

Matrix for Mapping ICT Roles in Small and Medium Enterprises with TRIZ Inventive Principles Based on Redesign Service Types

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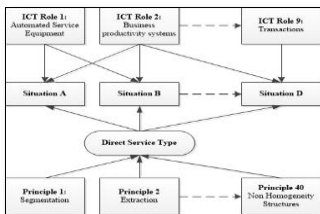
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Graphical abstract



Abstract

Information and communications technology (ICT) has a high impact on Small and Medium Enterprises (SMEs) business. It enhances capacity for innovation and adds greater value to services in order to attract more customers and produce greater returns to the company. This paper aims to map the ICT roles for SMEs with the TRIZ 40 inventive principles (IP). The methodology of mapping is based on using Service Redesign Types (SRTs) as bridge to link between the ICT roles and the 40 IP. The results produced a new TRIZ 40 IP matrix with ICT roles that add value to implement the 40 IP to support SRTs. This paper conducted a case study in order to demonstrate the usability of mapping ICT role categories with the 40 IP based on SRTs. The output of this study can enhance the way of thinking of redesigning current services and lead SMEs to consider particular technologies that may improve performing the service.

Keywords: Service redesign types; Small and Medium Enterprise (SME); 40 Inventive principles; TRIZ; ICT; ICT roles; innovation

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1.0 INTRODUCTION

Many studies have discussed information and communication technology (ICT) benefits and advantages for enhancing small and medium enterprises (SMEs) [1-5]. Tektas, Gunay [6] reported that adopting a suitable ICT by SMEs can improve business productivity and profitability. The best way to enhance SME innovation in service is by integrating suitable ICT into their services [6]. However, there is no specific approach that can be used to guide SMEs what type of ICT should be used to improve service performance in order to satisfy its customers. In fact, the massive capabilities of ICT leave all options open for organizations to select suitable and effective technologies in order to improve their business. Study conducted by different types of ICT used by different SMEs in service sector into nine categories. The categorization was based on the finding that a particular ICT plays for performing services. The findings of that categorization offered organizations different ways to think about the using ICT and its capability to improve their business performance.

The systematic innovation method as TRIZ theory of inventive problem solving is a problem solver to produce effective and innovative solutions to product or service problems. TRIZ was developed by Genrich Altshuller and his colleagues, beginning in 1946. It has different tools for eliminating of contradiction problems in technical context. The most important tool in TRIZ is the 40 inventive principles (IP) [8, 9]. However, 40 IP can be used in service context [12]. In order to facilitate the using of TRIZ in service context, the study that was conducted by Gazeem and Rahman [13]

grouped the 40 IP with five typical Service Redesign Types (SRTs), which were developed by Berry and Lampo [14]. The different SRTs are self-service, direct service, service bundle service, and physical service type. Offer managers a way to improve existing services for the benefit of customers and company. Studies to integrate ICT roles with the proposed grouping of the 40 IP based on SRAs is missing. Integrating integration can bring innovation to the existing business [15]. Therefore, this study intend to develop matrix combining the 40 IP, ICT roles categories, and SRAs in order to enable SMEs to tap into a broader resource of ideas to generate solution(s) for service problem.

The rest of this paper includes five sections. Section 2 highlights the relationship for redesign existing services, grouping 40 IP with SRAs, and categorization of ICT for SMEs. Section 3 illustrates the methodology that has been used to conduct this study, and how the approach maps ICT roles into SRT and 40 IP. Section 4 presents the discussion. Section 5 demonstrates the usability of mapping ICT roles with 40 IP based on service types. Finally, section 6 concludes the paper and highlights the further work.

2.0 LITERATURE REVIEW

2.1 Service Redesign Types

The process of redesigning a service may lead to the innovation of new services. Study conducted by Vetter, Pullman [15] pointed out that there are thirteen factors that should be take in

consideration by the designer when designing new services. However, the innovation option in services is formed not only when developing new services, but can also be achieved from redesigning services [14]. L. Berry and Lampo [14] also mentioned that existing services must be analyzed, outdated assumptions eliminated, and customer perspectives adopted to revitalize existing services. They categorized the process of redesign services to five types. Figure 1 shows many examples in the redesign services as shown in Figure 1. The purpose from the SRTs was to improve the innovation opportunities with a direct service. Although L. Berry and Lampo [14] suggested research on addressing the redesign service types yet the five types have not been updated yet.

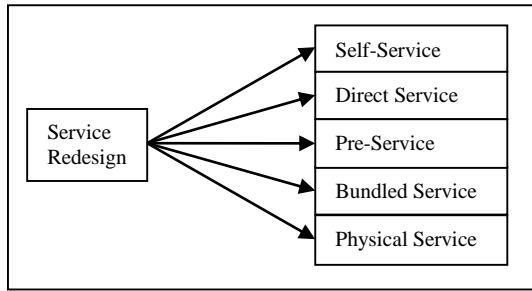


Figure 1 Service redesign types source from [14]

In each SRT, [14] developed a set of characteristics for each SRTs which are used as criteria to group a service examples based on the strongest fit. Those characteristics are clearly different service delivery situations that require redesigning current services using specific type of services. According to their study, it was obvious that innovation from different industries could have the same basic pattern that fits same situations. In this study, term service redesign type situations is used instead of service redesign type characteristics since characteristics refer to particular problem situation in each of the service types. For example, in self-service type 'h \ Y \ W \ U f U W h Y f] g h] W. [7 s l o t i o n , a Y f g ' f Y e i] f Y ' Z f Y e i Y b h ' U b X ' Z ' Y I] V ' Y ' U W W Y g g I ' f Y Z Y f g ' h c ' g] h i U h] c b g ' k \ Y b ' h \ Y ' W i g h c a Y f g ' b Y Y' easy way to access a service at any time. Thus service providers need to redesign services to be performed by customers with need for direct interaction with service provider.

2.2.40 Inventive Principles with Service Redesigns

The theory of inventive problem solving (TRIZ) which basically has developed for systematic innovation method can be associated to be considered as a service-based SMEs generating new services, or solving current service problems. TRIZ has been getting attention from many researches in terms of using TRIZ in service contexts [9, 11, 1-21]. In fact, implementing TRIZ in a service contexts can lead to promote innovation which is needed to ensure revive services [22]. Many of the previous studies have been focused on the 40 inventive principles because this is commonly used for solving contradiction problems. However, it was mentioned that most of TRIZ problem solvers often have difficulty to manage and remember 40 [23]. Gazem and Rahman [24] interpreted the 40 more illustration of using those principles in the service context. Later one, a study was conducted by Gazem and Rahman [18] grouped the 40 on the services redesign context based on the interpretation. Each principle was grouped within the SRTs: self-service, direct service, preservice, bundled service and physical service. Their study was focusing to solve the use of the 40 according to particular service type for eliminating the service contradiction problem and facilitating principles using service prospective. This

2.3 ICT Roles

Active ICT evolves, it has a pivotal role in almost all aspects of business activities and different organizations use different types of ICT for diverse purposes. While many researches have focused on benefits, barriers, and adoption intention of ICT in SMEs [3, 25, 28] little effort has been devoted to explore the types of ICT that are implemented by SMEs in different industries [1, 29, 31].

The capability of ICT is vital to create opportunity for SMEs to improve their business performance as long as SMEs have the desire to invest in ICT services in competitive markets. SMEs in different sectors may use different ICT tools. Moreover, SME adopt different ICT tools according to business needs. Atham and Ahmad [32] indicated that many SMEs use internet-based ICT for searching general information or product advertisement. While a few of them use it for online purchases to end customers. SMEs in manufacturing may adopt more complex ICT applications such as Enterprise Resource Planning (ERP) software [1]. However, investment in such complex ICT by some SMEs in service sector in developing countries is quite low [9]. Gazem and Abdul Rahman [7] developed nine ICT categories that can correspond to service based SMEs. The Table 1 shows each category with some illustration.

The categorization was based on the roles that a particular ICT plays for performing services. The findings of that categorization offered organizations different ways to think about the existing ICT and its capability to improve their business performance.

According to [29] SME would be able to improve their ICT adoption if they have adequate knowledge about suitable and effective technologies. Therefore, the effort of this study is to improve the capability limitation of the way of thinking of redesigning current services. The Table 1 shows the mapping between each ICT role category and the SRTs in order to help SMEs to consider particular technologies for their business.

3.0 RESEARCH METHODOLOGY

Mapping between ICT role categories and 40 IP is difficult because each inventive principle gives brief and general suggestions to look at solutions that may solve the problem. In fact, generating ideas by each inventive principle can be associated with all ICT roles. This issue of using ICT roles rely on how the SMEs comprehend each principle and how they intend to use it to solve a problem. For example, principle "2: Extraction" provides a brief suggestion that extract most wanted or most unwanted process from the service to work alone. A problem solver can use any to ICT roles for achieving that process such as using internet for distribute knowledge, online marketing, tracking buyers behaviour, change way of physical payment to virtual payment, etc. On other hand, mapping between ICT roles and SRTs can be precise in certain level when we refer to the usefulness of ICT roles with each service redesign situations. For instance, we can note that using entertainment technology can not support a situation of assisting customers to perform self-service in order to secure private customer information during service delivery.

Table 1 Categories of ICT role

Category	Explanation	Example
1- Automated Service Equipment Technology	A company uses Automated Service Equipment Technology to allow customer to perform self-service. The main focus here is on tangible means which often has characteristics of hardware devices. Customers interact directly with these devices to serve themselves with no direct interaction with service provider.	Auto phone answer, automated ticket machines, automated Sale Devices, automated teller machines, Barcode Scanner, etc.
2- Business productivity systems Technology	A company involves sophisticated information technologies in order to improve the efficiency and proactivity of its business. The main focus here is on the available ICT systems that can be worked through Internet or intranet to improve the efficiency of the company. This category includes any software that can be used for controlling and managing company resources for better serving of customers.	Supply Chain Management, HR Management, Finance/Accounting, Inventory Management, etc.
3- Contact Technology	A company uses technology to facilitate contacting with customers for better relationship between customers and service provider. The main focus here is on means that assist the peer-to-peer contacting between the customer and service provider.	Email, cellular phones, fixed line phone, fax, VOIP, Mobile technology, Social network, Wireless networking, etc.
4- Entertainment Technologies	A company uses technology that can play role in enhancing the service environment and gives value in term of pleasant and satisfaction. The main focus here is on any technology that can be used for entertaining, convenience, or satisfying customers or employees in service facility.	Lighting, sound, video, Internet, Wi-Fi, flat screens, etc.
5- Knowledge Dissemination Technology	A company uses this technology for educating or share information with customers. The main focus here is in visual and audiology means that allow customers to receive a particular service.	Radio, Television, CCTV for broadcasting events, E-Learning, forums, blogs, Informative websites, etc.
6- Marketing Technology	A company uses this technology for online marketing, shopping, or trading. Marketing technology mainly focuses on means that gives opportunity of online trading, and facilitates customer online shopping, booking, reservation, or any task to streamlines activation of the service.	E-commerce, Social network, Websites for advertising, etc.
7- Storage Technology	A company uses this technology for storing and conserving data. The main focusing here is on any means that facilitate and promotes the concept of the storing, retrieve, process and analyze data.	Servers, storage devices such as keychain RFID device, recorded audio and video, members card, cloud computing, files, storage area network such as Dropbox.com, Google Drive.com, etc.
8- Tracking Technology	Tracking technology covers a wide range of ICT types. It can be used for security context, or business context. A company uses this technology for tracking customers' behavior, needs, or monitoring service delivery such as purchase order tracking systems, and for security purpose such as using anti-theft sensor gates. The basic focusing here is on getting feedback, controlling service and managing security issues.	For business context: barcode scanner system for monitoring store repository, tracking systems such as global positioning system (GPS), wireless networking, etc. For security context: CCTV cameras, security technology such as fingerprint locks, electronic gates, etc.
9- Transactions Technology	A company uses this technology to streamline the financial issues. The transactions technology mainly focus on hardware or software that assist in money transaction process.	Electronic Funds Transfer point of sale (EFTPOS), Electronic Point Of Sale (ESOP), debit cards, Smart Card, e-banking, etc.

However, that type of technology can support a situation in the beginning, the roles and SRTs were mapped. Then the customizing the service by including different services in order to come one of the first mappings used to map ICT roles with each convince customers to use the service, e.g., providing channels for hotel guests. Therefore, mapping between ICT roles, the ICT roles exist within interaction between a specific IP needs to be done through SRTs situations as bridge for that principle and all situations in SRT were selected according to purpose. The Figure 2 gives example on how the mapping process has been done.

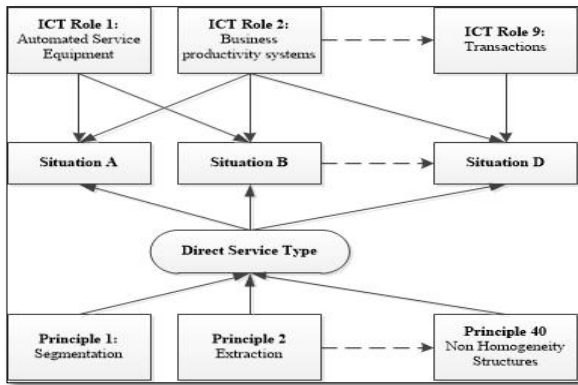


Figure 2 ICT roles and 40 IP mapping based on direct service type

3.1 Mapping ICT with Service Redesign Types

The process of mapping is based on the ability of each ICT role to improve each situation. However, it is not easy to do direct mapping between each SRTs with ICT. Therefore, mapping should have certain criteria in order to facilitate mapping process. Situations in each SRT can represent that criteria. For example, ICT role can assist to achieving self-service situation (A): 'Customers can perform the service without any supervision from a provider'. This situation is used in order to highlight the technological criteria in each SRT situation. Each situation was revised so that it is understandable from a technological perspective. Table 2 shows suggestions from technological perspective that has been offered to achieve each situation.

Table 2 Service redesign types and technological suggestions for improvement

Service Redesign Types	Characteristics/ Situations	Suggestion from Technological Perspective
Self Service	A. Customers require frequent and flexible access to service.	Use technology that assists customers to perform service in order to allow more flexible access to service.
	B. Speed of service delivery is paramount.	Use technology that assists customers to perform service in order to increase the speed of delivery.
	C.	
	D. Service performance requires limited skills that are easily transferable to customers.	Use technology that assists customers to perform service in order to improve customer skills to perform tasks from a service provider to customer operating a service.
	E. Technology exists to enable customer to perform the service.	Use technology that assists customers to perform service without any supervision from a provider.
	F. Customers may be concerned about disclosing private information to service personnel.	Use technology that assists customers to perform service in order to secure private customer information during service delivery.
Direct Service	G. Gross margins are low, making self-service alternatives especially attractive.	Use technology that assists customer to perform self-service in order to improve customer participation in the service for lower service operation cost.
	A. Customers must significantly disrupt their normal routines to receive the service.	Use technology that assists to direct a customer to their normal routines to receive the service.
PreService	B. The inconvenience of a service facility outweighs the benefits of their service.	Use technology that assists to direct a customer to a service more convenient.
	A. Customers must supply detailed information to receive the service.	Use technology that assists to support preparation of the service operations by provider in order to streamline activation service.
	B. Customers are usually in a hurry to receive service.	Use technology that assists in shifting task from customer to service provider by supporting a preparation of the service operation by provider in order to quicken and shortcut customer waiting time to receive the service.
	C. Customers plan service consumption ahead of time.	Use technology that assists customers to consume service before receiving the service.
	D. Customers use the service frequently.	Use technology that assists to support preparation for most frequent consumption of service part(s) by customers in order to insure the convenience and simplicity of receiving the service.

Suggestion from Technological Perspective	*ICT Roles								
	1	2	3	4	5	6	7	8	9
operation by service provider in order to quick and shortcut customer waiting time to receive the service.		■	■		■	■			■
Use technology that assist customers to customize service before receiving the service.									
Use technology that assist to support advanced preparation for most frequent consuming of service part(s) by customer in order to insure the continuity and simplicity of receiving the service.	■		■		■	■			■
Use technology that assist to multiple services into offering for segmented customers based on use needs.	■		■		■	■			■
Use technology that assist to efficient consumption service by improving customer knowledge of the value added in service bundle.									
Use technology that assist to combine core and complimentary services that improves the perceived value in order to meet a customer expectation.				■	■				■
Use technology that assist to support customizing the service by including different services in order to convince customers to use the service.			■		■				
Use technology that assist to support tangible aspect associated with service in order to attract customer visit the service facility.	■		■		■				
Use technology that assist to support tangible aspect associated with the service in order to improve customer experience at the service facility.	■		■		■				
Use technology that assist to support improving service environment in order to make customers more comfortable within the facility location.									
Use technology that assist to support tangibles aspect associated with the service in order to differentiate the company performing the service from other competitors.	■		■		■				■

* 1: Automated service equipment Technology; 2: Business productivity system Technology; 3: Contacting; 4:EntertainingTechnology; 5: Knowledge Dissemination Technology; 6: Marketing Technology; 7: Storage; 8: Tracking Technology; 9: Transactions Technology.

The next step in this paper is to use Table 3 findings to map between the ICT roles and TRIZ inventive principles

3.2 Mapping the ICT Roles with the 40 Inventive Principles

At the beginning, the findings of the previous study of group IP with the TRIZ by [13] was used to determine the interaction between each TRIZ situations and the 40. According to that study, principles 21, 22, 23, 24, and 25 in fact, can be used with self-service situations B, C, D, E, and F (see Table 4). Gray cells in the Table mean that a particular inventive principle has grouped under a specific service type situation.

Table 4 service redesign types with inventive principles

Principles	Self-service type Situations					
	A	B	C	D	E	F
21: Skipping		■		■	■	
22: Convert Harm Into Benefit						
23: Feedback						
24: Intermediary						
25: Self-Service		■	■	■	■	■

In each interaction time gray cells in Table 4 mean of the ICT roles were filled in according to the mapping between each TRIZ situations and ICT roles (see Table 3). For example, according to Table 3, self-service situation (B) has interaction with the Automated service equipment, contacting, knowledge dissemination, marketing, storage, and transaction technology. Therefore, those ICT roles placed in the interaction between self-service situations B and D. The process of Z filling in was repeated with self-service situation (D and E) Table 5

Table 5 ICT Roles filled in interaction between skipping principle with self-service type situations

Principles	Self-service type Situations		
	B	D	E
21: Skipping	1:Automated Service Equipment 3:Contacting 5:Knowledge Dissemination 6:Marketing 7:Storage 9:Transactions	1:Automated Service Equipment 5:Knowledge Dissemination 6:Marketing 7:Storage 8:Tracking 9:Transactions	1:Automated Service Equipment 3:Contacting 5:Knowledge Dissemination 6:Marketing 7:Storage 9:Transactions

The result of Table 5 was analyzed in order to identify the frequency for each ICT role in all situations of self-service type that have interaction with self-service type. The output from this step shows the output from this step

Table 6 The frequency of each ICT role with “Skipping Principle”

Principles	ICT roles	Frequency
21: Skipping	1:Automated Service Equipment	3
	3:Contacting	2
	5:Knowledge Dissemination	3
	6:Marketing	3
	7:Storage	3
	8:Tracking	1
	9:Transactions	3

The last step was arranging principles that have equine frequency number with descending order. This is to show priority of roles in the final matrix. Therefore, outcome from table 6 was arranged like Automated Service Equipment, Knowledge Dissemination, Marketing, Storage and Transactions have first equal priority, Contacting technology has the second priority,

and Tracking technology has the third priority. This arrangement was shown in the interaction matrix self-service and principle [G _] d] table 7. After repeating this process with each principle and SRAs situation, the TRIZ matrix with ICT roles for each SRT was produced as it shows in table 7.

Table 7 ICT roles mapped with 40 IP base on SRTs

Principles	Self-Service	Direct Service	Per-Service	Bundle Service	Physical Service
1. Segmentation	<u>1, 2, 3, 5, 6, 7, 9.</u> * **	<u>1, 3, 5, 6, 8, 9.</u> * *	<u>2, 3, 6, 8, 9.</u> * **	<u>5, 6, 1, 3, 7, 8.</u> * **	
2. Extraction	<u>1, 5, 6, 7, 9, 8.</u> * **	<u>1, 3, 5, 6, 8, 9.</u> * *	<u>2, 3, 5, 6, 8, 9.</u> * *		
3. Optimal Resource		<u>1, 3, 5, 6, 8, 9.</u> * *	<u>3, 5, 6.</u> * *	<u>4, 5, 6, 3, 9.</u> * **	<u>4, 1, 5.</u> * **
4. Symmetry Change	<u>1, 3, 5, 6, 7, 8, 9</u> * *	<u>3, 5, 6, 8, 9.</u> * **		<u>5, 6, 3, 4, 1, 7, 8, 9</u> * ** ***	<u>1, 4, 5, 9.</u> * *
5. Consolidation	<u>1, 3, 5, 6, 7, 8, 9</u> * *			<u>5, 6, 3, 4, 1, 7, 8, 9</u> * ** ***	4
6. Multi functionality				<u>5, 6, 4, 3, 9.</u> * ** ***	<u>4, 1, 5, 9.</u> * **
7. Nesting	<u>1, 5, 6, 7, 8, 9.</u> * *	<u>2, 3, 5, 6, 8.</u> * *		<u>4, 5, 6, 3, 9.</u> * **	<u>1, 4, 5.</u> * *
8. Counter Balance	<u>1, 3, 5, 6, 7, 8, 9</u> * *			<u>5, 6, 3, 4.</u> * **	
9. Prior Counteraction			<u>3, 5, 6, 1, 7, 8, 9.</u> * **		
10. Prior Action	<u>1, 3, 5, 6, 7, 9.</u> * *		<u>3, 6, 2, 5, 8, 9.</u> * *		
11. Prior Cushioning		<u>2, 3, 5, 6, 8.</u> * *		<u>3, 4, 5, 6.</u> * *	
12. Remove Tension		<u>1, 3, 5, 6, 8, 9.</u> * *			
13. Inversion	<u>1, 5, 6, 7, 9, 8.</u> * **	<u>3, 5, 6, 8, 9, 2.</u> * ** ***	<u>3, 6, 2, 5, 8, 9.</u> * *		<u>1, 4, 5, 9.</u> * *
14. Curvature		<u>1, 3, 5, 6, 8.</u> * *			4.
15. Dynamization	<u>1, 5, 6, 7, 8, 9.</u> * *	<u>1, 3, 5, 6, 8, 9.</u> * *	<u>3, 5, 6.</u> * *		<u>1, 4, 5.</u> * *
16. Slight Less/Slightly More				<u>4, 5, 6, 9.</u> * *	<u>1, 4, 5, 9.</u> * *
17. Another Dimension	<u>1, 5, 6, 7, 8, 9.</u> * *			<u>1, 3, 5, 6, 7, 8.</u> * *	<u>1, 4, 5, 9.</u> * **
18. Resonance			<u>3, 5, 6.</u> * *		
19. Periodic Action			<u>3, 5, 6.</u> * *	<u>3, 4, 5, 6.</u> * *	
20. Continuity of Useful Action	<u>1, 5, 6, 7, 8, 9.</u> * *	<u>2, 3, 5, 6, 8.</u> * *	<u>3, 5, 6, 8, 9, 2, 7.</u> * **	<u>4, 5, 6, 9.</u> * *	
21. Skipping	<u>1, 5, 6, 7, 9, 8.</u> * ** ***	<u>1, 3, 5, 6, 8, 9.</u> * **	<u>3, 5, 6, 8, 9.</u> * *		
22. Convert Harm Into Benefit		<u>1, 3, 5, 6, 8, 9.</u> * *	<u>3, 5, 6.</u> * *		<u>1, 4, 5.</u> * *
23. Feedback			<u>3, 6, 2, 5, 8, 9.</u> * **	<u>1, 3, 5, 6, 7, 8.</u> * *	<u>1, 4, 5.</u> * *
24. Intermediary	<u>1, 5, 6, 7, 9, 8.</u> * **	<u>3, 5, 6, 8, 1, 9.</u> * *		<u>4, 5, 6, 9.</u> * *	
25. Self-Service	<u>1, 5, 6, 7, 9, 8.</u> * **	<u>1, 3, 5, 6, 8, 9.</u> * *	<u>2, 3, 5, 6, 8, 9.</u> * *		
26. Copying		<u>2, 3, 5, 6, 8.</u> * *		<u>3, 4, 5, 6.</u> * *	<u>1, 4, 5, 9.</u> * *

Principles	Self-Service	Direct Service	Per-Service	Bundle Service	Physical Service
27.Cheap Disposables			<u>3, 5, 6.</u> *	<u>3, 4, 5, 6.</u> *	<u>1, 4, 5.</u> *
28.Another Sense					<u>4, 1, 5.</u> * **
29.Intangibility				<u>3, 4, 5, 6.</u> *	
30.Thin and Flexible	<u>1, 3, 5, 6, 7, 9.</u> *	<u>1, 3, 5, 6, 8, 9.</u> *			
31.Holes	<u>1, 5, 6, 7, 8, 9.</u> *	<u>2, 3, 5, 6, 8.</u> *	<u>2, 3, 6, 8, 9.</u> * **	<u>4, 5, 6, 9.</u> *	
32.Color Change:				<u>1, 3, 5, 6, 7, 8.</u> *	4.
33.Homogeneity				<u>4, 5, 6, 9.</u> * **	
34.Rejecting and Regenerating Par			<u>2, 3, 6, 8, 9.</u> *	<u>5, 6.</u> *	<u>1, 4, 5.</u> *
35.Transformatic of Properties	<u>1, 5, 6, 7, 8, 9.</u> * **	<u>3, 5, 6, 8, 2, 9.</u> * **		<u>1, 3, 5, 6, 7, 8.</u> *	<u>1, 4, 5.</u> *
36.Phenomenon Utilization			<u>3, 5, 6.</u> *		
37. Relative Change		<u>1, 3, 5, 6, 8, 9.</u> *			
38. Enriched Atmosphere	<u>1, 3, 5, 6, 7, 8, 9.</u> *			<u>4, 5, 6, 9.</u> * *	
39. Calm Atmosphere	<u>1, 3, 5, 6, 7, 9.</u> *				4.
40. Non Homogeneity Structures				<u>1, 3, 5, 6, 7, 8.</u> *	<u>1, 4, 5, 9.</u> *

The numbers within matrix cells refer to: 1. Automated service equipment Technology; 2. Business productivity system Technology; 3. Contacting; 4. Entertaining Technology; 5. Knowledge Dissemination Technology; 6. Marketing Technology; 7. Storage; 8. Tracking Technology; 9. Transactions Technology.
 *: Refers to set of ICT Roles that have first priority.
 **: Refers to set of ICT Roles that have equal second priority.
 ***: Refers to set of ICT Roles that have equal third priority.

› 4.0 DISCUSSION

From Table 3, the authors noted that technologies can have different roles to improve a particular service situation. For example, ICT tool such as social media (Facebook, Google plus etc.) can be used for marketing and at the same time can play a role in providing a method of contact between users and a service provider. In addition, the different association of ICT categories that have been shown in Table 3 with many situations showed different benefits of ICT category. For instance, automated service equipment can assist to improve situations 1, 2, 3, 4, 5, 6, 7, 8, 9, 14, 15, 19, 20 and 22 as shown in Table 3. Similarly, a particular situation in a system can be achieved and improved by taking into consideration more than one ICT role. For example, the suggestion linked with (A) time ratio self-service type can be used to allow more flexible access to perform self-service in order to allow more flexible access to knowledge dissemination, marketing, storage, or transactions technology.

In Table 7, the ICT roles have been mapped to 40 IP and the 40 IP. In addition, it is more reasonable when SMEs need to redesign the service to look for applicable ICT roles that can be related to a specific principle or innovative ideas. ICT roles listed under an interaction between 40 IP and 40 SRTs can give a SME new opportunities to integrate the ICT with their suggested solutions as discussed in the last paper. Even though a particular principle is grouped under specific SRT situation, other still can be used. The only limitation is our imaginations. Same with ICT roles in Table 7, the SMEs still can

explore other ICT roles though they do not listed under interaction place.

› 5.0 EMPIRICAL CASE STUDY

The case study was conducted on a commercial company named I-SIHAT. This company provides customers with nutrition, weight management and skin products. The company coaches and monitors their customer so they get better health awareness while customers consume nutritional products. The monitoring needs to be periodic in order to check customer progress in losing weight or sometimes in gaining weight. When a customer comes first time, they open one document (time to record customer weight, body fat, age, problems in bodies and other information. This record should be updated twice a month with new data according to customer health achievement. The problem they have is that whenever they want to set a meeting with the customers, the customers keep changing the meeting time. Sometimes they does not have time to see them because changing the time interfere with other customer monitoring time. After analyzing the problem, we found that the closest situation is that customers must significantly disrupt their normal routines to receive the service. This situation can be found under direct service type. According to the 40 IP grouping with direct service type [37] U h d f d b W] d ` Y g ` [g Y [a Y b h [c d h] a U g c i f W Y I z ` [f Y a c j Y ` h Y b [D m b U a] n U h] c b I z ` U b X ` [f Y ^ Y W h] b [` Y ` Y W h Y X " ` 5 Z h Y f ` f Y j] Y k] b [` h \ c g

principle. This principle suggests to do the service in opposite way [24]. Therefore, the solution was: instead of the customer come to the company, the company needs to direct the service to his/her place. At this point, we can look to Table 7 and see if this solution can be improved. This table suggests taking in consideration the ICT role 3, 5, 6, 8, 1, and 9. The priority looks to 3 (Contacting technology). If this ICT role can not support or improve the solution, the next ICT role can be examined and so on. After investigating the suggested ICT roles, we found that contacting technology can support the solution. The company can use any ICT tools such as application such as WhatsApp, email, fix line phone, etc., to facilitate contacting with the customer and set the meeting time according to the customer free time. Thus the company can send one of its employees to check the customer progress in the customer location.

6.0 CONCLUSION

Redesigning existing service and adopting a suitable ICT by a firm can achieve the innovation option in services. This study focused on mapping between ICT roles and TRIZ 40 inventive principles base on different service redesign in order to create innovative service problem solutions. The methodology of mapping consists of three stages. First stage depended on the SRTs situations and using suggestions from technological prospect as criteria to map ICT roles with each situation. Second stage used the outcome from the first stage to map ICT roles with each TRIZ inventive principle that grouped under each SRT. The frequency exist within interaction between a specific principle and all situations in SRT. The result of mapping showed that each SRT can associate with more than ICT role, and vice versa. In addition, mapping the ICT roles to the 40 inventive principles can be assist SMEs in redesigning the service to generate innovative ideas to solve their problem. Therefore, developing TRIZ matrix that list ICT roles within the interaction between the inventive principles and service redesign facilitated integrated ICT roles with TRIZ 40 inventive principles. The case study showed the feasibility of the matrix in enhancing the service problem solutions. With capability limitation in research and development in SME, this study can improve the way of thinking in redesigning current services. Moreover, it can lead the SME to consider particular technologies that may improve performing the service. Future work will involve integrating the mapping result with the systematic innovation process in order to enhance generating problem solutions according to a firm service redesign plan.

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