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MODELLING TELECENTRE AS COMMUNITY LEARNING CENTRE FOR YOUTHS USING TRIZ

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Abstract

Though telecentre projects such as Pusat Internet (PI) centres are widely deployed in Malaysia to provide equitable socio-economic benefits to the rural community using ICT, their social impacts are not fully exploited unless the rural youths are adequately and actively engaged in their programs or activities. One of the problems PIs or telecentres in general face is their inability to engage rural youths in local development via the offered programs. This leads to missed opportunity for youth empowerment and the subsequent development outcomes. To address this non-engineering social problem, we model telecentre as community learning centre for youths by applying TRIZ's systematic approach to problem solving, rather than the standard community-based participatory action research (PAR) approach. We explore TRIZ tools such as functional analysis, cause and effect chain analysis, and engineering and physical contradictions. By applying inventive principles, the potential solutions suggested are modification of program structure and launching of Youth Profiling app. In the qualitative survey with 30 PIs, 70% agreed that the app can increase youth participation in PI programs, and thereby induce positive youth development and mobilize youth for the socio-economic development of their local community.

Keywords: telecentre; learning centre; youth engagement; TRIZ.

1. Introduction

Telecentres are extensively deployed in developing countries as a means to bridge the rural urban digital divide and induce inclusive socio-economic development by reaping the benefits information and communication technology (ICT) has to offer. But studies have stressed that providing ICT based services alone is not sufficient for telecentres to create social impact, unless it addresses the local contextual needs of the community being served [1,2]. The challenge lies in empathizing with a community because there is no concrete picture of what a community means - it comprises of diverse dynamic social groups, for instance youths, elders, entrepreneurs, farmers, disabled, poor and so on [3]. The realization of specific target group within a community gives an edge over the success of telecentre projects. Since socio-economic development of a community is at the core of why telecentre is promoted in the first place, nurturing the youth population especially the marginalized rural youth is essential to make substantial progress [4]. It goes without saying that youths are the drivers for social change and the workforce for building the nation's economy, especially for Malaysia where youth represent a larger percentage of the population [5]. This is where telecentre could serve an important role to groom the rural youths with the skillsets they need, contribute in positive youth development and mobilize them for the socio-economic development of their local community.

The Malaysian government in response to its National Strategic Framework for Bridging the Digital Divide (NSF-BDD) has implemented several telecentre projects in rural areas to provide equitable access and opportunities to all segments of society [1]. There are around 2500 telecentres all over the country.

The Malaysian Communications and Multimedia Commission (MCMC) alone has implemented around 800 Pusat Internet (PI) centres under the rural transformation program. Though the rural community in general is positioned as the beneficiary of the trainings and ICT services offered, the notion of community as a mix of heterogeneous social groups is not exploited in their service delivery. For instance, the objectives listed by PI centres loosely generalizes socio-economic benefit for the community. This misses the development outcomes for specific groups such as youths, regarded as the most important but marginalized social group, and consequently misses the opportunities to nurture them and engage them in socio-economic development.

The generic objective is also a potential reason why rural youth participation in the activities organized by PI centres is not adequate to produce development outcomes for the community. In our qualitative survey with the PI operation staffs from the 30 PIs, we found that only 56% agreed that youths participated in PI training. From a development perspective, the figure is still not convincing as there is significant missed opportunities for youth empowerment. Even in cases where youth participation is higher the value created is questionable. A study of Malaysian youths in marginalized communities, aged 15-25 years, has reported that the digital engagement spans only around basic activities such as communication and entertainment [6]. This also suggests that positive youth development with ICT, though stressed as the need for Malaysian rural youths [7], is also at stake and calls for regenerating rural youth development by engaging them in value-driven programs. The problem PIs and telecentres in general face is their inability to engage rural youths adequately to catalyse the development process.

To solve this social problem tied with PIs inability to engage rural youths in local development, the conventional approach is to apply community based participatory action research. Since TRIZ's systematic approach to problem-solving is becoming increasingly popular outside the engineering disciplines, in this paper we are tempted to reflect on the TRIZ toolkits and extend their application in this rather unusual, non-technical and social problem.

2. Methodology

The TRIZ abbreviated form for the "Theory of Inventive Problem Solving" was developed by a soviet inventor and a science fiction author Genrich Saulovich Altshuller and his colleagues between 1946 and 1985, based on the foundation of extensive research covering millions of patents and generalizing the patterns in the nature of inventive solution [8]. TRIZ is touted as a human-oriented knowledge-based systematic methodology of inventive problem solving that advances the capability to resolve issues in a creative manner [9,10]. Within the TRIZ framework, a number of problem-solving analysis methods and tools have been developed, such as functional analysis, cause and effect chain analysis, contradiction matrix, analysis with 40 inventive principles etc [11]. We chose TRIZ methodology since its application to non-engineering fields such as business [12], social study [13], quality management [14], service operation [15] and so on is becoming popular, aside from its extensive use in solving engineering problems.

In this study we primarily use following TRIZ tools: function analysis, cause and effect chain analysis, and engineering and physical contradictions. To apply the TRIZ methodology we highlight the general problem "PI program is incapable of engaging rural youths in local development" as an initial step. Then the functional analysis is used to dissect a system, a non-engineering system in our case, into components, analyse their interactions and identify the advantages and disadvantages of the functions acting on each of the components. Thereafter, the cause and effect chain (CEC) analysis is performed to generate hypotheses about possible causes (reasons) and effects (results) of the problem by answering series of 'why' questions. The problem space is narrowed down to a key problem to resolve. Next the solution space is explored by framing engineering and physical contradictions, selecting a specific inventive principle by referring to Altshuller's contradiction matrix and applying them to find a solution. The details are presented in the subsequent sections.

2.1 Functional Analysis

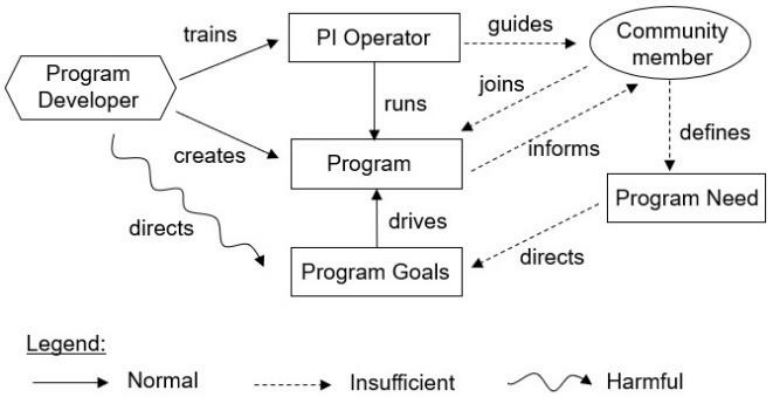


Fig. 1. Functional Model of Pusat Internet Centre.

As depicted in Fig. 1. the primary function of a PI is to guide the community in their pursuit for socio-economic development by offering ICT services and running programs comprising of training activities, course modules, workshops. The product is community since the PI is supposed to guide the community, or precisely youths in our case, to foster positive youth development. The PI operator and the Programs run in PI, their needs and goals to drive the program are essential system components to deliver PI's intended objectives, exempting the hardware components such as ICT equipment and power sources (solar or battery) in this study. The supersystem component is Program Developer, the one responsible to create the programs and train the PI operators to run those programs. The program developer could be government bodies (MCMC), consultant agencies and development partners.

Basing the analysis of the function's usefulness on our experiential knowledge gained from the PI projects, it is revealed that though the PI operator is well-trained by the program developer to run the programs properly, they do not sufficiently guide the youths in their pursuit for socio-economic development. It is also revealed that the program's goals are directed by the program developer without encompassing the needs of the community member. Henceforth the programs are created without the notion of co-creation, which worsens the value creation outcome of the program. As a result, the rural youths do not join the programs as much as they should, since the programs do not sufficiently inform them the skills and knowledge they need to contribute in the socio-economic development. PI as a non-engineering system revealed flaws in the system to deliver the intended outcomes using a functional model.

2.2 Cause and Effect Chain (CEC) Analysis

The CEC analysis is performed in Fig. 2. to identify the root cause of the main problem "PI program is incapable of engaging rural youths in local development" by answering to a series of 'why' questions. Three possible reasons are revealed where the actual problem lies.

First is the inefficiency of the administrative side. The PI operators could be least motivated and do not contribute to engage youths in the programs they run. The reasons could be shallow KPIs (focusing on quantity rather than quality) to monitor their progress based on surficial outcomes, or failing to see themselves as community champions in the absence of training programs to groom them. The second is the unsupportive governance practices implementing PIs, which do not engage youths in the development planning agendas for the community, and do not value the role of actors in horizontal networking to formulate development strategy. The reason is multi-stakeholder

participatory action is not common in governance practices. The third is the disinterest from the youths to engage with PI. The reasons could be youths are not aware of their role as community champion, or youths are not available in the village, or programs offered by PI are not what youths prefer. The further reasons could be that programs do not groom youth as community champions or youths migrate to urban areas in search for jobs or better life, or programs are not created without performing the needs analysis of the youths. This leads to a key problem that programs are created with a top down approach because co-design involving youths is not supported.

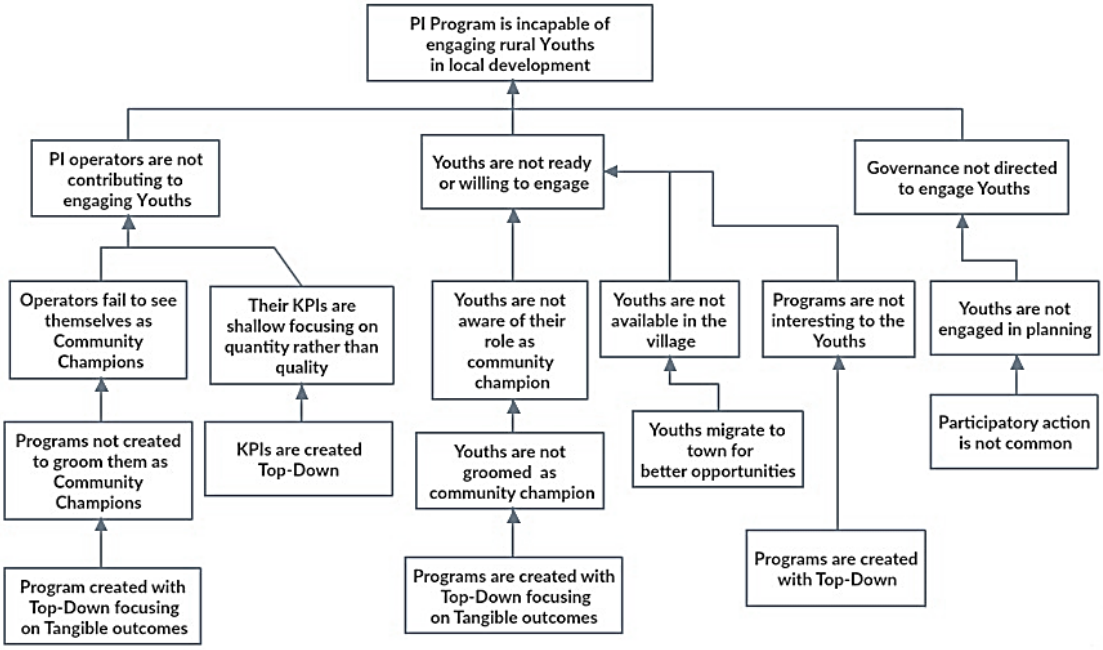


Fig. 2. Cause and Effect Chain (CEC) Analysis.

From the CEC analysis it is evident that the lack of, or little interest to co-design involving youths in creating programs is a key problem why PI is not capable of engaging rural youths in local development via its programs. Since the inefficiencies on the administrative and governance sides cannot be controlled, we focus on addressing problems on the youth side and find solutions to engage them with PI.

2.3 Engineering Contradiction

The engineering contradiction refers to a situation in which an attempt to improve one characteristics of a system leads to the worsening of another characteristics. This also means contradiction between the feature to improve and feature to preserve. Altshuller and his colleagues have identified 39 systems parameters which are laid out in 39 x 39 matrix called as contradiction matrix, where x-axis is the parameter that worsens, while the y-axis is the parameter that improves in the contradiction. The next step in finding the solution is to choose the parameters that closely relates to the responding variables in the formulated engineering contradiction.

Based on CEC we find that the top-down approach to creating programs is the key problem to resolve. This also highlights the importance of co-design involving youths in creating programs. A co-design is a transparent process of value creation in ongoing, productive collaboration with, and supported by all relevant parties, with end-users playing a central role [16]. To formulate engineering contradictions, we ground on ‘Program Creation’ and ‘Youth Participation’ perspectives.

EC#1: ***IF*** *programs are created with a co-design* ***THEN*** *contextual needs of youths are integrated in the program* ***BUT*** *that does not guarantee program will engage youths.*

From the perspective of 'Program Creation' we formulate engineering contradiction (EC#1). Though the contextual needs of youth are met when program are created with a co-design, whether the youths will actually participate in the actual program session run by PI cannot be guaranteed. Since PI's intended function is to engage youths through the programs they run, it's performance or the reliability needs to be preserved. The improving parameter is **Adaptability** and the feature to preserve is **Reliability**. By referring to Altshuller's contradiction matrix, we gather following Inventive Principles: **#35 Parameter changes, #13 The Other way round, #8 Anti-weight** and **#24 Intermediary** as possible solutions.

EC#2: ***IF*** *youths are involved in co-design* ***THEN*** *programs can be refurbished to meet their interests* ***BUT*** *youth participation in the actual program session is not guaranteed.*

From the perspective of 'Youth Participation' we formulate engineering contradiction (EC#2). Involving youths in co-design will guarantee that the existing programs can be modified/repaired to meet their contextual needs but will the youths join the actual programs cannot be guaranteed in advance. Since engaging youths through the program is the intended function of PI, it's performance or the reliability needs to be preserved. The improving parameter is **Ease of repair** and the feature to preserve is **Reliability**. By referring to Altshuller's contradiction matrix we gather following Inventive Principles: **#11 Beforehand cushioning, #10 Preliminary action, #1 Segmentation, #16 Partial or excessive actions** as possible solutions.

2.4 Physical Contradiction

The physical contradiction refers to a situation when opposite requirements are applied to the same subsystem. From the perspective of 'Youth Participation' we formulate physical contradiction (PC#1).

PC#1: *Youth participation has to be* ***HIGH*** *in co-design in order to cover a broad range of interests AND Youth participation has to be* ***LOW*** *in co-design in order to avoid conflicts.*

To create a program that can engage large number of youths, each and every individual youth are required to participate in a co-design. But a large number of youth participation leads to a 'too many cooks in a kitchen' situation, and conflicts can be anticipated. By separation in time, youth participation can be broken into two scenarios: once during baseline survey when more youths are needed and the other time during feedback and reflection session when few selected youths are enough. The inventive principles gathered from Altshuller's contradiction matrix to resolve '**Separation in Time'** are**: #1 Segmentation #7 Nested Doll #9 Prior Counteraction #10 Prior Action #11 Cushion in Advance #15 Dynamics #16 Partial or Excessive action #18 Mechanical Vibration #19 Periodic Action #20 Continuity of Useful Action #21 Rushing Through #24 Intermediary #26 Copying #27 Cheap Short Living Objects #29 Pneumatics and Hydraulics #34 Discarding and Recovering #37 Thermal Expansion.**

PC#2: *Program has to be* ***GENERAL*** *in order to be replicable to multiple project sites AND program has to be* ***SPECIFIC*** *in order to meet the local needs of a site.*

From the perspective of 'Program Creation' we list the following physical contradiction (PC#2). To avoid creating programs for each project sites, the program should be general enough so that it can be replicable to many sites. This will reduce the financial burden to sustain the PI. But having said that the relevance of program to a specific site or a local community should not be compromised. The '**Separation in Space'** helps to break the program into two portions: one where the global content is share by all sites, and the other where local content is used. The selected inventive principles are **#1 Segmentation #2 Taking Out #3 Local Quality # 4 Asymmetry #7 Nested Doll #13 The other way rounds #14**

Curvature #17 Another dimension #24 Intermediary #26 Copying #30 Flexible Membrane #40 Composite Materials.

3. Potential Solution

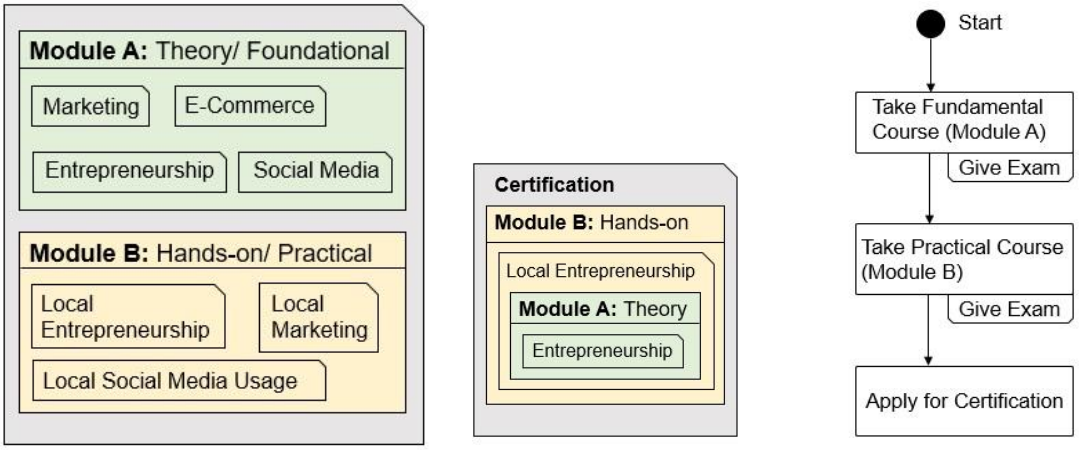
Though a broad array of inventive principles was identified in the process of resolving contradictions, only few principles are selected due to relevance to the problem domain and the technical feasibility. The potential solutions for program creation and supporting youth participation in the program session are presented below.

3.1 Program Creation

From the perspective of program creation, the physical contradiction (PC#2) highlighted that program has to set a boundary of what can be shared across multiple project sites (locations) and what is specific to a single site. To resolve this issue, the selected inventive principles and the solutions are compiled below.

3.1.1 Segmentation and Taking Out

For a program to be replicable to multiple project sites and yet be suitable for a local site, the program can be segmented by granularity. As shown in Fig. 3.a. with granularity a program can be restructured as modules. By doing this, module A can focus on the theoretical knowledge needed to cover general topics on entrepreneurship, marketing, e-commerce, social media and so on. While module B can focus on the practical knowledge or the hands-on to local marketing, or local entrepreneurship. This also means that by Taking out principle, the core part of a program which focuses on fundamental skills can remain intact but the 'hands-on' part can be extracted and modified to meet the local needs. With these principles, creating module A is relatively easier following the standards and can be shared across multiple sites. But in order to create module B site-specific youth profiling is necessary.



a. Modular Program b. Nested Modules c. Youth engagement

Fig. 3. Restructuring Program Modules.

3.1.2 Nested Doll and The other way round

The downside of a modular structure in Fig. 3.b. is that it is possible for youths to join hands-on session and skip the theory sessions of the program. To enforce the youths to take theory classes before

joining the practical ones, the modular structure of program can be taken to a next level with nested modules as shown in Fig. 4. By doing this, module A (foundational knowledge) is nested inside module B (practical knowledge), which means youth needs to complete module A in order to join module B. Certification scheme can also be introduced so that youths need to complete module A and module B to be certified for a certain skill set. The principle 'the other way round' is also applicable here. Instead of designating a specific program that should be taken by the youths from a specific site, with a modular structure it is possible to reverse the process. The youths can choose the modules they would like to participate. But if they are serious about getting a certification they will have to complete the nested modules.

3.2 Supporting Youth Participation

From the perspective of youth participation, the engineering contradictions (EC#1, EC#2) highlighted that even if the program is created with a co-design, it cannot be said with certainty and in advance that youths will participate later when the program is delivered. And the physical contradiction (PC#1) highlighted that participation of youth in co-design has to be just enough to cover a broad range of interests but also not create conflict of interests. To resolve the issues, the selected inventive principles and the solutions are compiled below.

3.2.1 Prior Action and Before Cushioning

In order to be certain that youths join the actual program session, it is necessary to develop a notification system to constantly remind them of the upcoming program sessions. Since youths mostly own mobile phones and are familiar with apps, it is feasible to create a youth profiling app that has a notification feature. Cognitive features can also be enabled in the app to keep a log of youth preferences so that specific programs can be delivered based on profiles. The youth profiling app has to be launched before the program sessions are operational to maximize youth participation. Using the Beforehand Cushioning principle, it is also possible to prepare for the worst case, which is to say that very few youths turn up in the actual program session, it can be mitigated by recording the sessions, produce CDs, upload in YouTube, release the recorded version via the app. This way those who have missed to attend the program can view in their comfort time. Fig. 4. compiles the features a youth profiling app can have to encourage youth participation in the programs.

3.2.2 Partial or excessive actions and Anti-weight

To encourage more youths to join the program session, the promotion can be done excessively by various channels, such as community radio, TV channels, local newspapers, advertising, social media, pamphlets and so on. The easiest way is to do excessive notification about program dates, venues, teaser trailer with an app. Using principle 'anti-weight' it is also possible to compensate for the few youth's participation by combining it with other local events such as youths counselling, charity, sports tournament.

3.2.3 Intermediary

The intermediary/mediator to reach youths can take many physical forms such as parents, teachers, local champions, school, church and so on. But the most convenient way is to use the digital form or the app as a mediator to keep the youths informed about the upcoming programs. A formation of site-specific youth steering committees can also be created to mobilize the youths to participate in the programs. The representative youth champion from a committee also can serve as the resource person to receive feedback during co-design which will also help to resolve 'conflict of interest' issue highlighted in PC#1.

Fig. 4. Features in a Youth Profiling app.

3.2.4 The Other way around and Parameter Change

Usually the venue for the program delivery is PI centre. This can be reversed by launching mobile venues that can be moved from one place to another. The GIS features on the app can be used to track the most visited location by the youths and it can be used as a venue. Using the parameter change principle, the flexibility of session timings can be increased. The program can be delivered as an open day rather than having specific morning or afternoon sessions. By doing this youths can join the program session on their own convenient time during the day.

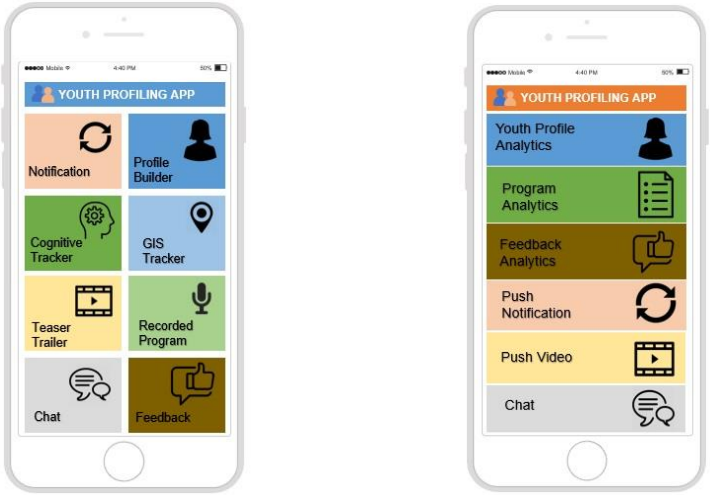
3.2.5 Segmentation, Taking Out and Local Quality

To resolve PC#1 which also means to avoid "too many cooks in a kitchen" situation in co-design when creating programs, segmentation based on youth profiles can be used to filter the youths for a baseline survey or/and for feedback and reflection session. The profiling app is a better option to separate the most active youths from the inactive ones. This way inactive ones can be used for baseline but only active ones will be considered for receiving feedback. Some principles not listed are also useful. The principle Taking Out is also applicable in extracting the youths that are bound to create conflicts, which can be generated from the youth profiles. Similarly, the local quality principle can also be applied to locate the venue for co-design to nearby locations whether the most active youths are situated. The GIS features can be used to locate most active youths and can be used to strategically plan nearby locations to perform feedback sessions during co-design without conflict.

4. Discussion

By applying inventive principles, the potential solution to the social problem tied to the inability of PI program to engage rural youths in local development, resulted in two outcomes. First is the modification of program structure and second is the launching of a Youth Profiling App. Restructuring a program (training activities, courses) into modules supports the reusability of the program at multiple sites and at the same time maintain relevance to a specific community. The modular structure also supports the possibility to combine related modules and to create a certification program. With restructured program the youth engagement is also changed from 'take-only' to 'give-and-take' as shown in Fig. 3.c., since youths are able to get certified for what they have learned and thus the program creates a value for them.

Youth Profiling app supports encouraging youth engagement in the programs through its extensive features as shown in Fig. 5.a. The notification feature enables updates on upcoming programs to the youths and reminds them to join the program. The teaser trailer feature enables promotion of the programs by giving them a glimpse of what to expect and entice youths to join the program. The cognitive tracker feature enables recording what youth does online, which content youth like/dislike, what is their social network and so on to strategically plan what program must be delivered. The GIS tracker feature enables recording the location where the youths spend most of their times to strategically plan venues to conduct mobile program sessions. The profile builder feature collects location and cognitive information to build a profile required for analytical purposes. The recorded feature provides access to the recorded version of program session in case the youths have missed to join the program. The chat feature enables youths to converse with the local youth steering committee members. The feedback feature enables youths to voice their opinions on how to improve the program. Youth Profiling app bundled with all these features will increase the youth engagement with the programs run by PI or any other telecentre for that matter.



a. Regular Functionalities b. Administrative Functionalities

Fig. 5. Wireframe diagram of Youth Profiling App.

The administrative side of the Youth Profiling app is also shown in Fig. 5.b. which mostly has analytics features to be used by the PI operator to monitor the changes in cognitive preferences of youths, their locations, the program schedules, logistic, broadcast upcoming programs, push video recordings, promotional materials of the program, communicate with the local youth committee members via chat etc. The solutions presented in this paper are conceptual but promising to increase youth's engagement in PI programs and help them uplift the socio-economic situation of their local community. In our qualitative survey with the PI operation staffs from the 30 PIs, we found that 70% agreed that the Youth Profiling app can increase youth participation in PI programs. Their implementation will shed more light on the usefulness of the proposed solution and how it contributes to positive youth development.

5. Conclusion

Though telecentre projects such as Pusat Internet centres are widely deployed to bridge the rural urban digital divide and bring equitable socio-economic benefits to the rural community, their social impact is unlikely unless the youths are adequately and actively engaged in the programs or activities. One of the problems PI face is their inability to engage rural youths in local development via the offered programs. This research applied TRIZ's systemic approach to problem solving and proposed solutions on modification of program structure and launching of Youth Profiling app. By restructuring program or activities as

modules it is possible to entice youths to join program sessions for certification, create a value for them, and thereby transform them into a more productive and active learner community. Additionally, with Youth profiling app it is possible to significantly increase youth engagement due to its extensive features and analytics. The solutions presented are conceptual but promising to increase youth engagement in PI programs, induce positive youth development and mobilize youth for the socio-economic development of their local community. This research also extended TRIZ application to a non-engineering social problem.

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