is complicated with the mixed-content form, and it limits the number of problem description words but without pictures or video upload functions to help clarify the problem. Therefore, it results in some difficulties for students to report repair problems. The current repair service is also opaque.

The low-quality repair quality not only brings inconvenience but also causes lots of dissatisfaction with students. This study hopes to analyze existing repair service problems and propose improvement measures through BPR philosophy and reengineering technology (IDEF), establish a new repair service process and repair system to shorten repair time and service cycle time, improve service response speed and accuracy of repair-problem identification, thus providing students with high-quality repair services.

## 2. Improvement Methods

#### 2.1 BPR

BPR is a business management strategy that focuses on the analysis and design of workflows and business processes within an organization. It aims to help organizations "fundamentally" rethink how they do their work to improve customer service, cut operational costs, and become world-class competitors.

#### **2.2 IDEF**

IDEF is a group of modeling methods that can be used to clearly describe the operations of an organization or a system. It should assist in organizing system analysis and promote effective communication between the analyst and the customer through simplified graphical devices. Thus, IDEF models are often created as one of the first tasks of a system development effort. Moreover, IDEF can apply to BPR, information system development, and automated system, etc.

## 3. Analyze and Improvement

## 3.1. Process Description with IDEF Method

#### 3.1.1 Original Process



In A0, if the user wants to use the repair system, he needs to fill out the form. After receiving the orders, the supervisor will judge the level of damage. If the supervisors think it can be repaired by themselves, they will repair it and call the repair company if it damaged severely or they can't do it.

After receiving the notice, the company will key in the orders into the system. Sometimes the company goes to the dormitory in person because the supervisors can't express the problems exactly. Customers need to fill out the orders again if the consequence is not as expected.





The above three figures represent the second layer. In A1, we divide ordering into logging, filling out the form, and confirming. In A2, we divide order handling into receiving, supervisors logging, and processing. In A9, repairing is subdivided into choosing tools, confirming problems, and fixing.



We also separate the A12 from A1. Filling out the form can be subdivided into detailed steps. The user needs to fill in the dormitory, room number, student ID, name, e-mail, check the maintenance categories, the repair location, the maintenance items, and describe the scenarios in thirty words.



### 3.1.2 New Process

In A0, we can see that if the user wants a repair service, he needs to enter the system. The order goes to the company's system directly. Problems will be classified by the AI system, then be matched with the corresponding tool man. An assigned tool man will receive an e-mail, choose the tools and do the jobs.











In A1, the users must register before login the system. In A2, the company system accepts the order directly. Then it will be sent to the AI system, sorted by keyword searching. In A3, the order will be passed to the next system to match a suitable tool man. The tool man will choose the required items in A4. In A5, the tool man needs to punch when they reach the destination. He will check the problems again and fix it. After that, he will notice the customers and punch out.



A1 layer can further separate into A11 and A12. New users need to register before the service. In A12, 90 percent is similar, but we add a space to upload the videos or photos.



## 3.1.3 Comparison

We can find out that the original process is much more complicated. There are two main reasons. First, users need to wait for order handling because the supervisors aren't on duty 24 hours, and the level of damage is not easy to judge precisely. Second, owing to the maintenance capability or the uncertainty, sometimes the supervisors think they can repair by themselves but forgive during fixing.

Also, we change the form design. Some check fields are too vague to understand, so we add a brief description. The limit of supplementary explanation is up to 300 words. Upload space can help to judge the problems efficiently.

cenarios	Performance Measures	Experiment Run	Optimizer	Design Optimizer	Run Optimizer Results	Advanced
1.8	Reset Experim	ent	End Time	上午 11:00:00 🖨	2019/10/18	Save dashboard data for each replication
	resser Experim	F	Run Time	10800.00	Seconds ~	Save state after each replication
Replication	ns per Scenario 20.00	N	Narmup	0.00	Seconds ~	Restore original state after each replication
				Experiment	Status	

Figure. 4.1.1

## 4. Improvement Results

## 4.1 FlexSim Simulation Comparison

We use FlexSim to simulate to understand the processes. Some basic hypotheses are needed, the number of simulations is 20, and the length is 10800 minutes, the distribution of the source is normal (100,10) (see Fig. 4.1.1). The comparisons we made are the number of outputs and the average cycle time.



#### 4.1.1 Original Repair Process



#### Mean (90% Confidence) Sample Std Dev Min Max

Current Scenario 37.3 < 39.5 < 41.7 5.6 31.0 49.0

Repl	Rep2	Rep3	Rep4	Rep5	Rep6	Rep7	Rep8	Rep9	Rep10
28	44	31	43	40	45	42	38	35	49
Rep11	Rep12	Rep13	Rep14	Rep15	Rep16	Rep17	Rep18	Rep19	Rep20
32	44	31	40	31	45	44	39	45	34

🛃 Sink1 - On Entry	
1/**Custom Code*/	
<pre>2 Object current = ownerobject(c);</pre>	
3 Object item = param(1);	
<pre>4 int port = param(2);</pre>	
5 double cycletime;	
<pre>6 cycletime=time()-getlabel(item, "start");</pre>	
<pre>7 settablenum("GlobalTable2",1,1,cycletime);</pre>	
	Row

In the original process, sink1 is the order completion quantity from supervisors. In the above figures, we can see that the total average number is 39.5 in twenty simulations. The average cycle time is 94.77 minutes.



5 double cycletime:

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6	aral ati	montime	13

6 cycletime=time()-getlabel(item, "start"); 7 settablenum("GlobalTable1",1,1,cycletime);

	Col 1
Row 1	8437.88

Col 1

94.77

Sink2 is finished by the company, and we also calculate the average events (order completion) and cycle time. It's obvious that the completion number is less than sink1 and cycle time is even more than 8400 minutes.

#### 4.1.2 New Repair Process





Mean (90% Confidence)     Sample Std Dev       Current Scenario     105.38 < 105.90 < 106.42     1.33								Min 103.00	Max 108.00
Rep1	Rep2	Rep3	Rep4	Rep5	Rep6	Rep7	Rep8	Rep9	Rep10
107	108	106	106	105	104	104	107	104	106
Rep11	Rep12	Rep13	Rep14	Rep15	Rep16	Rep17	Rep18	Rep19	Rep20
107	107	107	106	105	106	103	107	107	106

1 /**Custom Code*/	
2 Object current = ownerobject(c);	
3 Object item = param(1);	
4 int port = param(2);	
5 double cycletime;	
<pre>6 cycletime=time()-getlabel(item, "start");</pre>	Col 1
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## 4.1.3 Comparison of Two Repair Processes

If we redesign the process, it's dramatically different and can improve both the company's benefits and customers' satisfactory (see Table 4.1.1). The discrepancy is visualized in two State Gantt graphs.

	original	new
Output	42.65	106
Cycle	8400/94.77	130
time(minute)		
Differences	Dormitory supervisors handle the problems first	Do all jobs by AI system and management system directly

#### Table 4.1.1 The Comparison of Original and New Processes



#### 4.2 Web Design and App Transformation

After IDEF and simulation analysis, a website is developed and transformed into the App to demonstrate the improved repair process.

#### 4.2.1 Member Function and Manager Function

To safeguard users' rights and interests, we need to confirm users' identities as students; therefore, users can only apply for repair after logging in the member system. Fig. 4.2.1-4.2.3 and 4.2.7 show detailed steps. (See appendix for database content)

LOG IN	
忘記密碼?未註冊賬號?	
賬號	
諸使用英文或數字键	
密碼	
請使用英文或數字键	
	恭喜您已經註冊成功了,您的資料如下:(請勿按重新整理鈕) 幌號:wenyuchu
登入	密碼:123123 請記下您的帳號及密碼,然後 <u>請登入會員系統!</u> 。
Figure 4.2.1. Log in page	Figure 4.2.2. Registration success page

TOOLMAN	Home	About	Pricng	Contact	Repair	Member Log In
	Join U	Is				
請填入下列資	滁(標示「*」≬	闌位請務必填	寫)			
*帳號:	請使用英文或	或數字鍵				
*密碼:	請使用英文或	或數字鍵				

Figure 4.2.3. Registration page

Haven't logged in for a while, users are apt to forget their password. As a consequence, click "Forget Password" in the Sign-in page and Checking Coverage status page and enter username and e-mail, then the user's password will be shown. See Fig. 4.2.4-4.2.5.

密碼查詢	
賬號	
請使用英文或數字鍵	
電子郵件帳號	
顯示方式 網頁顯示 ▼	朱文仔 您好・您的帳號資料如
查詢  重填	帳號:wenyuchu 密碼:123123
	接此登入本站



Figure 4.2.5. Search password results

Managers can log in from the homepage of the web page and check the customer order information that he has received so far. Managers can get all customer information. The steps are as follows:



### 4.2.2 Repair Form

In general, users can't describe their problem clearly in just 30 words. Consequently, we relax problem description to 300 words and allow users to upload the picture or video of the situation. What's more, we delete time-wasting item selection in our new form. There are also classification directions added on the repair page to eliminate confusion.

編號: 149982	國立清華大學學生宿舍修繕工作申請單 Anintenance & Repair Form for National Tsing-Hua University Student Rooms	錐修項目: Items for work	不可項目的終結導分開開立。 因興重 傳靈 法國為為於選,如無熱水清先填實修經單後並治管理員更投戰地超起,激励!! 若墳窗的雖修地址甚在確室內,原則上將會有管理員把问應商進入理空內修總,這你不便,敬請見記
Serial Numbers 工作癖別: Dorm Name for work	中山町口Me(Application Late): 2019/10/20 アナ 03:56:36		Prease submit the forms separately for aimerent items. file we take dom repaining in your rooms, basically administrators will accompany maintenance workers during fixation. ② 課題(class) (学校(Bolt)) (建築)(keyboard Stand) ③ 課題(fixed)(fixe
室別: Room Number	ex:40101		● 日展園(Window Shades) ● 大阪(beephate) ● 日展(Lock) ● 紗門(Screen Door) ● 銀櫨熟水(Boiler) ● 飲水板(Water Dispenser)
學號/人事编號: Student ID Number	ex.912345、 <b>學號</b> 前不須加字母		し 販賣機(Vending Machine)
姓名: Name			Equipment) 日光燈(Fluorescent light) Light) Light)
E-mail:			■ 其他(Others)
	水電檢修(Utility repairs)▼ 選擇其他',請在此空格填寫 If you choose "Others", please fill in the item here		: 避理"其他', 請在此空格填寫 If you choose "Others", please fill in the item here
工作類別: Classification	* "治损" 相關樂務請勿填高終過單,撤謝!! 枚本部請必服 分極3000、 衛大校區請改服 分號7405, 或撥 03-5715131 轉接,將由專人為愈跟勝! Extension 31000 (main campus) and 76405 (nan-da campus) is offered for calling for repair	補充說明: Other Description	(論以30字/竹酸短至80時)
	of dormitory network.		送出申調單(Submit) 清除重填(Reset)
地點: Location for work	◎ 康奎	p.s.格式中請勿出現 p.s. Please do not use er	()[] < > + - = ,' * , ~ ' ;   等等转跌字元  coptional chancter such as ( )[] < > + - =,' * , ~ ' ), etc. 管理表 \ [

Figure 4.2.6. Repair form NTHU currently use

中文 English			
學校	•	齋別	室號
學號		姓名	E-mail
維修項目類別		工具人選擇	問題說明/加購商品(限300字)
選擇檔案 未選擇任何檔案 請上傳清晰的圖片或視頻			
提交表單			

Figure 4.2.7. Repair form of Tool Man

維修項目類別說明 如果不清楚如何選擇維修項目類別,請您閱讀下方說明



Figure 4.2.8. Classification directions

## 4.2.3 Checking Coverage Status

In the original repair system, there's no "real-time checking coverage status" service. Students are always annoyed by whether their problem be fixed or not. As a result, we add a checking coverage status system on our home page. See Fig.4.2.9.

維修進度查詢	服務反饋
忘記密碼?未註冊賬號?	您每一次寶費的建讓都是我們進步的動力!
報號	工具人雏修效率:⑧高◎一般◎低
wonyuchu 🗮	<b>工具人服務務度</b> : ◎好◎一般◎差
請使用英文政數字標	<b>緣修效果:</b> ●好◎一般◎差
查看特定時間段	<b>總體詳價:</b> ●極差◎差◎一般◎好◎很好
開始日期	
<b>服務評價</b>	需要改善的地方
►滿意 2	<b>浙</b> 大壁说出您的不满!
查詢進度	提交您的推薦

Figure 4.2.9. Checking Coverage status Figure 4.2.10 Customers' Satisfaction Survey

#### 4.2.4 Customer's Satisfaction Survey

For continuous improvement, users can log into the member system and fill out the customers' satisfaction survey after the repair is done. (See Fig. 4.2.10)

#### 4.2.5 FAQ-Chatbot

Users can question by using the How It Works, Service Robot, and FAQ function at the bottom of the page, where there is a chat robot prompt replying. (See Fig.4.2.11)

#### Program O Example GUI Page - HTML

Say: 營業時間是什麼時候呢	× say
Seeker: 營業時間是什麼時候呢 10803: 我們24小時全天營業	

#### Figure 4.2.11 Chat Robot

### 5. Summary

Through the BPR analysis as well as IDEF techniques, we find out the root causes of inefficiency in the current process: long cycle-time repairs, unreasonable design of repair system, complicated and unbalanced operation process, and unprofessional dormitory supervisors. To deal with this, a new simplified process is proposed to accelerate the order completion and enhance the accuracy of problem identification. Furthermore, a user-friendly website and an app are developed to rapidly report repair, obtain the customized service, and manage customer information. Finally, simulation experiments are executed in FlexSim and demonstrate that the ideal new repair process takes only 1.5% time of the original, which greatly improves the repair efficiency and customer satisfaction.

## Appendix

#### 1.Database Table for Member System

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#### 2. Database Table for Repair and Manager System

